

# **The Development of Technology Entrepreneurship in the Context of Technology Incubators in Lagos, Nigeria**

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## Declaration of Authorship

I **Patrick Oisemuzeime Giwa** hereby declare that this thesis and the work presented in it is entirely my own. Where I have consulted the work of others, this is always clearly stated.

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## ABSTRACT

Technology entrepreneurship involves creating new business ventures based on technological ideas and opportunities. Technology incubators are the instruments employed in both developed and emerging economies to support such ventures by providing the necessary resources for technology entrepreneurs and their ventures to thrive.

Despite recognising the importance of incubators in supporting new technology ventures, scholars have mainly focused on other areas, such as incubation configuration, economic development and impact studies. Little attention has been paid to the influence of the incubators on the ventures they serve. Moreover, most of the research has been in developed countries; there are almost no studies of incubators in developing countries, particularly in Sub-Saharan countries.

Consequently, this thesis aims to explore the state of technology entrepreneurship and technology incubators in Nigeria, Africa's largest country by economy and population. The thesis explores how technology ventures leverage the resources of the technology incubators. It addresses three important questions: i) How do the qualities and experiences of entrepreneurs in technology incubators affect their ability to start and grow a new venture? ii) What resources do Nigerian incubators provide and how do these help nurture technology ventures? iii) What are the resource implications for the technology entrepreneurs and their ventures? Key literature on entrepreneurship, technology entrepreneurship and incubators are reviewed to establish a framework for the investigation. A qualitative empirical investigation of entrepreneurs in incubators in Lagos, Nigeria is then conducted and analysed.

The study contributes to the technology entrepreneurship and incubator literature, providing new insights into how technology entrepreneurs leverage resources provided by incubators. The analysis highlights resources that are vital to new technology ventures in a developing country and reveals how resources do not always lead to competitive advantage, but can, instead, be a curse to the sponsored ventures.

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# CHAPTER 1

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## 1.0 Overview

This thesis investigates the development of technology entrepreneurship and the role of technology incubators in a developing country, Nigeria. It explores the relationship between technology ventures and the resources provided by technology incubators. The thesis sets out to examine this relationship from the theoretical perspective of the Resource Based View theory, with a view to capturing the way these resources are bundled and utilised in the process of creating a new technology venture. This chapter presents a general outline of the thesis over four sections: 1.1 Research Scope and Background; 1.2 Statement of the problem; 1.3 Research Aims and Objectives and 1.4 Structure of the thesis.

## 1.1 Research Scope and Background

The concept of technology entrepreneurship involves discovering and exploring technological ideas and opportunities which lead to founding and growing new ventures. It combines different components and factors, such as ideas, individuals, and markets to commercialise technological projects and capture value (Bailetti, 2012). The technology entrepreneurship process involves opportunity recognition, idea generation, product development, and launch of new technology ventures. New technology ventures serve a critical role in developing local, regional and national economies through the creation of employment, attraction of foreign direct investments, generating new innovations and becoming profitable (Lindholm Dahlstrand, 2007).

Globally, there is an exponential increase in technology innovation which has led to the creation and development of successful technology ventures such as Google, Facebook, and Alibaba (KPMG, 2018). Contrary to Willie Siyanbola's comments (2011), Africa is not sitting on the sidelines, but rather, through technology transfers and investments, Africa is a participant in this global phenomenon. In banking, for instance, Africa is known to be at the forefront of an innovative form of banking known as mobile banking. Countries like Nigeria, Kenya, and South Africa are not just on the receiving end of technology transfer, but are also manufacturers and exporters of innovative technology (Ondiege, 2010).

This incremental adoption of technological innovations is attributed to the advent of affordable internet connections and mobile phones in sub-Saharan Africa (Etzo and Collender, 2010). Essentially, it is thought that, with the initiation of new technology, Africa is set to leapfrog centuries of industrial development and benefit from the achievements of the information age. Although the continent still lags behind due to poorly developed infrastructure, technology leapfrogging has been one of the most striking “good news” stories from Africa (Gatune and Najam, 2011). It is a widely held view by governments and industry professionals that the appropriate deployment of technology can help African countries solve some of their developmental challenges. A report produced by the African Development Bank (AfDB) and the World Bank, with support from the African Union, suggests that “information and communication technologies (ICTs) have the potential to transform business and government in Africa, driving entrepreneurship, innovation and economic growth” (Yonazi et al., 2012 p.12). This growth in affordable internet subscriptions and mobile phones has brought new opportunities for technology entrepreneurs to build mobile and web solutions for these devices, leading to the creation of new technology ventures. The role of these entrepreneurs is recognised in the field of entrepreneurship, as they are central to the creation and successful management of business ventures (Carree and Thurik, 2003; Audretsch, 2009). In recognition of this understanding, the survival of new technology ventures is just as important to economic growth as their creation.

However, a significant challenge with launching new technology ventures is their high failure rate. Literature illustrates that out of every 100 newly formed ventures, only 50 survive beyond the first three years (Van Praag, 2003; Strotmann, 2007). This is why Littunen (2000) emphasises that the first 3 years of a newly formed company are vital to its survival. Although the survival of newly formed companies varies from region to region, nonetheless, it is still considered that their survival rate is between 20% - 50% overall (Bartelsman, Scarpetta and Schivardi, 2005; Santarelli and Vivarelli, 2007). These figures have drawn researchers, and policy makers to find ways of increasing the survival rates of newly formed ventures in light of their direct impact on economic development (Carree and Thurik, 2003; Santarelli and Vivarelli, 2007; Mojica, Gebremedhin and Schaeffer, 2009; Audretsch, 2009). Recently, there has been renewed interest in practice and literature on business incubators, which play a significant role in addressing these issues. Business incubators are organisations set up to provide business and technical support in the form of resources to new ventures they are affiliated with, so as to accelerate their survival and growth rate (Rubin, Aas and Stead, 2015). Technology incubators are a subset of business incubators, solely focused on enabling technology ventures to survive and thrive.

A considerable amount of literature has been published to illustrate how business incubators help new entrepreneurial ventures survive and grow to become successful (Smilor, 1987; Wynarczyk and Raine, 2005; Rubin, Aas and Stead, 2015). However, there is also contradictory evidence in literature to suggest that business incubators have little or no effect on the success of new technology ventures (Ratinho and Henriques, 2010). This is compounded by the difficulty of regional comparisons, considering that technology entrepreneurship is a regional phenomenon (Lindholm Dahlstrand, 2007), disjointed selection criteria of business incubators, difficulty in acquiring data from new technology firms, and a lack of consensus on what business incubators entail. As a result, there is no clear understanding regarding the role of business incubators in successful venture creation (Hackett and Dilts, 2004a).

Moreover, beyond the successful creation of a venture, there is a need for better understanding of the implication of resources provided by business incubators to new technology ventures. Most studies on business incubators are focused on incubation configuration, entrepreneurship, knowledge, economic development and impact studies. While these are meaningful perspectives, there is a need for research first to understand how business incubators influence the process of venture creation and further explore how technology ventures bundle and utilise resources provided by business incubators.

Technology entrepreneurship activity is a reflection of the extent of commercialisation and corporate innovation of their local region (Li et al., 2008). Despite the recognition that technology incubators are effective, multi-faceted, small business economic development mechanisms in the region in which they are embedded; through creation of jobs, technical knowledge spill overs, new firms, and economic development, the majority of the studies share their responses and experiences from the perspective of developed countries (Hichri, M'chirgui and Lamine, 2016). The question of the influence of business incubators, therefore, remains unanswered for developing countries, particularly in sub-Saharan Africa, where studies are rare and sometimes almost non-existent. This is important as the literature highlights the highly region-dependent nature of technology entrepreneurship (Shane and Venkataraman, 2003; Lindholm Dahlstrand, 2007; Li, Peng and Li, 2008). Therefore, given the potential width of this research area, this study particularly engages with the influence of Nigerian technology incubators on the venture creation process, by illuminating the way resources are bundled and exploited by technology ventures in Nigeria.

## 1.2 Statement of the Problem

From observations and reviews of literature on technology entrepreneurship and business incubators, it can be said that technology ventures are significant, as the role of innovation is universally recognised as a key source of competitiveness and economic development. Also, technology incubators are considered to be instrumental in fostering these innovative ventures, because of their provision of the necessary resources for new technology ventures. Moreover, the resource-based view argues that resources are ingredients for competitive advantage, provided they are valuable, rare, inimitable, and non-substitutable. RBV has been found to be useful in explaining incubators, university spin-offs, ethnic entrepreneurship, green entrepreneurship, and social entrepreneurship among other phenomena (McAdam and McAdam, 2008).

However, little is known of the direct relationship between the process of venture creation and the way resources provided by technology incubators are bundled and exploited. Although there is extensive research on technology incubators and technology entrepreneurship, they are generally presented as independent of each other. This is puzzling because technology incubators encompass the entire technology entrepreneurship process and seek ways to contribute to functions and components of the process. Also, it is rather surprising against the background of research such as Scillitoe and Chakrabarti's (2010) study which examined the differing roles of counselling and networking on business and technical assistance for new technology ventures, and Akhuemonkhan et al.'s (2014) study that presents a framework for harnessing the potential of technology incubators as tools for entrepreneurship development and actualising Nigeria's Vision 2020, stimulating economic growth and launching the country onto a path of sustained and rapid socio-economic development.

Furthermore, few studies consider the perspective of the technology entrepreneur as most studies are designed around the incubator facility and its management. This is astonishing, considering that the technology entrepreneur or entrepreneurial team is central to the way ideas are developed and opportunities are exploited and are in themselves resources for their ventures (Alvarez and Busenitz, 2001). The characteristics and experiences of these entrepreneurs and how they affect new venture creation in the context of an incubator are not well studied.

More importantly, few studies attempt to explain the influence of technology incubators beyond the provision of resources. Resources in themselves are static, unless properly bundled and utilised by technology entrepreneurs and their ventures. Moreover, the resource-based view framework, which is mainly presented as a theory of the firm, does not take into account the dynamic nature of entrepreneurial ventures and does not fully explain the social nature of

technology ventures. While the RBV theory is instrumental in explaining how resources contribute to the competitive advantage of a firm, it presents a static view of a social phenomenon and fails to uncover the dynamic process of interaction and interpretation by entrepreneurs and their heterogeneous resources

Another understudied area in the literature on technology incubators and technology entrepreneurship is that of developing countries. Most of the studies share insights and experiences from the perspective of developed countries, with very few studies on the perspectives of developing countries. There is a lack of in-depth studies, particularly, in sub-Saharan Africa, where the few studies that exist are rather descriptive, lack depth, and fail to provide empirical evidence. Very little is known about the overall state of technology entrepreneurship in Nigeria, especially concerning technology incubators and their influence on technological development.

However, the emergence of the mobile industry in sub-Saharan Africa has brought new opportunities for technology entrepreneurship. It is not necessarily about the mobile handsets or cheap computers and tablets themselves; it relates rather to the applications and information they can deliver. The growth of the mobile industry has stimulated the establishment of a number of hubs, incubators and accelerators across the region, from Cape Town to Kigali, Lagos and Nairobi, to harness technological ideas and transform them into successful ventures. Although they are still in their early stages, these hubs have the potential to support and grow successful technology businesses across the region. In consequence, this thesis aims to empirically discover the roles of incubators in the development of technology entrepreneurship in Africa's largest economy - Nigeria - and in its commercial capital, Lagos state. Nigeria is chosen because of the growing technology entrepreneurship. It houses some of Africa's most successful and well-funded technology ventures. It is also the leading destination for venture capital funding (Kazeem, 2018).

A review of individual studies on business incubators in Nigeria exposes some key findings. First, most of the studies, aside from Adegbite (2001), were conceptual and descriptive in nature. They based their analysis on secondary data and offered no empirical data to back up their claims.

Second, all previous authors have focused only on government-sponsored incubators, which have repeatedly produced the same poor implementation results. These studies would be more relevant if a wider range of incubator sponsor types, such as privately sponsored and operated incubators, were explored.

Third, none of the studies actually conducted a proper investigation of the tenant firms, the entrepreneurs, and other stakeholders in the incubation process.



Fourth, all of the studies were carried out in small, concentrated areas, ignoring the well-known commercial capital of the nation, Lagos state. Moreover, none of the studies makes any reference to how the technology incubators influence the development of technology entrepreneurship in the region. Overall, data in this field of research in Nigeria is 14 years old and, considering the fast-paced nature of the industry, it is essential to investigate the phenomenon with more up-to-date empirical data.

### **1.3 Research Aims and Objectives.**

In order to address this gap in research, the main aim of this thesis is to provide an understanding of the development of technology entrepreneurship in Nigeria and the role of technology incubators. This will involve accounting for the entrepreneurs, their entrepreneurial ventures and the technology incubators within the region. As a result, the study can play a substantial role in developing an in-depth understanding of the significance of technology business incubators in an emerging region to technology entrepreneurs, their ventures, and the entire process of technology entrepreneurship. To achieve the stated research aim, the explicit objectives of this research are;

- To analyse the current development of technology entrepreneurship in Lagos, Nigeria, by studying technology entrepreneurs, their ventures, and the entire process of technology entrepreneurship.
- To evaluate the role of technology business incubators in facilitating the entrepreneurial process, including new technology venture creation and development.
- To provide an assessment of technology business incubators in fostering technology entrepreneurship in Lagos, Nigeria and draw lessons for other developing countries.

Within these objectives, the research seeks to answer the following research questions:

- **How does the development of technology entrepreneurship in Nigeria leverage technology incubators?**
  - a. *What are the qualities and experiences of entrepreneurs in technology incubator and how do these qualities affect their ability to start and grow a new venture in the context of the incubator?*
  - b. *What resources are provided by Nigerian incubators and how do these resources help nurture and develop technology ventures in the region in the context of resource-based view theory?*
  - c. *What are the resource implications for technology entrepreneurs and their ventures?*

By exploring these questions, this research study will be able to enhance understanding of technology entrepreneurship research; that is, studying relationships and influence between specific components in the technology entrepreneurship process, especially in the context of an emerging region (Lu, Petti and Zhang, 2011). The study will highlight the most relevant aspects of the technology entrepreneurship process, in which technology incubators are most relevant, particularly in the context of a developing country (Olaopa and Siyanbola, 2012). Furthermore, this thesis will address the knowledge gap regarding technology entrepreneurship and technology incubators in Nigeria.

As a starting point, an initial framework will be constructed from extant literature to provide the basis for the research study and inform the research questions. It draws upon and integrates previous knowledge on technology entrepreneurship and business incubation. The integration of the literature provides a preliminary theoretical framework for conceptualising the technology entrepreneurship process and the role of technology incubators. The framework encompasses the activities and processes that take place in the development of technology entrepreneurship and also inputs the role of technology incubators. This includes: the technology entrepreneur, who is the ultimate player in the entire technology entrepreneurship process; the technology venture, which is the eventual outcome of the technology process; and the technology incubator, which houses these processes and activities. The technology incubator ensures that there is a steady relationship between i) the entrepreneurs and the incubator management; ii) the incubator management (on behalf of the entrepreneur) and the external network; and iii) the entrepreneur and other entrepreneurs within the incubator.

In order to address the above research questions, this research employs a qualitative research strategy to provide a means to expose the subjective reality of the phenomenon under study. That is, to investigate the underlying mechanism that links the development of technology entrepreneurship to technology incubators. Primary data were collected through semi-structured interviews with entrepreneurs, incubator managers and other stakeholders in Lagos, the commercial capital of Africa's largest economy, Nigeria. The entrepreneurs and their ventures were mainly categorised into two types of incubator; privately sponsored and government-sponsored incubators. The interviews were supplemented by personal notes from observations of activities around the incubator. By observing the participants' behaviour in the setting of the incubator, and within events in the incubator, I was able to complement the interviews and provide a narrative of the role of the participant. Furthermore, interview data from technology entrepreneurs and their ventures, incubator management and other data information from secondary sources enabled me to triangulate the data to obtain a robust and comprehensive understanding. This is because a single source would be insufficient to

adequately explain the complex nature of technology entrepreneurship and technology business incubators.

Qualitative data analysis methods and tools were used to analyse the primary data and develop insights. This was achieved by a process of familiarisation, indexing, coding, charting, and mapping key issues, themes, and categories (Ritchie and Spencer, 2002). The next section outlines the structure of the thesis.

## **1.4 Structure of the Thesis**

Chapter 2 begins with a review of the literature on entrepreneurship, technology entrepreneurship and the processes involved, business incubation and technology business incubators. At the end of chapter 2, the literature is synthesised and integrated to provide a preliminary literature framework for the research to investigate the research questions.

Chapter 3 sets the context in place, describing the nation of Nigeria and its economic development prospects and challenges. Additionally, this chapter reviews the state of technology entrepreneurship in Nigeria and critically examines the literature on technology incubators in the region. The end of chapter 3 presents research gaps in the literature concerning technology entrepreneurship and technology incubators in Nigeria.

Chapter 4 identifies the research methods and approach that will be adopted in conducting the research study. As mentioned above, this thesis uses a qualitative research strategy to explore the research questions. Furthermore, this chapter discusses the research strategy and research design in depth and explains the rationale for selection of location, sample and data collection, data analysis and ethical considerations.

Chapter 5 presents results and analyses the characteristics and attributes that make up the Nigerian technology entrepreneur.

Chapter 6 presents results and analyses on the types of incubators in Nigeria, selection processes employed by the incubators, and the resources they provide.

Chapter 7 presents the discussion of the empirical findings in regard to the implications of the resources for entrepreneurs and their ventures. The chapter also provides an improved TE-TI schematic diagram of the interaction between the venture creation process and resources provided by technology incubators, expanding on the one developed in chapter 2 with a set of propositions based on the empirical findings.

Chapter 8 concludes the thesis by explaining the contributions of the research to the relevant literature. Managerial and policy implications stemming from the findings are also discussed. Additionally, the limitations of the research, comments on the personal development of the author during the PhD and suggestions for further research are made by way of a conclusion.

# **CHAPTER 2: Entrepreneurship: Definitions, Domains, and Theoretical Approach**

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## **2.0 Introduction**

This chapter will define entrepreneurship by exploring and analysing previous studies that have made theoretical and methodological contributions to this phenomenon. This chapter is arranged in sections in recognition of the need for clarity and to reduce vagueness. The central aim is to critically examine the broad field of entrepreneurship and its theoretical contexts to set up the foundation for examining entrepreneurship, specifically in technology. Additionally, it will present a preliminary examination of the field of technology entrepreneurship to develop a definition for the phenomenon and further explore different aspects of technology entrepreneurship. This will help in clarifying and shaping an appropriate agenda for the following section, which investigates in more detail the domain of business incubators. The review will begin with a broad examination of the entrepreneurship field in general, key theories, and explanation of terms, followed by a critical analysis of different aspects of entrepreneurship.

## **2.1 The Evolving Domain of Entrepreneurship**

Entrepreneurship as a concept has evolved over time and has been applied to a range of phenomena. It has become the buzzword of the decade and can be seen in every aspect of society, profit-making and non-profit making, governmental and private, cultural, social and commercial (Drucker, 2014). Rising from being an obscure phenomenon, entrepreneurship has transformed into a universal ideal (Keat, Selvarajah and Meyer, 2011). Over the years, entrepreneurship has grown its sphere of influence to include governments as entrepreneurs (Link and Scott, 2010), charities (Morris et al., 2001), social and non-governmental organisations (Dees, 2017). Consequently, the language of economic growth and job creation is increasingly anchored in entrepreneurship (Decker et al., 2014) and driven by audacious entrepreneurs.

The domain of entrepreneurship research embraces these diverse dimensions in which entrepreneurship can exist. Analysis can be carried out at various levels (individual or team level, venture or firm level, or macroeconomic level (Jones, Coviello and Tang, 2011, pp. 632-659). The socioeconomic environment, which includes institutions, norms, and cultures as well as availability of finance, knowledge creation institutions, economic and social policies, presence of industry clusters, and geographical parameters are all factors that affect entrepreneurial activities at all levels.

The exploratory side of entrepreneurship involves the roles and characteristics of individuals and teams (Carlsson et al., 2013, pp. 913-930). The outcomes of these activities are opportunity recognition, innovation and venture creation (Cassis and Minoglou, 2005) which may be the creation of new organisations or new activities in existing organisations. The cumulative outcome is economic growth and development in human welfare. All these activities and outcomes are influenced one way or another by different dimensions of the socioeconomic environment.

Entrepreneurial activities are viewed through multiple disciplinary perspectives and at various levels of analysis, using different methods, which makes it difficult to outline the boundaries of the domain (Katz, 2003). Thus, entrepreneurship can be considered a subfield within several disciplines, each with its own unique perspective on the subject (Zahra and Wright, 2011, pp. 67-83). Many scholars agree that the multidisciplinary attribute of entrepreneurship research contributes its lack of a common theoretical framework or central research paradigm.

Although many of these subdivisions exist within their own paradigms, entrepreneurship research may still be viewed as a system that interacts with other parts of the economic system as a whole (Busenitz et al., 2014). Research on entrepreneurship can also be understood as an intricate system, where each separate level of analysis and each component contributes to a broader understanding of the phenomena.

Having discussed the evolving domain of entrepreneurship, the next section discusses definitions and interpretations of entrepreneurship and the entrepreneur.

### 2.1.1 Defining Entrepreneurship and the Entrepreneur

It is pertinent to first examine the literature on the general concept and interpretation of entrepreneurship, as the abstraction of entrepreneurship in itself has become a widely debated topic among academic researchers (Bull and Willard, 1993, pp. 183-195; Bruyat and Julien, 2001; Iversen, Jørgensen, & Malchow-Møller, 2008, pp. 1-63). It will help to understand the general literature on entrepreneurship to gain insight into entrepreneurial orientation, entrepreneurship motivations and entrepreneurship theories, and to comprehend the personality of the entrepreneur. These characterizations will aid in developing an understanding of what technology entrepreneurship is – a concept discussed later in this paper. Regardless of the various opinions on defining and understanding entrepreneurship (Audretsch, 2012, pp. 755-764) and the opposing techniques for measuring it (Vesper and Gartner, 1997, pp. 403-421; Luger and Koo, 2005, pp. 17-28; Ahmad and Hoffmann, 2008), it is good practice to begin research with definitions (Bygrave and Hofer, 1991, pp. 13-22).

Extensive collections of definitions and interpretations of entrepreneurship can be found in the literature. Not only do the sources and determinants of entrepreneurship differ in different fields of studies, but the impact of entrepreneurship on economic development is equally contentious (Baumol, 1990, pp. 893-921).

Bearing this in mind, how then can we define entrepreneurship, and interpret who is an entrepreneur? The question of what entrepreneurship really is and who entrepreneurs are is widely debated by researchers from various perspectives, sometimes contradicting each other in essential characteristics, processes, and values (Kaufmann and Dant, 1999, pp. 5-16). For instance, Davidsson (2005), defines entrepreneurship generally as a type of competitive behaviour that pushes market processes, whereas Shane and Venkataraman (2000a), define entrepreneurship as the exploitation and discovery of ideas and opportunities leading to profitability. Essentially, entrepreneurs are individuals who create and grow business organisations, while entrepreneurship involves the actual process of building a business (Thornton, Ribeiro-Soriano and Urbano, 2011). Audretsch and d'Empesa (2003) define entrepreneurship as exploiting ideas and opportunities, using available resources which are at most times limited. Thus, the individual responsible for exploiting these ideas and opportunities, as well as assembling the resources and executing a practical action plan, is known as the entrepreneur.

Muljadi (2011) refers to entrepreneurship as the culmination of finance, management, and business acumen to create economic goods. Entrepreneurship is a process of creating new business organisations (Gartner, 1988). According to Kirzner (2015), the ability to spot an opportunity and collect information make up the first steps in the entrepreneurial process.

Conversely, Venkataraman (1997, pp. 119-138) argues that, although entrepreneurs are usually skilled at exploiting opportunities, little is known about where these opportunities emerge from. Shane and Venkataraman (2000b) suggest that spotting opportunities mostly comes with the nature of the individual involved and other characteristics of the opportunity. Spotting an opportunity comes from the ability to connect previous experience and knowledge, judging that the time is right; this is a special attribute that most entrepreneurs possess (Venkataraman, 1997). Kirzner (2015) debates that entrepreneurs recognise an opportunity by being alert and aware of the current situation of a market.

Some researchers share the view that entrepreneurship is a thought process that results in outcomes. For instance, Spinelli (2012) defines entrepreneurship as a way of thinking, reasoning and acting in balance with the opportunity presented and leadership. Additionally, Casson (2005, pp. 327-348) defines entrepreneurs as dedicated individuals who deal with complex and novel problems by taking certain actionable decisions.

Entrepreneurial outcomes may be in the form of new products, new services, new ventures and businesses, innovation, self-fulfilment or wealth creation (Schumpeter, 1934). This view is supported by Spinelli (2012), who writes that entrepreneurship results in the creation, enhancement and renewal of value for stakeholders and participants in a venture.

More effort has been channelled into sorting definitions of entrepreneurship and the function of the entrepreneur into categories. Low (2009) draws out three attributes of an entrepreneur from the definitions of entrepreneurship; *ownership or operation of the firm, risk and uncertainty-bearing*, and *innovation or reallocation of resources*. Similarly, Stokes (2010) categorizes entrepreneurship definitions into *processes* – hinging on what entrepreneurship entails and why it concerns individuals, organisations, and society at large; *behaviours* – stemming from the roles played by particular individuals, referred to as entrepreneurs; and *outcome* – focus on the results of entrepreneurship. However, as Stokes (2010) points out, there is a great deal of overlap in the definitions of entrepreneurship, in processes, function, outcome or behaviours. According to Low (2009, p.11), “The entrepreneur function, as the owner or operator of a firm; bears the uncertainties and risks; and most importantly, is responsible for implementing innovative solutions.”

Together, these studies indicate that the understanding of entrepreneurship lies in the synthesis of all aspects of the entrepreneurial process, including attributes, outcomes and behaviours. Moreover, the various definitions of entrepreneurship and an entrepreneur highlight that:

- Entrepreneurship involves identifying, evaluating, and exploring ideas and opportunities; the individual directly responsible for these tasks is the entrepreneur (Shane and Venkataraman, 2000; Spinelli, 2012).
- Entrepreneurship involves creating and managing a new or existing organisation to enable production of innovative or new goods and services (Gartner, 1988; Audretsch, 2012).
- Entrepreneurship involves using ideas and opportunities to create value (Low, 2009; Shane, 2004; Kirzner, 2015).

Entrepreneurship exists in different forms and types. For instance, it can be the establishment of new firms (Gartner, 1988; Cooper, 1995); the acquisition of existing business ventures; or the purchase of a franchise (Baruch and Gebbie, 1998, pp. 423-439). Other types of entrepreneurship include: academic entrepreneurship, which refers to efforts undertaken by universities and academics to promote commercialisation of research activities through spinning off new ventures (Shane, 2004); corporate entrepreneurship, which involves development of new ideas of businesses within a large organisation that lead to direct



improvement and profitability of the large corporation (Covin and Miles, 2006); ethnic entrepreneurship, which involves a set of connected businesses sharing a common national background or migration experience (Volery, 2007, pp. 30-41). As Bruyat and Julien (2001) observe, the concept of entrepreneurship--once an indefinable idea--has transformed into one of the universal ideals reshaping the economic landscape.

Entrepreneurship classifications can be based on the vision of the entrepreneur or the entrepreneurial team. For instance, Blank (2011) classifies entrepreneurship into small business entrepreneurship, scalable startup entrepreneurship, large company entrepreneurship, and social entrepreneurship. Small business entrepreneurship makes up a vast majority of business owners in most developed economies (Van Praag, 2003). They consist of anyone who runs their own business; for example, carpenters, plumbers, electricians, hairdressers, consultants, travel agents, etc. Although most businesses start as a small business, the typical mindset of a small business owner is to make just enough money to take care of their family. Scalable startup entrepreneurs, however, are driven by the vision of attracting venture capital investors and discovering profitable, repeatable business models that can be scaled quickly (Branscomb and Auerswald, 2002, pp. 02-841).

Large company entrepreneurship happens within large corporations, either through launching new products, launching in new markets, or tinkering with existing products for relaunch. This type of entrepreneurship can also be referred to as intrapreneurship, which is a type of entrepreneurship that focuses on employees in a company taking initiatives to solve a given problem (Antoncic and Hisrich, 2001, pp. 495-527).

Lastly, social entrepreneurship is a type of entrepreneurship with a vision of creating products and services that solve social needs and problems (Dees, 2017). They are primarily motivated to make the world a better place, rather than to take market share or to create wealth for their enterprises (Dees, 1998).

Similarly, Aulet and Murray (2013) identify two types of entrepreneurship: innovation-driven entrepreneurship (IDE), and small business entrepreneurship. Innovation-driven entrepreneurship -- like scalable startup entrepreneurship -- focuses on creation of innovative enterprises that pursue high growth opportunities, based on bringing new innovations to the marketplace. Innovation in this context relates to what Joseph Schumpeter described as 'new combinations.' Although most innovative ventures are driven by technology, their innovativeness is not limited to technology; innovation can come in many forms, including technology, processes, and business models.

Small business entrepreneurship is described by Aulet and Murray (2013) as the creation of small and medium enterprises (SMEs), serving local markets with traditional, well-understood

business ideas and limited competitive advantage. The differences between SME entrepreneurship and IDE entrepreneurship include: i) focusing on addressing local and regional markets versus focusing on global markets; ii) SME entrepreneurship does not necessarily require innovation to grow nor does it need competitive advantage, whereas IDE entrepreneurship is usually based on some form of innovation and strives to gain competitive advantage; iii) SME entrepreneurship is mostly established as family-based businesses with very little external capital, whereas IDE entrepreneurship has a more diverse ownership base, with a wide array of external investors; iv) SME entrepreneurship typically grows at a linear rate, while IDE entrepreneurship starts off losing money but eventually grows exponentially if successful. Thus, SME entrepreneurship responds quickly to cash input, while IDE entrepreneurship responds slowly to cash input (Aulet and Murray, 2013).

SME programs that support small business entrepreneurship can provide short-term payback if well-executed. However, they are unlikely to have a substantial impact on large-scale job creation. Supporting innovation-driven entrepreneurship, on the other hand, requires long-term strategies and flexibility for economic growth (Aulet and Murray, 2013). It is often slower to produce desirable results and requires a range of stakeholders, such as corporate partners, universities, and risk-capital providers to accelerate the ventures. IDE entrepreneurship is definitely more difficult to implement, but offers much greater upside potential in the long-term (Stam and van Stel, 2011).

The focus of this thesis is on innovation-driven business that is driven by technology, otherwise known as technology entrepreneurship. Technology entrepreneurship is a relatively new and unexplored domain that offers rich opportunities for scholarly studies (Bailetti, 2012). Furthermore, recognising that context imposes subtle cultural and institutional forces that influence entrepreneurial activities (Welter, 2011), this thesis focuses on a study of an emerging economy in Africa, specifically, Nigeria. As Zahra and Wright (2011) point out, differences in national cultural values and institutional arrangements can accentuate variations in the types and rates of firms being created, why and how they are created, and how they evolve. With this as a point of departure, technology entrepreneurship is examined next.

## **2.2 Technology Entrepreneurship – A Definition**

Over recent years, there has been growing interest and a dramatic increase in investment in technology entrepreneurship. As was pointed out in the previous section of this chapter,

researchers now pay more attention to the entrepreneurship phenomenon and the emergence of new ventures, asking questions such as who starts them, when, where, and why they are started, and the process by which they advance or fail to advance with time. Fundamentally, entrepreneurship begins with the founders or founding team, who identify and explore ideas and opportunities, and as a result, create and discover novel opportunities (Beckman et al., 2012a, pp. 89-93). Technology entrepreneurship is distinguished from mainstream entrepreneurship by its focus on creating and nurturing these opportunities through innovations in science and engineering.

The conversion of discovery, development, and dissemination of technological innovations at the national level has become a part of the innovation and economic agenda for every developed economy (Mosey, Guerrero and Greenman, 2017, pp. 1-9). As Li et al. (2008 p.733) note, “technology entrepreneurship is an important way to commercialise technological innovation”. Countries across the world, recognising this, now implement policies to support technology entrepreneurship. As a result, research has advanced, not just into exploiting technological innovation and capabilities, but also into translating this knowledge into commercially viable businesses. As Litan and Song (2008, pp. 2-6) point out, it is not enough to understand the development of new technologies, but entrepreneurs also need to exploit and commercialise them. The formation of small startup firms developing inventions and introducing technological discoveries with significant potential and commercial application is crucial to the ‘smart economy.’ The process by which this is achieved is referred to as technology entrepreneurship (Evers, Cunningham and Hoholm, 2013).

One key to competitiveness and sustainability of regions and nations is to apply and interpret technological knowledge into practical businesses (Stokes, 1997). However, the domain of technology entrepreneurship is still very new, and the existing knowledge surrounding this phenomenon is still very limited (Beckman et al., 2012; Lindholm Dahlstrand, 2007). Moreover, while the terminology often floats around business, management, governmental, and academic circles, there is no common definition or understanding of the term (Spiegel and Marxt, 2011, pp. 1623; Ratinho, Harms and Walsh, 2015). The intention of this section of the chapter is to critically explore the literature on technology entrepreneurship to gain a comprehensive understanding of the definitions and scope of the topic. Additionally, existing research into the field of technology entrepreneurship will be drawn on to procure a comprehensive definition for the purposes of the research project as well as identify some distinctive aspects of technology entrepreneurship.

As explained in the introduction of this section, research definitions of technology entrepreneurship are still evolving. Early academic research used the term ‘technical

entrepreneurship' and related it to the founding of new ventures, through 'spin-offs' either from university departments or industry research laboratories. For instance, Cooper (1971 p.5) uses the term 'technical entrepreneurship' to refer to "a company which emphasises research and development ... is often founded by scientists or engineers, and usually includes a substantial percentage of professional technically trained personnel." Lamont (1972, pp. 16-23) describes 'technical entrepreneurship' as the desire of a university entrepreneur to commercialise new technology and start a new company.

Nonetheless, it is becoming increasingly difficult to separate technical knowledge from high-technology industries. This view is supported by Oakey (2012) who writes that most entrepreneurs starting new small firms in high-technology industries are technical entrepreneurs. High-technology ventures are defined as entrepreneurial business ventures with a high concentration of technical activities, founded primarily to further intellectual and professional goals, rather than the conventional financial goals (Corman, Perles and Vancini., 1988).

Much like 'entrepreneurship', 'high technology' is a popular term that has been misused and overused in various forms of media to describe forms of new technology, industrial, and/or commercial activity (Oakey, 2012). A typical example is the 'dotcom bubble' of the early, 2000s, in which a lot of so-called 'high-technology' firms were actually 'low-technology' firms, or simply firms with internet presence or websites to sell goods.

According to Breheny, Cheshire, and Langridge (1983 p.62), the term is used very vaguely and is no more than a "political glibspeak or property developer's advertising copy," to describe electronics or electronics-related activities. In Smith, Collins, and Clark's (2005) investigation of how existing and available knowledge of a firm impact its knowledge creation capability, high-technology firms are defined as those whose business strategy places great importance on invention and innovation, and allocates a significant amount of financial resources to research and development. This firm employs a high number of scientists and engineers and competes in worldwide 'short-life-cycle' product markets.

Although differences of opinion exist, there appears to be some agreement that 'high-technology' firms are heavily invested in research and development (R&D) and have a workforce of mostly scientists and engineers. Moreover, 'high-technology' firms could be key drivers to industrial and technological advancement in various sectors, such that high-technology ventures are not just independent firms but could exist as departments or enablers within a larger firm or sector. This view is supported by Oakey (2012), who indicates that the strength of high-technology small firms lies in their ability to effectively perform research and development leading to results better than large firms in established industries.

However, the significance of these small, high-technology firms does not merely lie in their capacity to produce innovative solutions and inventions; it is also in their ability to radically change the direction of large, existing industrial sectors and, more importantly, inspire new industrial activities through 'disruption' or 'creative destruction', offering consumers a variety of choices (Oakey, 2012). These developments and innovations in science and engineering by high-technology firms are the core component that leads to opportunity recognition and facilitates the emergence of new ventures, markets or industries (Beckman et al., 2012)

The migration from 'technical' to 'technological' can be seen in recent studies, even though the terms are still interchangeably used. For instance, Jones-Evans (1995) defines a technical entrepreneur as the founding owner of a technology-based business with the responsibility of planning, launching, and managing the organisation. In the same vein, Nichols and Armstrong (2003) suggest that technology entrepreneurship has to do with organising, managing, and bearing the risk of technology-based businesses.

A rather complex definition is given by Jelinek (1996, p.799), who describes technology entrepreneurship as a "quintessentially social activity, requiring joint efforts to interpret ambiguous data, joint understanding to sustain technology efforts, and a persistent, coordinated endeavour to accomplish technological change." Based on the premise of 'opportunity discovery,' technology entrepreneurship can be defined as the use of technology to discover and exploit market opportunities and provide solutions. Indeed, Liu et al. (2004) define technology entrepreneurship as the way in which entrepreneurs draw on resources to exploit emerging technology opportunities. Technology entrepreneurship is of the 'character of opportunity', defined as the discovery and exploitation of market opportunity of technology (Li et al., 2008).

What distinguishes technology entrepreneurs from other types of entrepreneurs is how they employ science and technology to approach and exploit market opportunities. In proposing a technology entrepreneurship policy framework for the US network economy, Hemphill (2005) refers to technology entrepreneurship as a business leadership style based on identifying potential high-technology-intensive opportunities, putting together resources such as human capital and cash, and using instantaneous decision-making skills to manage rapid growth. Similarly, Bailetti (2012) explains technology entrepreneurship as an investment in projects which engage special individuals and heterogeneous assets, committed to advances in scientific and technological knowledge, for the purpose of creating and capturing value for the firm. Furthermore, Beckman et al (2012 p.90) point out that technology entrepreneurship exists when "developments in science or engineering constitute a core element of the opportunity that enables the emergence of a venture, market, cluster, or industry."

More recently, a call for a review and consolidation of definitions of technology entrepreneurship has led to the appearance of new terms – digital entrepreneurship and digital technology entrepreneurship (Mosey, Guerrero and Greenman, 2017; Giones and Brem, 2017). Giones and Brem (2017) argue that definitions of technology entrepreneurship have evolved because of the conceptualisations of the term ‘technology.’ Although research in the field of technology entrepreneurship began as a result of the entrants’ new ventures into high-tech industries (Gans and Stern, 2003), the focus of the majority of previous research has been on how technology is commercialised, such as academic spin-offs (Wright et al., 2007; Fryges and Wright, 2014; Mosey, Guerrero and Greenman, 2017). This has led researchers to focus on a ‘technology-push’ situation, in which the entrepreneur has a mission of creating a new technology, and finding a market and application for the new technology (Mojica et al., 2009; Giones et al., 2013). Digital entrepreneurship, however, is not concerned with the specifics of the technology behind a business idea, but rather on the service or digital platform that is based on it, while digital technology entrepreneurship is a hybrid of traditional, science-based technology entrepreneurship emanating from university intellectual property (Hartmann, 2014) with new and rapidly evolving internet-based digital startups or ventures (Giones and Brem, 2017).

Based on these definitions, the opportunities do not have to be revolutionary; they can be evolutionary advancements targeting an existing market or creating a new one. Together, these studies indicate that the definition of technology entrepreneurship will continue to evolve. However, they provide important insights into the field. While a variety of definitions of technology entrepreneurship have been suggested, in this thesis, the term technology entrepreneurship will be used in its broadest sense to refer to **the discovery and exploitation of technological ideas and their use in creating new ventures by an individual or team of entrepreneurs.**

Table 1 : An overview of Technology entrepreneurship definitions

Author and Year	Empirical context and approach	Research Aim	Terminology used in literature	Definition
Lamont (1972)	Spin-off firms founded in the period 1955-69 in Ann Arbor, Michigan. Mixed methods of questionnaires and personal interviews	The article focuses on the role of the university as an incubator organization and the special problems of academic entrepreneurs and their firms. Guidelines are given to improve the academic entrepreneur's corporate performance and suggestions are offered to enable the university to facilitate the entrepreneurship process	Technical entrepreneurship	Commercialising a new technology and starting a company
Litvak and Maule (1976)	The population examined in the study consisted of 112 entrepreneurs involved in the establishment of one or more technologically based enterprises in	Examines some of the key characteristics of technical entrepreneurs in Canada and compares findings with similar studies conduct-	Technology based firm	Emphasizes research and development and exploitation of new technical knowledge.
Cooper and Bruno (1977)	Based upon investigation of 250 high-technology firms founded on the San Francisco Peninsula during the 1960s	The article considers the patterns of development for new, high-technology firms and some factors which seem related to their success or failure.	High-tech firms	Typically founded by scientists and engineers that emphasise R&D and focus on development of new tech
(Corman, Perles and Vancini, 1988)	Personal interviews combined with secondary research were used to examine twenty-two high technology companies and their founders in Bos-	To examine how personal values are important determinants in the choice of corporate strategy in high technology ventures, with particular emphases on the entrepreneurial decision process	High-technology ventures	Entrepreneurial business ventures founded to primarily further intellectual knowledge.
Jones - Evans (1995)	Detailed qualitative interviews administered to a sample of 61 technical entrepreneurs in the UK	Aims to develop a typology based on previous research into the organizational backgrounds from which technical entrepreneurs have emerged to form new ventures	Technical entrepreneur	Founding owner of a technology-based business with the responsibility of planning, launching, and managing
Jelinek (1996)		Attempts the nominal "managerial" tasks of sense making, mindful alertness to anomalies, and the joint creation of a shared cognitive context.	Technology entrepreneurship	Quintessentially social activity required joint efforts to interpret ambiguous data, joint understanding to sustain technology efforts, and a persistent, coordinated endeavour to accomplish technological change.

Nichols and Armstrong (2003)	The authors use as a context the engineering programs at the University of Texas at Austin, particularly the Department of Mechanical Engineering	Examines various definitions of engineering entrepreneurship, and also examines the pedagogical justification for including entrepreneurship in engineering education	Technology engineering) entrepreneurship (or	Organizing, managing, and bearing the risk of technology-based businesses
Liu et al (2004)	The research is based on an in-depth, inductive comparative case study of the historical involvement of UMC (United Microelectronics Corporation) and TSMC (Taiwan Semiconductor Manufacturing Company) in the semiconductor industry.	Examines and compares technology entrepreneurial styles of two leading Taiwanese Semiconductor firms, UMC and TSMC.	Technology entrepreneur	The way in which entrepreneurs draw on resources to exploit emerging technology opportunities.
Hemphill (2005)	Conceptual. Draws conclusion from policy inferences drawn from other research studies (focusing on national entrepreneurship policies in the industrialized world)	Aims to develop a national technology entrepreneurship policy “supportive” of the commercialization of new product technologies, that is, offering the legal environment, regulatory framework, modest financial assistance, and business incentives that are conducive to successful technology entrepreneurship, with markets providing the	Technology entrepreneurship	Business leadership style based on identifying potential high-technology intensive opportunities, putting together resources such as human capital and cash, and using instantaneous decision-making skills to manage
Marvel and Lumpkin (2007)	Finding from a sample of 145 technology entrepreneurs operating within university-affiliated incubators.	To investigate how the experience, education, and prior knowledge of technology entrepreneurs relate to innovation radicalness.	Technology entrepreneur	Individuals who recognizing and exploring opportunities by leveraging technology knowledge and experience to create new value through the
Lindholm Dahlstrand (2007)	Conceptual. Based on several of the author’s earlier studies, some empirical data are used to illustrate some characteristics of the Swedish case	The purpose of this paper is to analyse technology-based entrepreneurship and its importance for economic growth	Technology-based entrepreneurship	A NTBF is a new firm that is depending on technology
Spiegel and Marxt (2011)	Conceptual. Based on elements identified in a review of articles in the special issues.	This paper attempts to be starting point for discussions on technology entrepreneurship by deriving a framework.	Technology entrepreneurship	Investigates all questions regarding successful formation, exploitation and renewal of products, services and processes in technology oriented
Bailetti (2012)	Conceptual. Based on literature search	The purpose of the article is to identify the themes that dominate the technology entrepreneurship literature, provide a definition of technology entrepreneurship, and identify its distinguishing aspects relative to economics, entrepreneurship, and management	Technology entrepreneurship	Investment in projects which engages special individuals and heterogeneous assets committed to advantages in scientific and technological knowledge for



				the purpose of creating and capturing value for the firm
Beckman et al (2012)		Explores research questions at the nexus of entrepreneurship and technology to advance understanding of critical theoretical and managerial issues at this nexus.	Technology entrepreneur	Technical entrepreneurs often have a deep technical understanding of what their business is about, given them a clear vision of how the new technology they have created can be applied in a commercial context.
Oakey (2012)			Technology entrepreneurship	Technology entrepreneurs often have a deep technical understanding of what their business is about, given them a clear vision of how the new technology they have created can be applied in a commercial context
Evers, Cunningham and Hoholm, (2013)			Technology entrepreneur	An individual that starts a venture to exploit innovative and new technology market opportunity.
Ratinho, Harms and Walsh (2015)	Quantitative method based on objective data.	The paper structures the publication landscape in technology entrepreneurship by providing a ranking of journals that focus specifically on TE.	Technology entrepreneurship	Recognizing, creating and exploiting opportunities, and assembling resources around a technological solution, irrespective of the organizational context
Giones and Brem (2017)	Conceptual based on previous literature.	The article focuses on identifying and describing technology entrepreneurship from a digital perspective	Digital technology entrepreneurship	Digital technology entrepreneurship is concerned with the service and application of the technology rather than the specific technology. In the digital technology entrepreneurship, technology is an input factor only.

*Created by author*

This section has reviewed the literature to identify the puzzling and overlapping definitions and terminologies associated with technology entrepreneurship. The table above provides a summary of key definitions and terminologies used by the authors to describe the phenomenon. Having defined what is meant by technology entrepreneurship, the next section further identifies different aspects and approaches to the study of technology entrepreneurship.

### 2.2.1 Elements of Technology Entrepreneurship from Literature

As discussed above, technology entrepreneurship is a field with some level of confusion and misunderstanding, either in the terminologies used, or of the criteria that constitute a 'technology venture.' Conversely, as with the general phenomenon of entrepreneurship, the approach to the study of technology entrepreneurship can broadly be divided into three levels (Phan and Foo, 2004):

**The technology entrepreneur:** Concerned with the individual, or team of individuals, responsible for founding and managing the technology venture.

**The Venture:** concerned with attributes and characteristics of the team, structure, process, and organisational linkages that mark a technology venture.

**The Environment:** Concerned with the role of technology and how the technology venture interacts with its environment, such as industry standards, government policies, geographical location, and markets.

#### *The Technology Entrepreneur*

In any entrepreneurial venture, the founder or owner-manager plays a crucial role and is central to the invention, survival, and success of the firm (Schumpeter, 1934; Gartner, 1988; Shane and Venkataraman, 2000a; Newton and Gary Shreeve, 2002). As Baron (2004, p. 233) points out, the success of an entrepreneurial venture hinges on the actions of the entrepreneur, such as "the decisions they make, the strategies they develop, and the style of leadership they exercise." Likewise, in technology entrepreneurship, the founder or founding team plays a key role in the lifecycle of the entrepreneurial process. What is more, in technology entrepreneurship the firm is dependent on the technical knowledge of the founder or members of the founding team; in an earlier work, Cooper and Bruno (1977, p.21) note that the primary strength of a high-technology firm is in the knowledge and skills of its founders:

If the founder is strong in engineering, weak in marketing, and completely lacking in financial skills, then the new company must struggle with that combination of strengths

and weaknesses. If a team of founders is carefully assembled, skills can be complementary, and the new firm is more likely to have the full range of capabilities needed to survive and prosper. (Cooper and Bruno, 1977, p.21)

Nonetheless, the success of a 'technology firm' is not restricted to entrepreneurs who are deemed to be 'technical.' There are instances where a non-technical entrepreneur has successfully founded and managed a 'technology company.' An entrepreneur who is bold, imaginative, and constantly seeking opportunities to commercialise new products and technologies also has equal chances of founding and managing a successful technology firm (Baumol, 2002). Recognising their technical weakness, the entrepreneur has the option of combining with a technical co-founder or assembling a technical team who concentrate on producing the technology product or service to be exploited (Oakey, 2012). Some such examples include the Steve Jobs and Steve Wozniak partnership in creating Apple, Inc., Jack Ma of Alibaba, Tim Westergren of Pandora, Jeff Bezos of Amazon, Andrew Mason of Groupon, and Michael Bloomberg of Bloomberg (Dorf, 2008; Oakey, 2012).

Nevertheless, where complex technological advancements are central to the venture, the talent, experience and actions of the entrepreneur are overwhelmingly significant (Beckman et al., 2012b). Technology entrepreneurs have been recognised to display characteristics that are quite different from other types of entrepreneurs. In addition to their technical knowledge and industry experience in a particular technology or research lab (Cooper and Bruno, 1977; Colombo and Grilli, 2005), they are known to have some level of advanced degree, mostly in engineering and/or science, with an impressive social network of colleagues to aid in building the venture (Barringer, Jones and Neubaum, 2005). Cooper and Bruno (2000) recognise that technical entrepreneurs are moderately motivated by high financial rewards and highly motivated to apply their creative and technical skills to solving real issues.

One often-pursued avenue has been an attempt to relate the experience and talent of the technology entrepreneur to their venture performance. Roure and Keeley (1990) propose that, in measuring the success of a technology-based venture, while individual traits and skills are important to the founders or founding team, relevant experience is just as (if not more) valuable. Jones-Evans (1995) argues that technical entrepreneurs can be differentiated based on their occupational and organisational background into researcher, producer, user, and opportunist. This classification is useful and will be discussed further below: it provides a basis for differentiating the performance of 'technology-based' ventures, as well as providing cues to how policymakers can support technology entrepreneurs.

However, some researchers have found talent to be more important when the technologies are less familiar, and the industry is in disruption. Disruption is a term used in technology and

entrepreneurship to refer to a form of innovation that creates new market and value networks at the cost of displacing existing and established market-leading firms, products and alliances (Venkataraman, 2004). In a study which compared the importance of talent and experience in venture performance, Eesley and Roberts (2012) discovered that highly talented founders have a greater incentive to generate entrepreneurial experience by learning from each experience. Once an industry has been disrupted, the impact of prior funding experience becomes negative. Similarly, Furr, Cavarretta and Garg (2012) argue that, in an unfamiliar and dynamic environment, management with more flexible reasoning talent are more likely to influence major changes than teams with experience in a focal industry. As Eesley and Roberts (2012 p.25) state, "After an industry technological disruption, talented but inexperienced entrepreneurs have a better chance of seizing the opportunity."

Furthermore, researchers have shown that a founder's human capital affects the performance of a 'technology-based' venture. Formal education level, sound prior experience, a profound level of existing technological knowledge, and good knowledge of the market of operation all have a positive influence on technology companies (Marvel & Lumpkin, 2007). Similarly, Gimmon and Levie (2010) suggest that relevant human capital - such as having previous business experience and technological background - influences the survival of a technology venture. Pickernell et al. (2011) assert that graduate entrepreneurs have a greater propensity to be able to gain access to knowledge and a range of resources, including government resources, university advice, informal networks/trade associations, and direct industry resources.

Conversely, after a study of 506 high-tech industries in the manufacturing and services industry in Italy, Colombo and Grilli (2005) found that, in new technology-based firms, the founder's educational background and previous work experience affect the performance of the venture differently. While the years spent in education had no relation to the growth of the firms, specific education in graduate and undergraduate levels of economics and managerial fields had a more positive effect on the firm's growth. Furthermore, in professional experience, founders with previous technical experience in the field of the new venture had superior results to founders with experience in a different industry or in the same industry but in commercial functions.

Studies which use econometrics as a method of analysis fail to acknowledge how their findings might differ in a different geographical setting. Ganotakis (2012) highlights the need for technical entrepreneurs to complement their technical skills and knowledge with managerial capabilities gained from either education or experience.

All the studies reviewed so far, however, suffer from a selection bias, either by selected companies or in specific regions and industries. One question that needs to be asked is: in developing regions, where there is limited technology knowledge and poor education infrastructure, what human capital, skills, and characteristics would be necessary for technology entrepreneurs to launch a successful venture? Moreover, are technology knowledge and managerial experience enough to launch a technology company? As pointed out,

... much research on technology entrepreneurship uses the biotechnology and semiconductor industries as its setting. As a result, we know little about entrepreneurial activity in novel areas, such as ventures that rely on user-driven technical innovations, pursue technical innovations for education, and target technologies for developing economies. (Hitt et al., 2010, p.1)

“Is technology entrepreneurship different in these settings Hitt et al. (2010, p.1)?” asked.

Having discussed the characteristics and experiences that influence the founders or founding team, it is important to ask how they come up with new ideas and discover opportunities. The next section discusses how the individuals or founding team of a technology firm explore opportunities and ideas and how they exploit them to form new ventures.

#### The Idea/Opportunity

It is generally agreed that the entrepreneur is utterly crucial in technology entrepreneurship; in most cases, it is the job of the individual founder or founding team to identify and evaluate opportunities and to come up with the ideas and strategies to explore them. Duening, Hisrich and Lechter (2009) maintain that all technology ventures are based on the vision of a new product or service tapped by the founder or founding team. Moreover, the major difference between technology entrepreneurs and conventional entrepreneurs is the involvement of technological/technical systems in the ad hoc nature of their venture. Aside from that, idea-generation and opportunity recognition are among the general characteristics shared with other categories of entrepreneurs (Dorf, 2008; Evers, Cunningham and Hoholm, 2013).

In describing the formation phase of a new technology venture, Spiegel and Marxt (2011) note that both new and existing technology ventures constantly find new ways of introducing new products and services, and building improved ventures. The question often asked by every technology entrepreneur is: “What problem can I solve using technology that can create a successful business?” Thus, “How can technology-based companies uncover, generate and select new business opportunities?” (Duening, Hisrich and Lechter, 2009, p.25). Entrepreneurship begins with an idea which, when evaluated, becomes a valuable opportunity.

However, the factor distinguishing technology entrepreneurship from other entrepreneurship domains is the high rate of innovation. Innovation is defined as something new, either a new way of developing a product or an improved process (Van de Ven et al., 1999). Schumpeter (1950) originally introduced the concept of innovation as the use of new technologies and new ideas to produce the effect of 'creative destruction.' According to Schumpeter (1950), while established companies were concerned with improving their normal ways of carrying out activities, new entrants (innovators) used the concept of creative destruction to introduce new products and services.

That said, innovation is beyond just invention or introducing new products and services. It spans the entire entrepreneurial process and can sometimes be found in reinventing products (Evers, Cunningham and Hoholm, 2013). In addition, it is important to ask what factors influence technology entrepreneurs to generate and explore technological ideas and opportunities and how these factors influence them.

Generally, in entrepreneurship, there are two broad motivations of ideas which lead to the creation of new firms: entrepreneurship out of *necessity* and entrepreneurship out of *opportunity* (Broughton and Ussher, 2014). While opportunity entrepreneurs participate in entrepreneurship activities in order to exploit perceived business opportunities, necessity entrepreneurs get involved in entrepreneurship as a requirement, usually as a result of having no other employment option. (Block and Wagner, 2010). That said, job satisfaction could be another motivating factor for necessity entrepreneurs (Acs et al., 2004), while Hechavarria and Reynolds (2009) found that opportunity entrepreneurship has a strong correlation with high-technology, high-growth firms.

While it may be true that technology entrepreneurship is mostly explored by opportunity entrepreneurs who choose to start a business opportunity by taking advantage of a perceived opportunity (e.g., Bill Gates, Steve Jobs), this fails to consider regional factors, such as emerging economies where there is a population of necessity entrepreneurs. Is it possible that opportunity entrepreneurship is enhanced by the regional environment in which the entrepreneur is situated? Or would perceived opportunity entrepreneurs thrive in building successful technology ventures in a region where the practice of entrepreneurship is predominantly out of necessity?

The background of a technology entrepreneur can also be a motivating factor to the type of ideas and opportunities found. In a study of the typology of technology entrepreneurs, Jones-Evans (1995) identifies four distinct types of entrepreneurs, based on their organisational background: the research technical entrepreneur, the producer technical entrepreneur, the user technical entrepreneur, and the opportunist technical entrepreneur.

The technical entrepreneur who has a foundation in scientific or technical development at a university or other academic higher institution is termed a research technical entrepreneur (Jones-Evans, 1997). The research technical entrepreneur is often linked to the academic entrepreneur since they originate typically from university settings, research labs or spin-offs (Wright, 2007).

The producer technical entrepreneur has previous experience in a larger organisation, with first-hand commercial and developmental knowledge of products and services. Evers, Cunningham and Hoholm (2013) note that the role of a 'producer' on a team is essential because they are the 'doers' who think practically of what should be done.

The third classification is the 'user' technical entrepreneur who has a background in a supporting role or as an end user, not particularly involved in the development of the technology. Conversely, Shah and Tripsas (2007) argue that the user entrepreneur is an 'accidental' entrepreneur who happens upon an idea while using an already commercialised product, develops a solution and shares it with others for feedback. This type of entrepreneur relies on the collective feedback of other users and usually develops an idea to commercial value after experimentation, adaptation, and preliminary adoption (Shah and Tripsas, 2007). This class of entrepreneur is less studied in the dominant literature in entrepreneurship, which emphasises the discovery of entrepreneurial opportunities by individuals with relevant knowledge and experiences (Venkataraman, 1997).

Jones-Evans' last type of technical entrepreneur is referred to as the 'opportunist' technical entrepreneur, because this type of entrepreneur has no previous experience in a technical organisation and has no technical skills relevant to developing the technology. Preliminary work on 'opportunistic' entrepreneurs was undertaken by Smith and Miner (1983), who differentiated 'opportunistic' entrepreneurs as hailing from a middle-class background, with a broad education and some management experience, seeking to capitalise on new and innovative opportunities. However, this type of entrepreneur is known to exhibit a high level of success and growth because of their opportunistic adaptation (Bhide, 2000). This prompted Pendergast (2003) to ask whether "opportunistic" entrepreneurs manifest different traits from "visionary" entrepreneurs. In most cases, 'opportunist' and 'user' entrepreneurs combine with the 'researcher' or 'technical' entrepreneur to form a successful technology firm (Oakey, 2012). Interestingly, the 'user' and 'opportunist' types of technical entrepreneur can be linked to the theory of entrepreneurship based on opportunity, in which the entrepreneur creates and exploits opportunities, and generates change (Simpeh, 2011).

In an attempt to understand how new technology ventures are formed, Jones-Evans follows the individual-level analysis to determine how the previous occupation of the entrepreneur

affects the formation process. While Jones-Evans' study is useful in categorizing technical entrepreneurs, it fails to explain further how their previous occupational experience influences the role they play in the founding process or in opportunity discovery and then development of the technology firm. Moreover, its method of analysis has a number of limitations. The study selected participants from a government scheme, SMART, which did not function as an exclusive hub to technology firms. Instead, it merely highlighted technological innovation as one of its criteria.

However, although limited to one region, this study was useful in categorising technical entrepreneurs based on their previous occupational experience. It also highlights some elements which motivate technology entrepreneurs when thinking of a new venture to found. As Dorf (2008) points out: "Good opportunities also emerge from circumstances of employment or experience." An opportunist technical entrepreneur may be motivated to exploit ideas and opportunities while working for a technology-based venture, despite lacking technical experience or technical skills. Likewise, a user technical entrepreneur might be motivated by their experience in using or testing a product. In this respect, Weiss (2012) suggests the following questions as a pointer to discovering new business opportunities, seen from the user's point of view:

- What problems are being solved?
- What frustration is currently experienced with the present solution?
- How are users presently solving their problems?
- What better ways can be used to solve the problem? What skills are available?
- How is the solution different from what is on offer?

Taken together, these studies highlight the importance of the individual involved in founding a new technology venture, focusing on the mechanism and influences by which technology founders generate ideas and explore opportunities. However, these studies do not acknowledge other players, such as the management team and strategic investors, who influence the initial startup phase, growth, and success of most technology ventures. Hayton and Zahra's (2005) study of the human capital characteristics of the top management of 340 high-technology ventures found that the top management team is an important source of knowledge for the ventures; thus affecting their capacity to thrive, through venturing activities, innovation, and financial performance.

Furthermore, little is known about technology entrepreneurs in emerging and developing countries, either due to the difficulty of gathering information from the field or a lack of focus on the region, since the field of technology entrepreneurship is still relatively in its early stages and is still evolving. Nonetheless, it is equally important to understand the context in which



technology entrepreneurs operate, as well as their unique traits and characteristics. This will provide an improved understanding of technology entrepreneurship and entrepreneurs and how they come upon ideas and exploit opportunities (Shane and Venkataraman, 2003).

#### *The Venture*

Another important aspect of technology entrepreneurship is the venture itself. As such, emphasis has been placed on what constitutes technology firms in terms of industries, venture formation, growth, and survival (Beckman et al., 2012). Furthermore, Bailetti (2012, p.11) outlines that the theory of the firm in technology entrepreneurship has to do with “why firms exist, what determines their boundaries, what determines their structure, and what drives their different actions and performances.” But before understanding these integral aspects of the firm, it is important to understand how technology firms are defined and categorised. While there is general acceptance of the importance of ‘technology firms’ in the marketplace, there is a lack of agreement in the literature of how to classify technology firms and their activities (Grinstein and Goldman, 2006).

Technology firms are different from traditional firms because of their level of engagement with technology, research and development, and a concentrated workforce of science and engineering employees (Cooper and Bruno, 1977; Oakey, 2012). Also, they are mostly nascent firms, which are new and innovative in nature (Newbert, 2005). Some research suggests technology companies can be ‘high growth’ firms due to their fast growth rate (Colombo and Grilli, 2005).

It has become commonplace to distinguish firms in technology entrepreneurship as either high-technology or low-technology. However, a bias exists more towards high-technology industries, such as bio-technology, manufacturing, and semiconductors (Cooper and Bruno, 1977; Corman, Perles and Vancini, 1988; Cooper and Bruno, 2000; Smith, Collins and Clark, 2005; Oakey, 2012). Other researchers classify technology entrepreneurship firms into ‘New-technology-based Firms’ and ‘Incumbent-technology-based Firms’; in which the NTBFs are responsible for ‘radical innovations’ and ITBFs are already existing firms who possess the resources and capabilities to reinvent already existing technologies (Spiegel and Marxt, 2011). That said, much preference is ascribed to ‘New-technology-based Firms,’ which are still analysed as, or linked to, ‘High-Technology Companies’ (Roure and Keeley, 1990).

Additionally, some researchers have taken cues from industry classifications to aid the categorisation of technology firms (Kile and Phillips, 2009). Grinstein and Goldman (2006) argue that, for lack of guidance on how to classify technology firms, some researchers simply sought to use industry membership as the criterion for classification. As a result, it has placed more focus on manufacturing, electronics, and pharmaceutical industries, all of which are

predominantly high-technology industries. Grinstein and Goldman (2006) identified these discrepancies in the field and proposed characteristics for classifying technology firms under 3 dimensions: the nature of R&D activity and organisational market condition, the nature of the product strategy, and the corporate culture. Outlining 21 characteristics associated with technology firms, the study concluded that R&D simply does not stop at being the core of a technology firm, as noted by Lamont (1972), Litvak and Maule (1976) and Smith, Collins and Clark (2005); R&D activities are also embedded within the organisational characteristics of the firm.

Furthermore, a link is made between R&D activities and market conditions, because consumer demand, as well as marketing, influences R&D activities. A technology firm that has a product strategy of introducing new products into the marketplace has a good chance of growth and prosperity (Grinstein and Goldman, 2006). This view is complemented by Tanev (2012), who argues that one of the conditions for a technology company to have a global competitive advantage is to have technically advanced product offerings with significant first-mover advantage. However, Grinstein states that inputs such as R&D and corporate culture are more important than outputs (i.e., products and processes).

One prominent criterion in all of the characterisations is that the firm must be innovative, and technology driven. In other words, it should have in-depth roots and interaction with science, engineering or technology. Consequently, ventures in technology entrepreneurship may be broadly divided into two categories: technology-venture and technology-based venture. Fundamentally, technology companies are mostly responsible for creating, developing, and selling the core technologies (Cooper and Bruno, 1977). Some examples include Google in creating search technology, Medtronic in medical technologies, and Intel in creating semiconductors and chip devices. By contrast, technology-based companies rely on core technologies already built (Lamont, 1972). Examples include Amazon Inc., relying on internet technology to sell other products, and Beats Electronics, relying on audio technology to sell headphones. Accordingly, technology ventures are able to create and develop novel technologies in-house, whereas in technology-based ventures, that function can be outsourced. Technology firms, such as Apple Computers, possess the capability of creating new markets and changing the direction of existing industries, while most technology-based firms tap into already existing markets, even though they use technology to extend their market reach (Grinstein and Goldman, 2006).

A widely held consensus is that research and development form a significant part of technology entrepreneurship (Beckman et al., 2012). While this is true for most firms whose primary purpose is developing new technologies from scratch (that is, technology firms), the

technology-based firms can afford not to be heavily invested in R&D. However, some technology-based firms are also known to innovate increasingly on existing technologies to produce better efficiency. An example would be Facebook, which, while not inventing social networking or the internet, improved upon these technologies to deliver a better social web connectivity service.

It is important in technology firms that the founders are equipped with technical experience or have technical backgrounds (Cooper and Bruno, 1977). But in technology-based firms, founders may have other backgrounds in business, marketing or economics (Ganotakis, 2012). In technology firms, as argued above, the solution or value offered is mainly the technology, while in technology-based firms, the technology drives the solution or value offer (Grinstein and Goldman, 2006).

In effect, most technology firms are listed under the technology sector in industry classifications. However, technology-based firms may be listed in other sectors, such as finance, transport, retail, media, and education.

*Table 2: Technology firms vs technology-based firms. Author's own*

<b>Technology Ventures</b>	<b>Technology-Based Ventures</b>
Create, Develop, and Sell Technology	Rely on technology
Have the capability to create new markets	Tap into new markets
Develop technology in house	Can outsource technology
Heavily involved in R&D	Can afford to not invest much in R&D
Founders are mostly technical	Founders can come from any background
Exists mainly under the 'technology sector'	Can exist in any sector
The solution is the technology The technology is the focus	Technology drives the solution The user/customer is the focus

This system of classification allows for high-technology ventures to be listed under 'technology ventures' because they are engaged in creating core innovative products and technologies, which are used by other firms to serve consumers.

Nonetheless, these classifications can clearly overlap. For instance, technology-based companies can sometimes come out as hybrids because of their ability to invest in R&D and develop innovative technologies in-house to make their solutions more efficient (Duening, Hisrich and Lechter, 2009). Furthermore, this classification does not give greater value to one over the other; it simply identifies the differences in how they operate and how they disseminate their value.

In technology entrepreneurship practice, new technology ventures are often called startups. Startups are simply young technology ventures with particular momentum behind them, based on perceived demand or opportunity for its products or services. They are usually small in size, but it is also common to spot big organisations that identify themselves as startups (Robehmed, 2013). The intention for startups is to grow rapidly and turn profits or engage in some form of exit, either through an initial public offering or a strategic buyout.

Technology startups vary widely in the mode of operation. Many startups do not have products to sell, while there are some that have a product/service to sell but are not generating any revenue. There are also startups that are generating significant revenue through their products/services but are not near profitability due to their high operating cost. There are no standard criteria on when a company ceases to be a startup (Marxt 2011).

Different approaches have been adopted to examine the success or failure of technology ventures. Essentially, technological developments lead to innovations in new products, new systems, distribution channels, customer segments or intellectual property (Beckman et al., 2012). As Corman, Perles and Vancini (1988) point out, technology entrepreneurs in high-tech industries are mostly motivated by furthering intellectual and professional goals. Intellectual property belongs to the category of intangible assets, along with creativity, innovation, invention, and knowledge; which are very important assets and form a major part of new technology firms (Duening, Hisrich and Lechter, 2009). The challenges confronting a new firm include:

- Identifying an opportunity or idea that serves a market and strategizing how to get a share of the market
- Finding a source for sufficient funds to execute the plans

- Engaging high-impact employees and developing a working product
- Arranging with key suppliers and consumers
- Ensuring there are enough funds for marketing, inventory, and administration
- Listening to customers' feedback and reiterating products to meet their needs.
- Modifying business strategy as market conditions change
- Expanding the product offering, obtaining more funds, growing the organisation (Roure and Keeley, 1990)

Collectively, these studies outline a critical role for empirical work to further the research understanding of technology ventures, such as understanding what factors determine the early success of technology firms and which of the factors are more favourable in creating new technology ventures. Thus, how can technology-based companies uncover, generate and select new business opportunities to be nurtured into new ventures? Spiegel and Marxt (2011) suggest factors such as economic cycles, political climate and location of the venture as a starting point.

Moreover, they raise the question of the survival rate of new technology ventures and the strategies in place to comprehend this issue. Shane and Venkataraman (2003) assert that technology firms rely hugely on activities and strategies that reduce uncertainty and risk, manage knowledge flow, develop and enhance new technology systems, and develop the institutional environment in which they are embedded. However, the authors fail to mention what these activities and strategies are.

#### *Environment*

In the creation of a new venture, entrepreneurs do not operate in isolation; they rely on resources available through networks, associates and other support organisations within the environment in which they are embedded. As Gartner (1985) argues, innovative entrepreneurs respond to their environment, as opposed to working in a vacuum. In a study by Cooper (1973), which set out to summarise the factors that affect the birth rate of high-technology companies, external factors reasoned to be regional in nature were among the major factors, alongside the entrepreneur and the organisation. These include access to capital, collective attitudes, perception and existing knowledge about entrepreneurship, accessibility to suppliers, personnel and markets, and economic conditions.

Similarly, Gartner (1985), identifies certain environmental factors that stimulate entrepreneurship, such as venture capital availability; the presence of experienced entrepreneurs; a technically skilled labour force; accessibility of suppliers; accessibility of customers or new markets; governmental influences; the proximity of universities; availability

of land or facilities; accessibility of transportation; attitude of the local population; availability of supporting services; and living conditions.

Nacu and Avasilcăi (2014), highlight factors like the geographic location of the venture; demographic influence in relation to demand; as well as source of labour; economic and financial environment; legal environment; and political environment in relation to policy development. Essentially, new technology ventures require an enabling environment that facilitates a new knowledge discovery that leads to an idea that is converted into an opportunity, as well as all the necessary support programs and resources required to develop the idea.

There has been an unambiguous relationship between regional clusters and the formation of new technology ventures. The most famous of them all is Silicon Valley and Route 128 in the USA (Saxenian, 1994). However, the general approach to studying the relationship between environments and technology ventures is mostly based on the classification of the environment as a benefactor (Venkataraman, 2004) or contributor (Cooper, 1973). That is, the environment either benefits from technology entrepreneurship activities or contributes to such activities in the region. While discussing the role of technology entrepreneurship in transforming a region, Venkataraman (2004) lists seven intangibles: novel ideas, role models, informal forums, region-specific opportunities, safety-nets, executive leadership, and access to large markets.

The relationship between technology ventures and their local region has resulted in some researchers exploring regional transformation through technology entrepreneurship in the context of a particular country or region. For instance, Lindholm Dahlstrand (2007) studied technology-based entrepreneurship and its importance for economic growth, using Sweden as a case study. Lindholm found that spin-off processes in technology entrepreneurship are likely to enhance regional knowledge development and learning processes, because of the flow and sharing of technological and managerial expertise within the region. In the same vein, Li et al. (2008), focusing on China, argue that developing a 'technology market' will promote regional individual technology entrepreneurship which improves technology transfer and innovation, and creates more opportunities for other entrepreneurs. Oh (2002) observes that TST (Taedok Science Town), based in a metropolitan city in Korea, is a success story of regional development policy based on technology entrepreneurship, which prompts interest from developing countries. Together, these studies portray the environment as a benefactor.

Nonetheless, for technology entrepreneurship to excel in any region, certain institutions and processes have to be in place. As Hemphill (2005, p.476) points out, "in the 21<sup>st</sup> century global

economy, the confluence of disruptive technology network modes of organisation requires a national business environment conducive to entrepreneurship". In local authorities, creating an advantage where technology entrepreneurship can thrive requires strengthening local support for innovation and private business (Li et al., 2008). Consequently, this implies that the relationship between technology companies and the environment is symbiotic.

The environment as a contributor to technology entrepreneurship can be seen in literature that suggests that certain facilities and resources ought to be present for the successful creation of new-technology ventures. For instance, the availability of and easy access to venture capital firms within the region plays a critical role in the early stages of a new technology firm, from helping to fund R&D to organising and advising the firm (Colombo and Grilli, 2010). However, it is not a prerequisite for a technology venture before success is achieved; the literature suggests that venture capital firms tend to converge towards areas booming with technology innovation and act as both catalyst and capitalist to business startups (Florida and Kenney, 1988).

A second environmental factor that performs as a 'contributor' to technology entrepreneurship is proximity to universities and higher education. As Audretsch, Lehmann and Warning (2005) suggest, new technology firms are influenced beyond other traditional regional characteristics to locate their firms in regions where there is opportunity to access knowledge generated by universities. Higher education transfer knowledge ("spillovers") inform new firms or "spinoffs." Spinoffs are firms that result out of direct funding and research from a university, research lab, or other higher institution (Bathelt, Kogler and Munro, 2010). Clarysse, Wright and Van de Velde (2005) identify 3 'spin-out' models: the first is usually service-oriented and supports the creation of self-employment, founded by students or researchers of a research institution; the second model stimulates economic profitability, specific to a niche market, and are growth-oriented, usually based on the technology developed at the research institution; the third spin-out model is primarily for investment gains and exits with sizable prospects and markets. However, beyond being a hub for knowledge, universities and other higher education institutions also function as labs and test grounds for aspiring entrepreneurs to try out new ideas, without necessarily relying on specific knowledge developed in higher education (Bathelt, Kogler and Munro, 2010).

The third way the environment functions as a contributing factor is through facilities known as incubators. Incubators span across different industries, but technology incubators are focused on developing, forming, supporting, and expanding new technology ventures to increase their chance of survival (Phillips, 2002). That said, the performance of business incubators is widely debated, as there is no understanding of how they are structured, measured, and managed

(Phan, Siegel and Wright, 2005). Nevertheless, technology incubators are widely believed to be the intermediary between university research and markets, acting as technology transfer mechanisms (Phan, Siegel and Wright, 2005). Additionally, incubators provide networks, exposure to capital, communal areas, working space and intangible assets, such as motivation and support. This qualifies them as environmental contributors.

Government policies are another factor that contributes to the landscape of technology entrepreneurship in a region. A host of literature covers the need for government policies that favour high-growth firms. Li et al.'s (2008) study of technology entrepreneurship in China found that government entrepreneurship policy has a positive impact on technology entrepreneurship. Hemphill (2005, p.476) concludes that "a national government does play an important supportive role in establishing the business environment that encourages entrepreneurial commercial activity and economic growth."

Overall, these studies stress the importance of an ecosystem for technology entrepreneurship to thrive: an ecosystem of knowledge from universities and higher education; capital from venture capitalists and other financial resources; facilities and support network found around incubators; favourable government policies; and an accessible market with lots of potential.

While most of these studies have focused on developed countries, such as the US and England, very little is known about how technology-based companies in developing countries interact with their environment; for instance, what role the governments and other institutions play and/or how they are different (if they are), considering the challenges that developing countries face, such as a lack of organised education systems, lack of financial networks, and poor management of institutions. As Lindholm Dahlstrand (2007) concludes, the phenomenon of technology entrepreneurship is highly regional. Additionally, Li et al. (2008, p.748) argue, "technology entrepreneurial activity in different regions has its strengths and weaknesses in terms of technology, funds, intelligence, and market." Perhaps a study of technology ventures in these regions will offer a more comprehensive study which would make a contribution to the technology entrepreneurship literature.

Having defined and discussed technology entrepreneurship and its elements in terms of the actors and players involved in the process, it is necessary to examine closely what the technology entrepreneurship process involves, as well as what its implications might be. What follows is a description of the entrepreneurship process and what constitutes the venture creation process.



### 2.2.2 The Technology Entrepreneurship Process

As discussed in the above section on technology entrepreneurship, the concept involves discovering and exploring technological ideas and opportunities, which leads to founding and growing new ventures. It combines different components and factors, such as ideas, individuals, and markets to commercialise technological projects and capture value (Bailetti, 2012). These activities that take place within the entrepreneurial journey highlight the entrepreneurship process. As Krajewski, Manoj and Ritzman (2013) note, a process is any activity or set of activities that takes one or more inputs, transforms and adds value to them, and provides one or more outputs. In this case, technology entrepreneurship is the activity or process which takes inputs provided by the entrepreneur and other key actors in the form of technological ideas, opportunities and capital, transforms and adds value to them, and produces outputs in the form of products, services or entirely new ventures.

As described in the previous section, the major differentiating factor between conventional entrepreneurship and technology entrepreneurship is the streamlined focus on commercialising technology-driven ideas and opportunities (Liu et al., 2004; Li et al., 2008). One question that needs to be asked, however, is: "What is the exact differentiating factor between conventional entrepreneurship processes and the technological entrepreneurship process?" Moreover, it is necessary to clarify what is meant by 'entrepreneurship process'.

One of the first scholars to define the entrepreneurial process was Gartner (1985), who wrote that the entrepreneurship process consists of locating a business opportunity, accumulating resources, producing the products, marketing the products and services, building an organisation around the product, and responding to governments and society.

Morris, Lewis and Sexton (1994) define the entrepreneurship process as input and output activities that involve starting new ventures, innovating, pursuing opportunities, taking risks, and managing and creating value. A more recent description is given by Baron and Shane (2007), who describe the entrepreneurial process in phases: recognition of an opportunity, assembling the essential resources, launching a new venture, managing growth and building success, and harvesting rewards.

Although differences of opinion exist, there appears to be some agreement that the entrepreneurship process involves recognising opportunities, building products or services, raising capital, and launching new ventures. On the other hand, the technology entrepreneurship process embodies the conventional entrepreneurship process with a bias focused on innovative technological ideas and opportunities.

A seminal study is presented by Smilor and Feeser (1991), who utilise chaos theory to provide some valuable insights into the uncertainty and unpredictability of the entrepreneurial process, creating a pattern for technology entrepreneurship. The model is complemented by four key factors that are essential for the formation of a new technology-based company; that is, *talent, technology, capital, and know-how*.

The first is *talent*, which denotes the individual or team of entrepreneurs who are responsible for identifying opportunities and organising the essential resources to execute and take advantage of the opportunities. This can be seen in Bailetti's (2012) definition of technology entrepreneurship, which highlights the collaborative experimentation and production of new products, new assets, and attributes which combine specialists and assets intricately linked to advances in scientific and technology to capture and create value for a firm. Talented technology entrepreneurs can be sourced in universities, technology-oriented corporations, and both the public and private sectors of a region (Oakey, 2012; Smilor and Feeser, 1991).

In the same vein, Lindholm Dahlstrand (2007) asserts that technology-based entrepreneurship relies on the existing corporate and educational institutions, which act as training grounds for future entrepreneurs. The key problem with this explanation is that it fails to acknowledge certain regions with ailing educational facilities and weak corporate structure, although it highlights the regional nature of technology entrepreneurship.

The second is *technology*, which is a combination of high-potential ideas and market validity. Smilor and Feeser (1991) note that emerging technology industries have huge potential for startups of new ventures. An idea shows good potential in technology entrepreneurship when it uses technology to address a social or economic need. Moreover, it needs to match the entrepreneur's interests and capabilities and exist within a favourable context (Dorf, 2008).

The third, *capital*, acts as a catalyst for the entrepreneurial chain reaction (Smilor and Feeser, 1991). Raising capital, which can be a daunting task for entrepreneurs, could be the fuel that ensures that a new technology venture survives and experiences rapid growth (Bonnet and Wirtz, 2012). In a quantitative study conducted on 1,106 internet firms by Chang (2004) to examine how venture capital financing for internet startups affects their ability to gather resources for necessary growth and survival, the study found that the rate of survival of internet firms was positively affected by the reputation of the venture capital involved in raising money; the amount raised; and the reputations and number of strategic alliances. Chang's (2004) analysis, however, does not take into consideration internet startups that were funded and failed or ones which were not funded at all. Moreover, difficulties arise in practice, as most startups are not fortunate enough to get access to the capital they need to grow or survive.

Perhaps an organisation that functions as an intermediary between newly founded companies and venture capital would make an impact on the entrepreneurial process chain.

The fourth key factor is *know-how*, which is the ability to use business or scientific knowledge in linking talent, technology, and capital to turn technological ideas and opportunities into commercially viable and marketable products. This technical know-how is highly influenced by the background experience and previous work experience of the entrepreneur, as illustrated by Jones-Evans (1997). Smilor and Feeser (1991) argue that technology entrepreneurship requires the right amount of collaboration between talent, technology, capital, and know-how for the entire process to result in a plausible output.

In this thesis, the components that make up the technology entrepreneurship process are identified as opportunity recognition, idea generation, product development, and launch. However, the presence of all four components is not a guarantee of success. They do not function in isolation but rather require an interaction with other factors and actors. As Bhave (1994) in his paper on the model of entrepreneurial venture creation concludes, the venture creation process is an interactive, nonlinear, feedback-driven, conceptual and physical process. The process of technology entrepreneurship has to do with collaborative production, based on a shared vision of future changes in technology (Bailetti, 2012). Technology entrepreneurship transcends single individuals and enterprises. It is much more a mix of relational and institutional configurations, linked and affected by the context in which it is deployed. The context here refers to sets of local conditions i.e., favourable environmental conditions to foster the development of technology entrepreneurship.

## **Discovery**

The first activity in the process of entrepreneurship is identifying entrepreneurial opportunities. Academic literature has given two different perspectives on the discovery of entrepreneurial opportunities. The first is the traditional, dominant perspective, which describes opportunities as a result of a set discovery process in a predictable environment. It originates from Casson (1982), who describes entrepreneurial opportunities as those situations in which new goods, services, raw materials, and organising methods can be introduced and sold at greater than their cost of production to reap a profit.

The second perspective on the discovery of entrepreneurial opportunities posits that entrepreneurial opportunities are conjectures created through the judgment and interpretation of the entrepreneur in an uncertain environment. This perspective ascends from Schumpeter's (1934) description of entrepreneurial opportunities, which describes entrepreneurial opportunities as a process of carrying out new combinations and creative destructions to create new products, production methods, new markets, and new forms of organisations.

These two perspectives offer a different approach and decision-making logic on the discovery of entrepreneurial opportunities, but they both recognise that identifying the right opportunities is at the heart of entrepreneurship.

In technology entrepreneurship, the term 'entrepreneurial opportunities' refers to the identification and exploitation of opportunities that rely on scientific and technical knowledge. What distinguishes technology entrepreneurship from mainstream entrepreneurship research is its focus on how these opportunities are fostered through innovation in science and engineering. Technology entrepreneurship seeks to shift economic opportunities from established firms and industries to new ventures by the introduction or modification of new technology inventions or innovations (Li et al., 2008). For instance, the high-tech boom of the 1990s was driven mainly by technological opportunities in the semiconductor and computer technologies industry.

Although the recognition of entrepreneurial opportunities is a subjective process, the opportunity itself is an objective phenomenon that is known to all concerned parties at all times (Baron, 2006). For example, the discovery of the mobile phone created new opportunities for communication, regardless of how or by whom the opportunities were discovered. Entrepreneurial opportunities occur in a variety of forms. Even though most prior research has focused on opportunities in product differentiation (1997), opportunities also exist in the form of new markets, new production lines, and new sets of customers (Schumpeter, 1934). Drucker (1985) describes three different categories of opportunities: i) the creation of new information, such as the invention of new technologies; ii) the exploitation of market inefficiencies that result from irregularities in information dispensation, due to time or geographical differences; and iii) the reaction to changes in the relative costs and benefits of alternative uses of resources, as occurs with political, regulatory, or demographic changes.

Moreover, research has sought to answer the question of how entrepreneurs happen upon entrepreneurial opportunities. According to prior literature, major factors that influence the process of opportunity discovery include entrepreneurial alertness; information asymmetry and prior knowledge; discovery by purposeful search; social networks; and personality traits, such as risk-taking, optimism, self-efficacy, and creativity. The term "alertness" was first used by Kirzner (1973, cited in Kirzner, 2015) to explain entrepreneurial recognition of opportunities. Ray and Cardozo (1996, in Ardichvili, Cardozo and Ray, 2003) argue that an entrepreneur is able to identify opportunities because of their heightened alertness to information, which they refer to as "entrepreneurial awareness (EA)". Entrepreneurial awareness is defined as "a propensity to notice and be sensitive to information about objects, incidents, and patterns of behaviour in the environment, with special sensitivity to market and user problems, unmet

needs and interests, and novel combinations of resources” (Ardichvili, Cardozo and Ray, 2003, p.113). Furthermore, they claim that entrepreneurial awareness is influenced by a mix of personality characteristics and environmental conditions and conclude that higher alertness increases the likelihood of an opportunity being recognised.

In contrast, Busenitz (1996) conducted an empirical test of a proposition by Kaish and Gilad (1991) that entrepreneurs are more alert to new opportunities and use of information than managers. The test found little empirical support of the theoretical framework established by Kaish and Gilad, leaving a gap for further development of the phenomenon of entrepreneurial alertness. In response to this criticism, a more recent work by Tang, Kacmar, and Busenitz. (2012) offers a redefined and refocused study on alertness, which comprises three dimensions: i) the scanning and search of information systematically and non-systematically; ii) connecting and piecing together unrelated information; and iii) making judgments on the commercial viability of an idea.

It is possible for entrepreneurial opportunities to occur through accidental discovery. Although a large part of entrepreneurship literature assumes that opportunity discovery takes a pre-planned, systematic approach, some researchers have argued that people do not just search for opportunities, but rather happen to recognise the value of new information. Kirzner (1997, p. 71-72) explains that “what distinguishes discovery (relevant to hitherto unknown profit opportunities) from successful search (relevant to the deliberate production of information which one knew one had lacked) is that the former (unlike the latter) involves the surprise that accompanies the realization that one had overlooked something in fact readily available.” Most entrepreneurs recognise the opportunities for their firm as opposed to seeking out opportunities (Ardichvili and Cardozo, 2000). Görling and Rehn (2008) discuss three cases of “accidental” entrepreneurs who professed no real hope in the survival of their venture yet achieved remarkable success. User entrepreneurs, who are entrepreneurs that commercialise products or services they use themselves, are mostly “accidental” entrepreneurs (Shah and Tripsas, 2007).

According to Bhave (1994), there are two types of opportunity recognition: one in which the entrepreneurial venture ensues from the recognition of an opportunity, and one in which the entrepreneurial opportunity was ‘discovered’ prior to founding the venture. It is possible for “accidental” discovery to happen when an entrepreneur is in a heightened state of entrepreneurial alertness while still performing a passive search of opportunities (Ardichvili, Cardozo and Ray, 2003). In a study by Hills and Shrader (1998) that examined multiple dimensions of opportunity discovery among groups of exceptionally successful entrepreneurs, fifty-four percent of the entrepreneurs admitted they did not actively search for an opportunity.

Rather, they were 'alert' to entrepreneurial opportunities, which allowed them to spot new business opportunities naturally.

However, it begs the question; "To what extent is entrepreneurial alertness an important characteristic for entrepreneurial success?" Nonetheless, one can hypothesize that, in a passive state of searching for opportunities, entrepreneurs with heightened entrepreneurial alertness are more likely to accidentally happen on new opportunities when compared to entrepreneurs with lower entrepreneurial alertness. This view is supported by Ardichvili, Cardozo and Ray (2003), who propose that a high level of entrepreneurial alertness is associated with successful opportunity recognition and development.

An entrepreneur's social network also plays a part in the process of opportunity recognition. This is because social networks form the conduit through which private information flows (Stuart and Sorenson, 2005). A substantial body of literature on social influence confirms the importance of social networks as pathways for conveying private information. One prominent study in this area is Granovetter's (1973) classic study on the strength of weak ties, which asserted that weak ties (including casual acquaintances) are bridges to information sources not necessarily available from strong-tie relationships such as close friends and families. An empirical test of this hypothesis by Hills, Lumpkin and Singh (1997) confirmed that entrepreneurs who have extended networks identify significantly more opportunities than lone entrepreneurs with small, closed network ties. Furthermore, Hills, Lumpkin and Singh. (1997) suggest that the quality of the contacts in the network can also influence an entrepreneur's creativity and ability to maintain heightened entrepreneurial alertness.

In De Koning and Muzyka's (1999) socio-cognitive framework of opportunity recognition, entrepreneurial opportunities are shown to evolve from three cognitive activities: i) information gathering; ii) analysing through interactions; and iii) assessing resources. The social interaction context can be in the form of an entrepreneur's inner circle, i.e., long-term friends and relationships; interactions with people specially recruited to provide specific resources or knowledge, such as partners and team members; or a network of weak ties.

Some studies have focused on the personality traits of entrepreneurs and how they influence their ability to discover entrepreneurial opportunities. Literature in entrepreneurship recognises that there are some personality traits that are linked to an entrepreneur's ability to detect and explore opportunities, manage complex situations, and create value with limited resources. Examples of these traits include the need for achievement, innovativeness, proactive personality, self-efficacy, stress tolerance, need for autonomy, internal locus of control and risk taking (Rauch and Frese, 2007).

However, two of these personality traits stand out. First, researchers have observed that there is a close connection between an entrepreneur's optimism and ability to recognise opportunities. Krueger and Brazeal (1994) and Krueger Jr (2003) show that entrepreneurial optimism is related to self-efficacy beliefs. Similarly, Neck and Manz (1996) illustrate that perceived self-efficacy leads to optimism and creates a higher tendency for opportunity discovery. Second is the creativity trait. The notion of creativity as a way of discovering opportunities in entrepreneurship was first proposed by Schumpeter (1934). 90% of the entrepreneurs surveyed by Hills, Lumpkin and Singh (1997) found creativity to be very important for opportunity identification. Fillis and Rentschler (2010) also conclude that creativity is a major contribution to the success of entrepreneurial opportunities.

Finally, the studies presented thus far illustrate how critical opportunity discovery and recognition is to the entrepreneurship process. While the debate regarding whether entrepreneurial opportunities are created or discovered will continue (Venkataraman and Sarasvathy, 2001), one can conclude that the discovery of entrepreneurial opportunities is the sole responsibility of the entrepreneur. This view is supported by Park (2005), who asserts that opportunity recognition among technology ventures involves three main components: the founding entrepreneur, the knowledge and experience of the firm, and the technology. Similarly, Leyden, Link and Siegel. (2014, p.1161) conclude that "entrepreneurial opportunities are formed endogenously by the entrepreneurs who create them, and their social network is one mechanism through which they create and exploit such opportunities."

Following these considerations, it is safe to say that the process of technology entrepreneurship begins with an entrepreneurial component, which is the discovery and recognition of opportunities.

## **Idea Generation**

The next step after discovering and identifying opportunities is the intentional pursuit and creation of business ideas. As Audretsch (2007) emphasised, successful ventures are rooted in the quality, newness, and potential of their business idea. The process of generating and exploiting business ideas is intertwined with opportunity discovery (Meseri and Maital 2001). Opportunities begin with simple concepts that become more elaborate as entrepreneurs develop them (Grandi and Grimaldi 2005). This process involves a proactive effort and a development process that gives rise to an entire business (Ardichvili, Cardozo and Ray, 2003). Idea generation is the point at which an opportunity becomes a continuous proactive process towards the formation of a business.

In contrast, Hayton and Cholakova (2012) argue that, from the perspective of the potential entrepreneur, the entrepreneurial process begins with an idea. This includes sets of activities and actions, such as determining whether an opportunity is attractive and feasible enough to warrant further attention, gathering information to reduce uncertainties and constantly adapting the idea to meet new sets of information. Further, they explain that an idea remains only an idea unless some action is taken to further develop the idea into an opportunity. Consequently, if an idea is not developed, it doesn't become an opportunity, and an opportunity does not exist without an idea. Fundamentally, in the process of entrepreneurship, recognition of opportunities and idea generation are activities which are interrelated and occur prior to the establishment of a business and after founding the business: they form a continuous process that lasts through the lifespan of the business and the entrepreneur.

The business idea embodies all the criteria that a venture capitalist seeks in a new venture before investing. This includes characteristics of the market, the external environment, the technology, the business, and the founding team. Consequently, Grandi and Grimaldi (2005) propose that business ideas are judged by two main characteristics of the business idea; its market attractiveness and its articulation.

A business idea's market attractiveness refers to the capacity of the idea to be accepted by potential customers. The reason why an idea will be attractive to a potential customer is either because the idea satisfies an existing market demand or because it shows the potential for creating a demand in the marketplace. A significant examination by MacMillan et al. (1987) of the criteria that distinguish a successful from an unsuccessful venture screening process asserts that the degree of market acceptance of a new business idea lies in the ability of the new business to create new markets or stimulate existing markets to their new products or services. Meseri and Maital (2001) found that one of the criteria used by venture capitalists to assess the potential of a new venture for investment is its ability to demonstrate market demand and penetrate a new market. Similarly, Mason and Stark (2004) affirm that potential funders of a new business want to see that the business clearly outlines its market potential in its business plan. These include the prospective growth of the market, the market need, the level/nature of competition, and barriers to entry. The literature suggests that business ideas that can show this characteristic are more attractive to investors and more likely to succeed (Roberts, 1991).

Secondly, a well-articulated business idea often results in better performance. Business idea articulation denotes the level of detail of the business concept and the extent to which it communicates its mission and objectives effectively (Lumpkin et al., 1998). It also refers to a broad and well-defined set of planning processes which highlight the starting point of the new



entrepreneurial idea and project its future with specific timelines (Grandi and Grimaldi, 2005). Research literature suggests that a well-thought-out business idea with broad sets of details has a positive influence on the establishment of new ventures, while a lack of planning or poor planning can lead to business failure (Delmar and Shane, 2003).

A seminal study by Rouse and Keeley (1990) on the predictors of success in new technology ventures argues that newly established businesses need an in-depth plan to effectively communicate their mission and objectives. This is because a new venture can lose its identity as it grows rapidly and adapts to market changes. Meseri and Maital (2001) discovered that one of the criteria investors were looking for in a new venture was clearly defined project goals. Similarly, Mason and Stark (2004) state that a business plan must contain a detailed concept and strategy of the business, illustrating how the business will be operated and organised to produce its products or services. As Grandi and Grimaldi (2005, p.827) conclude, “conventional wisdom appears to take it for granted that firm performance is positively affected by clear communication and definition of the firm’s mission.”

Collectively, these studies outline the critical role of idea generation in the technology entrepreneurship process. In technology entrepreneurship, a business idea is generally aimed at discovering and exploiting new technologies where they are created and bringing them to the place (market) where they are needed (Lu et al., 2011). Thus, the business idea needs to capitalise on existing technological opportunities and present an initiative that is both marketable and articulate.

### **Product development**

This next component of the entrepreneurship process has been labelled differently by several researchers and industry practitioners. Most scholars describe it as the concept development stage, which involves developing the business plan, business location, and intellectual property. Others refer to it as the implementation stage (Bygrave, 1997). Larson (2011) labels this stage as the product concept stage, which involves devising the service or product to be sold, understanding the buyers and their problems and providing a solution to sell. Moreover, in technology entrepreneurship, the essence of exploiting technological opportunities is to transform these promising technologies into new products and processes and successfully commercialize them (Zahra and Covin, 1993). However, new products do not have to be originally created or manufactured; they can be improved, with better features to meet market needs (Evers et al., 2013).

Just as with every other component of entrepreneurship, product development consumes a lot of resources and is the physical embodiment of the business idea and opportunity. According to Bhave (1994), entrepreneurs view products in their relationship with the markets

and customers and as a marketable form of the business concept. Although the product or service does not have to be perfect to meet market needs, it nonetheless needs to be able to demonstrate its capabilities in solving the customer's problems. Consequently, when customers need changes, due to technology advances or other external forces, entrepreneurs must respond rapidly by modifying their products to satisfy their customer needs at the bare minimum. As Lu et al. (2011) point out, the success of a new technology venture depends on the ability to create new and significantly improved products by identifying and exploiting technological opportunities.

Brown and Eisenhardt (1995) identify three perspectives of product development: product development as a rational plan, product development as communication web, and product development as problem-solving. Product development as a rational plan emphasises that successful product development is the result of careful planning, execution of the plan, and support of the senior management team. This perspective on product development emphasizes that the product must be a superior product primed for an attractive market with the backing of a functional senior management team. The second perspective on product development hinges on communication. It proposes that communication among project team members and with the general public stimulates a better performance among development teams. As a result, the output of the development process is enhanced. Finally, the third perspective on product development emphasises that the product development process is inspired by problem solving. In this case, the process of product development is viewed as a balance between an attempt by the project team to solve a problem and the support of a strong management with clear vision. This usually yields a high-quality product concept and results in a fast and productive development cycle.

In technology entrepreneurship, after recognising opportunities and developing business ideas, the next step in the process is the development of products or services and testing of prototypes. As Duening, Hisrich and Lechter (2009) assert, technology ventures are based on the vision of a new product or service conceived by the founder or founding team. Similarly, Oakey (2012) in his book underscores that the role of a technology entrepreneur is to assemble a team together that is capable of producing the technology product or service.

In view of all that has been mentioned so far, one can hypothesize that product / service development is central to the success of a technology venture. As a result, product development is included in the technology entrepreneurship process framework.

## **Launch**

An important aspect of the technology entrepreneurship process is the launch phase. Jones-Evans (1995), in his definition of a technology entrepreneur, attributes to the entrepreneur the

responsibility of planning and launching the organisation. Similarly, Baron and Shane (2007) describe the entrepreneurial process as including recognition of an opportunity, assembling the essential resources, launching a new venture, managing growth and building success, and harvesting rewards. Launching a venture involves a set of activities that includes gathering and managing resources to bring a product or service to the marketplace. The term 'launch activities' is used by Herron and Sapienza (1992) to refer to sets of activities that go beyond internal planning for the venture but extend to the creation of formal relations with organisations within and without the venture. These sets of activities include choosing the legal form of the new venture, establishing the roles of the top management team, and labelling the product or service (Baron and Shane, 2007). After recognising an opportunity, building a business idea, and developing a product, launching the business concept into the marketplace becomes the next rational action to take. As Santos, Curral and Caetano (2010, p.33) state,

the decision to launch a venture is the output from the early stages of the entrepreneurship process, according to the existence of essential factors that are perceived as indispensable to the continuation of the entrepreneurship process. The decision to launch a venture occurs when their meaningful features are recognized as prototypical of a pattern. (Santos, Curral and Caetano, 2010, p.33)

Conversely, the launch phase of a business is not only concerned with the corporate launch of the business entity but could also be the launch of a new product or service. Beard and Easingwood (1996) argue that the launch of a new product is a critical stage of the entrepreneurship process and could determine how well a venture performs in the marketplace. This is even more important in the high-tech setting, where the window of opportunity for technology entrepreneurs is narrow, considering the fast pace at which the industry and market needs are changing, leading to a high degree of uncertainty. Nonetheless, high-technology products are able to differentiate themselves by emphasizing their innovative technical components. This is illustrated in an investigation into the strategies employed by salespersons to launch high-technology products. It was discovered that the salespersons tended to emphasize the technical component of their products and used attack tactics to approach the market, rather than waiting for market preparation (Beard and Easingwood, 1996).

At the phase of launching the product, service or entire business entity, there is a considerable amount of work before the eventual unveiling. Johnson and Holcomb (2006) stress that a new business requires a considerable amount of research and meticulous planning to improve the odds of success. Consequently, there are decisions and activities an entrepreneur must

embark on before launching a new venture; these are referred to as pre-launch activities. Greenberger and Sexton (1988) believed that supporting conditions such as: i) impact on the entrepreneur; ii) certain personality characteristics; iii) social support network; and iv) individual need for control must be present for an entrepreneur to launch a new venture. According to Johnson and Holcomb (2006), the important activities to be considered before launching a venture include: developing, testing, and implementing a production plan; forming a distribution plan with contingency steps in the event of unforeseen market occurrences; and establishing working capital to see the business through the launch phase and beyond. Overall, these studies reveal the need for entrepreneurs to ensure the necessary resources, including human, financial, and knowledge, are in place before launching.

In technology entrepreneurship, the launch phase is important for testing and validating the business idea, getting to know the customer and gathering feedback, and understanding the product or service and how it fits the market. This allows the entrepreneur to alter the product or service to suit the customer needs and improve the chance of success of the venture. However, the launch phase is not the final stage of the technology process. As Lu et al. (2011, p.11) affirm, "Technology entrepreneurship hinges on a system of diverse actors, with various and somewhat overlapping roles and sets of generic activities aimed at bringing technologies to market."

Furthermore, each of the components in the technology entrepreneurship process does not simply occur on its own; neither is it only the singular effort of the talented, creative, and sometimes lucky individual or pair of entrepreneurs. Rather, it is a function of a collective, systematic effort that involves many actors in constant harmony. The role of these actors is to provide the resources, set the right working conditions, and contribute to the development and growth of the product or services. Thus, technology entrepreneurship development thrives where there is an interactive system in place that delivers talented individuals, supportive government agencies, education and research institutions, successful enterprises, financial investors, and most importantly the market.

### 2.2.3 Summary

This chapter has focused on technology entrepreneurship. Having discussed the various definitions, adopted a definition for technology entrepreneurship for this thesis, deliberated on the different levels of research approach in the field, discussed the technology entrepreneurship process, and created a theoretical framework to explain the process of technology entrepreneurship, it is now necessary to explain what role technology business incubators play in the development of technology entrepreneurship. Forming and promoting

new technology-based ventures is the keystone of technology entrepreneurship (Brown and Mason, 2014).

However, one of the drawbacks of new-technology-based firms, as with most entrepreneurial ventures, is their high failure rate. The case of failure is more frequent with technology-based companies, due to their high-risk nature and involvement in new and innovative technologies which are often new and sometimes strange to consumers, leading to a slow adoption rate by the market. In such circumstances, a venture may be unable to raise additional funds and, possibly lacking good management and a support system, they exhaust their lifelines (Scillitoe and Chakrabarti, 2010).

Business incubators are newer and increasingly popular organisations, formed to provide technical and business assistance to support and accelerate the survival and growth of new ventures and to eventually achieve economic development goals (Abetti, 2004; Mian, 1996; Rubin, Aas and Stead, 2015). The next section discusses the literature surrounding business incubators in greater depth, leading to a focus on technology business incubators and how they influence technology entrepreneurship in the context of this thesis. A final schematic diagram will be presented at the end of the literature review, which will be used to inform the research design and data collection of this thesis.

### **2.3 Technology Entrepreneurship and Technology Business Incubators Nexus**

As discussed in the previous section, research in the entrepreneurship field recognises the importance of entrepreneurs and their role in forming new ventures which are major instruments in job creation. As a result, both researchers and policymakers are increasingly interested in the process of creating new ventures and their impact on the economy and development. (Audretsch, 2009; Carree and Thurik, 2003). Also, considering that entrepreneurial ventures depend for their success on the resources available within the environment where they are embedded, governments have sought ways of devising policies, programs, and support mechanisms that could function as resource banks for new technology ventures (Williams and Tsiteladze, 2016).

New technology ventures are subject to great risk of failure, often declining to non-existence soon after starting up. Generally, it is acknowledged that most new technology ventures are more likely to fail than succeed. The literature suggests that, in developed countries, such as Germany and the United States, out of every 100 newly formed ventures, only 50 survive beyond the first three years (Strotmann, 2007; Van Praag, 2003), which is why Littunen (2000)

insists that the first 3 years of a newly-formed company are vital to its survival. Although the survival of newly formed companies varies from region to region, their survival rate is nonetheless still considered to average between 20% - 50% overall (Bartelsman et al., 2005; Santarelli and Vivarelli, 2007). These figures have drawn researchers and policymakers to seek ways of increasing the survival rates of these newly formed ventures, considering they have a direct impact on economic development (Audretsch, 2009; Carree and Thurik, 2003; Mojica et al., 2009; Santarelli and Vivarelli, 2007). Recently, there has been renewed interest in practice and literature on business incubators, which play an important role in addressing these issues. They are organisations set up to provide business and technical support to new ventures they are affiliated with, so as to accelerate their growth rate and improve their chances of survival (Rubin et al., 2015).

A key aspect of business incubators is co-locating their ventures within a geographical area (Mian, 1996) as this model has proven to be effective, particularly in technology entrepreneurship (Scillitoe and Chakrabarti, 2010). Lindholm Dahlstrand (2007) asserts that technology entrepreneurship is largely a regional phenomenon, in which large companies within the region are important in coaching and breeding future entrepreneurs. These entrepreneurs are responsible for starting new firms within the region, thus enhancing acquisition and development of local knowledge, as a result of collaboration, which involves sharing technological and managerial know-how to help new firms survive and grow within the region. Recognisable examples include regional clusters in Silicon Valley and Route 128; a group of technological companies around a geographic location that have successfully shown that concentrated technological entrepreneurship within a region can create economic growth (Saxenian, 1994; Venkataraman, 2004). Saxenian (1994) argues that the performance and attention devoted to Silicon Valley has resulted in it being a facilitator for regional entrepreneurship, thus conveying its possibilities for economic development to policymakers.

Consequently, this has led other researchers to investigate how entrepreneurship can be promoted within regions and have an impact on economic growth (Audretsch and d'Empresa, 2003; Audretsch, 2009; Lindholm Dahlstrand, 2007; Venkataraman, 2004). As illustrated above, entrepreneurs do not work in isolation, as entrepreneurship is a social role embedded within a social context (Zimmer, 1986). They rely on both human and environmental networks to get access to human capital, financial investors, lead generators, and even the initial customers for their startup companies (Greve and Salaff, 2003). The saying 'It is not just what you know but who you know' applies to entrepreneurship as well. In a study of networks and entrepreneurship among high-technology firms, Elfring and Hulsink (2003) found that, in the entrepreneurial process, the importance of an embedded network could be the link to finding crucial resources.

The awareness and importance of the connection between entrepreneurial success and the use of access to networks have led to increased attention in the area of business incubation and science parks, which are tools for replicating and relying on entrepreneurial networks and resources, as well as agents of economic development (Phan et al., 2005). The urge of policymakers to generate economic growth has led to a quest to launch business-friendly initiatives, such as business incubators. The astonishing worldwide growth and establishment of these business incubators--particularly technology business incubators--has amounted to more research attention to the field from academics, practitioners and policymakers. However, before proceeding to examine the impact of technology business incubators on technology entrepreneurship within a region in the context of this thesis, it is necessary to first understand the basic concepts of business incubation.

Consequently, this section of the literature review discusses the existing incubation literature as it relates to the process of incubating and nurturing new ventures. The review begins by establishing an historical overview of business incubators to provide a basic understanding of how and why they exist and how they have developed over time. A taxonomy of business incubators and definitions is discussed next, as there is little consensus in the existing literature on the various types of business incubators or what constitutes an incubator. Apart from the general incubation literature, the review continues by focusing on technology business incubators and critically examines their roles and processes of incubating new technology ventures which relates to literature on technology entrepreneurship. This represents the incubation process type that will be analysed in the thesis. Furthermore, the review progresses into an examination of technology business incubators in an emerging region, forming a more in-depth look into a regional incubation process from the perspective of an emerging region in Africa, an area with little or no literature on technology entrepreneurship and technology business incubators.

## **2.4 A Historical Perspective on Incubation and Its Theoretical Context**

The importance of proximity has long been evident and appreciated by location theorists after observing the trends of co-location in the early days of the industrial revolution in the eighteenth century (Oakey, 2012). As Delgado, Porter and Stern (2010) note, clusters play a key role in facilitating entrepreneurship and technological innovation by reducing the risks of failure and encouraging the diffusion of new technologies. This was clearly the case in Great Britain during the industrial revolution, where collocated industries benefited from each other's

expertise and resources. For instance: iron making at Coalbrookdale in Shropshire; cotton textile production in North Cheshire and Lancashire; clock making in London; gun and jewellery making in Birmingham; and furniture manufacturing in the East End of London (Oakey, 2012).

Early theorists, such as Weber (1929), proposed that the motivation behind these agglomerations of industries is the critical role played by skilled labour, minimum transportation cost, and input of raw materials. Others argued that the market availability of industrial products was the main determinant of location (Hotelling, 1990). Yet it is a coalition of both input and output factors that forms the basis of the agglomeration of these industries in particular regions (McCann, 1995). Fast forward to the 20<sup>th</sup> century, and the United States, through clusters of high-technological industries in areas such as Silicon Valley and Route 128 illustrated how much of an impact agglomerative behaviour among entrepreneurs and entrepreneurship in general have on a region (Saxenian, 1994).

However, in the last two decades, business incubation has become an important research area, particularly in developed OECD countries, with the United States and Europe leading the way (Soetanto and Jack, 2013). Conversely, the concept of incubation owes its etymological roots to ancient Roman and Greek pagan culture, where individuals lay in a temple dedicated to the god of medicine, *Aesculapius*, to obtain knowledge of how to get protection from diseases through visionary dreams (Aernoudt, 2004). This practice was known as *incubation*. Considering this act took place in the temple of a medicinal god, it led to the adoption of the concept of incubation in modern-day medicine. Thus, an incubator became a place where prematurely born infants were nurtured and looked after until they became independent to survive, develop, and grow on their own. In the same way, business incubators exist to nurture young companies to the point where they can develop and grow on their own. Oakey (2012) points out that the intended role of business incubators is simply to provide small premises for nascent firms, logistical support, and a collaboration and networking opportunity with occupants of the incubator and other local resources around the area. This ties into the early literature on clusters and entrepreneurship, which generally concludes that the proximity of entrepreneurs and their firms within a local area enhances the entrepreneurial start up opportunities within the area, while reducing the costs of starting a new business (Delgado, Porter and Stern, 2010).

The first business incubator can be traced back to Batavia in the Batavia industrial centre, New York, in the late 1950s (Leblebici and Shah, 2004). The Batavia industrial centre was an 850,000 ft. building, too large to be used or owned by an individual company, and as a result, it was broken down into sublets, affordable and viable for small startup companies and small



enterprises (Adkins, 2001; Hackett and Dilts, 2004). In the early 1980s, the concept of incubation gained popularity as a result of the collapse of traditional industries and a lack of support for small companies as all the support and focus was on large and expanding corporations (Al-Mubarak and Busler, 2010). The business incubation industry emerged, dotting about 200 business incubators (Aernoudt, 2004), which were seen as: instruments for supporting innovation; facilitating technology transfer; and encouraging entrepreneurship to develop local economies (Wynarczyk and Raine, 2005). According to the National Business Incubation Association (2015), the phenomenal growth of business incubators in the US in the 1980s is attributed to three major activities:

- First, through a series of regional conferences, the US Small Business Association took on the challenge of promoting business incubators and explaining their purpose. Consequently, business incubators grew from 20 opening annually in 1984 to more than 70 openings in 1987
- Second, the introduction of the Ben Franklin Partnership Programme was one of the first agendas in the US on technology and manufacturing. Incubators were a key component of this programme and its success led to other states' support of business incubation
- Last, a unique partnership developed between government and private corporations to meet societal needs. Control Data Corporation, under the direction of its founder William Norris, became one of the earliest supporters of the business incubation industry. He formed City Venture Corporation (CVC) under Control Data Corporation to develop business incubators in several cities across the States some of which still exist today.

However, Hackett and Dilts (2004) have a contrary view on what aided the growth of business incubators in the 1980s and provide three different reasons: (1) the passage of the Bayh-Dole act in the US Congress, which eased complications hindering the ability to commercialise federally-funded research; (2) the increasing emphasis of the US legal system on protecting intellectual property and enhancing innovation; and (3) the profit opportunities that arose from commercialising biomedical research. Regardless of what might have inspired the surge in business incubators from 200 in the 1980s to over 7,000 business incubators as of 2012 (NBIA, 2012), this significant era was the birth of earnest academic research into the field of business incubation.

In Europe, the adoption of the concept of business incubation was sluggish compared to the US. Prior to the mid-1970s, business innovation centres, industrial estates, enterprise agencies, and managed workshops were more popular in the United Kingdom (NBIA, 2012).

While the US established a professional body to oversee business incubators, called National Business Incubation Association (NBIA) as far back as 1985 (Leblebici and Shah, 2004), the UK equivalent, UK Business Incubation (UKBI), was only established in 1998, a whopping 13 years later, although the first business incubator in the UK had been set up in 1975 as a subsidiary organisation under British Steel, known as British Steel Industry, to create jobs in the steel industry and closure areas (Aernoudt, 2004). Furthermore, despite its slow evolution in the UK, the concept has grown rapidly, thanks to the support of the government; business incubators in the UK currently number over 300 (Better Business, 2013)

In its earliest days, between the 1970s and 1980s, two incubator strategies emerged; that is, (a) incubators that focus on providing entrepreneurs and their firms affordable working space and (b) incubators that focus on leveraging their resources to help companies grow (Smilor, 1987). Furthermore, the 1990s saw a trend towards business incubators emerging in specific industries, such as technology, environment, biotechnology, and manufacturing (Aernoudt, 2004). Another trend that emerged in the evolution of business incubators was the for-profit and non-profit modes of operation. Non-profit-operated incubators placed more emphasis on stimulating entrepreneurship to support growth, development and job creation for low-skilled workers, long-term unemployed or the disabled, while the for-profit incubators were in close contact with research centres to bridge the discovery gap and explore opportunities for commercialising fundamental research (Aernoudt, 2004).

This evolution has seen business incubators forming strategic partnerships with higher institutions, leading researchers to investigate how these partnerships work and how effective they are (Soetanto and Jack, 2013). Subjects such as incubator development and configuration are studied to understand how incubators are formed. Early examples include initial compilation, comparison, and logical attempts to understand the incubation strategy in small business incubators across America (Kuratko and LaFollette, 1987). Allen and McCluskey (1990) empirically examined 127 managers of incubators in America and found that the age and the size of the incubation facility were important determinants of the jobs created and firms graduated. In recent years, researchers began treating incubators in categories and diversity. For example, Grimaldi and Grandi (2005) argue that incubating organisations vary in the way they disseminate their range of services, which is largely driven by the evolution of the incubated companies' requirements and needs. As Clarysse et al (2005) assert, different incubators develop different incubation models and have diverse resource implications in managing their incubation process.

Other aspects of incubation explored by researchers have been their impact and influence on their immediate surroundings. For instance, Mardas et al. (2002) evaluate the role of science

parks in Greece, laying emphasis on the links between university, industry and firms in the science parks. They discovered each science park had a dissimilar link and relationship with the university and industry in its region. Additionally, the synergies between firms in the science parks were limited to commercial transactions and social interactions.

Ratinho and Henriques (2010) investigate the impact of business incubation services and science parks in a converging economy (Portugal), to find that, although business incubation services are acclaimed as major tools for job growth, the impact in Portugal was modest at best. In a different study of 45 Italian technology firms initially based in business incubators, Colombo and Delmastro (2002) found that these firms showed higher growth rates than their non-incubated counterparts. While many studies show outcomes from the incubation process to be positive (Colombo and Delmastro, 2002; Lalkaka, 2002; Rice, 2002), others disagree, raising questions about the support that business incubators provide and how they influence the outcomes (Peters, Rice and Sundararajan, 2004; Phillips, 2002; Tamasy, 2007).

There seems to be evidence that business incubators have an impact on the entrepreneurial process. For instance, a Scillitoe and Chakrabarti (2010) study of new technology-based firms in business incubators in Finland and the United States suggests that business assistance is enabled by incubators through counselling interactions with the incubator management, while technical assistance is enabled through networking interactions with the incubator management. In a review of the literature by Özdemir and Şehitoğlu (2013) on the impact of business incubators on small businesses and its relevance to Turkey, the study acknowledges that business incubators are effective tools for supporting venture growth and entrepreneurship. However, the results and measures differ from country to country. In a recent study to better understand how incubators help new ventures overcome the obstacles of raising capital and cultivate good managerial skills, Rubin, Aas and Stead (2015) conducted 13 case study analyses on incubators in Australia and Israel. The study concludes that collaborations between incubated companies, graduated incubatees, and incubator management increase the incubatees' knowledge of technology and markets in both countries, as well as increasing the likelihood of new ventures being able to raise venture capital.

Overall, these studies show how much of a wide area of research the business incubation field has become over the years. Yet, the need to understand the concept, scope, and functions of business incubators deserves further analysis in diverse regional and sectoral contexts. The next section discusses the definitions of business incubation in depth and presents various taxonomies of the concept.

## 2.5 A Taxonomy and Definition of Business Incubators

Like 'technology entrepreneurship', 'business incubator' is a term often misunderstood yet widely used by policymakers, practitioners, and researchers. It falls into the gap of those concepts that become fashionable to use on media, brands, and policies, even though the underlying reference is far away from what incubators might actually be (Aernoudt, 2004). One of the reasons for this is the numerous terms and phrases, such as science park, technology park, technology innovation centre, research park, and, more recently, 'accelerators' that are associated with the concept of business incubation (Aernoudt, 2004). This will be further discussed in the typology of business incubators below.

Other sources of ambiguity around business incubators are in the type of services they render. Carayannis and Von Zedtwitz (2005) propose that incubators that offer services such as access to physical resources, office support, access to financial resources, access to advisors and networks of entrepreneurs are incubators in the fullest sense and anything less ceases to be an incubator. Based on that description, a new field of virtual business incubators, which seek to provide business support and assistance to incubated firms without physically co-locating them, will be disqualified from the business incubators league. Moreover, the ambition of various initiatives, governments, researchers, and practitioners to adapt the original concept of business incubation and fit it into local needs and conditions has further created variances around the concept of business incubation (Hedner et al., 2011; Kuratko and LaFollette 1987).

Early attempts at defining the concept of business incubation mostly revolved around the idea of a physical space with affordable rents, shared services, logistical support, and business consulting support. This is evident in a study carried out by Brooks (1986) on addressing the question of incubators and how they fit into an economic development process. Brooks (1986) describes incubators as a physical facility that: provides visibility to the community, the entrepreneur, and potential investors; provides tenant support; provides focus for entrepreneurial groups; and places the startup venture in close proximity to other startups. Similarly, in their study, Allen and Rahman (1985) defined business incubators as facilities that aid early-stage companies by providing rental space, shared office services, and business consulting assistance.

Other definitions of business incubators, however, emphasise the services they offer to their tenant firms, which are usually known as incubatees. This can be seen in Smilor's (1987) definition of new business incubators, in which they are described as innovative systems that provide a variety of services and support to entrepreneurs and their firms. A further definition

is given by Hackett and Dilts (2004, p.57), in which a business incubator is described as “a shared office space facility that seeks to provide incubatees with a strategic, value-adding intervention system (i.e., business incubation) of monitoring and business assistance.”

Wynarczyk and Raine (2005) argue that a business incubator is a process that builds stronger businesses, creates jobs, and encourages innovation by creating an environment of support and encouragement for entrepreneurs to develop, produce and realise the market potential of their products. This definition highlights a widely debated topic on the long-term impact of business incubators on their incubated firms. For instance, the early but detailed research by Udell (1990) into new business formation and survival rates of new enterprises showed that business incubators at the time were stressing concepts and components that had little impact on growth-oriented firms or technology-product-based firms. Udell (1990) recommends business incubators should place more emphasis on providing financial, management, and technical assistance to their tenants. The key problem with this assumption is what has been discussed in this section; that is, a fundamental definition of what business incubators are and should be. Udell’s (1990, p.108) definition of a business incubator hinges on “a building in which a new or growing business can locate and operate at a much lower cost than in conventional space where market rates prevail.” This definition is characterised by access to shared facilities, such as clerical and administrative help, receiving shipping facilities, conference rooms, computers, word processors and other physical assistance. However, it fails to acknowledge the intangible assets that are required in growing an innovative environment (Venkataraman, 2004). Not only is the study by Udell out of date and superseded by more recent studies, its method of analysis has a number of limitations, such as the very low response rate, partial review of the literature, and non-traditional research method, which resulted in a 12% response rate. Perhaps the business incubation industry, at less than five years old, was too young for substantive evidence of its impact.

In broad terms, the universal purpose of the existence of business incubators is to increase the chance of survival of start-up firms (Allen and Rahman, 1985). Consequently, definitions that have focused on the roles of business incubators and the services they provide have a more effective interpretation of the purpose of business incubators and take the focus away from just having a physical space for rent with shared facilities (Allen and Weinberg, 1988).

It is important to keep in mind that incubators are not simply shared office space facilities with infrastructure and a mission statement. Rather, incubators consist of a network of individuals, such as the entrepreneurs, incubator managers; organisations such as universities, local companies, government bodies, and advisors, who are mostly other successful entrepreneurs with a wealth of knowledge, and investors.

To this effect, Soetanto and Jack (2013) argue that networks are a critical element to the incubation process, particularly for obtaining resources. Their study examined 70 innovative technology companies in the bio-medical, digital/ICT, advanced engineering, energy, and environment sectors based in a government-supported incubator in the northwestern region of UK to find that the firms do indeed use networks for resource acquisition. The study, however, is limited because of its small sample and focus on a single business incubator.

In addressing the definitional ambiguity among terms used, business incubators are generally referred to as facilities that nurture the development of entrepreneurial companies, helping them grow and survive at their most vulnerable period by providing the necessary business support and resources (NBIA, 2012). The term 'science parks', on the other hand, which is used interchangeably with Research Park, Technology Park, Business Park, Innovation Centre, and Technology Innovation Centre, is widely used to refer to an agglomeration of science and technological activities which have a spiral effect on the firms located around the park (Westhead, Batstone and Martin, 2000). A more practical definition is given by the International Association of Science Parks (IASP, 2015), in which science parks or Science, Technology, and Research Parks (STPs), are referred to as organisations with a mandate to:

- Provide formal and operational links between higher education institutions, such as universities or research laboratory centres, companies, and technicians
- Encourage the formation and growth of knowledge-based businesses and other organisations through a spin-off mechanism normally located on its site,
- Provide a managerial function which is actively involved in the transfer of technology and business skills to organisations on its site, and
- To work in partnership with other innovative research companies, centres and science parks to facilitate global standards of the firms located on their site

With reference to the above practical definition, although science parks provide technical, logistical, administrative, and financial support to young firms--which is a similar strategy to business incubators--science parks place more emphasis on their links with research laboratory centres and universities. As Guy (1996) observes, science parks are different from business parks, which provide premises but little else; science parks are usually based around universities and interact continuously with them. Additionally, science parks boast of their ability to commercialise high-technology research innovations from these research centres and university labs, generally referred to as spin-off companies or simply spin-offs (Mustar et al., 2006).

Researchers argue over the effectiveness of science parks, raising some issues. For instance, Massey and Wield (2003) argue that science parks are not major sources of technology

development, and geographical proximity between universities and science parks had little impact on technology transfer. Massey and Wield (2003, p.124) conclude that science parks are primarily “prestigious real estate developments with little productive generated synergies.”

Westhead and Storey’s (1995) study of science parks in the UK in 1986 found that, although a number of firms relocated their firms to science parks just to be close to universities, the outcome of the relationship was less than anticipated. This study is complemented by Vedovello’s (1997) comparative analysis of a firm’s established links with a university across informal, formal and human resource links. Although proximity is important for informal and human resource links, Vedovello’s (1997) case study of a British science park in Surrey found that geographical proximity between partners is not a significant influence or a driving force for the existence or strength of formal links with academia and industry. Storey and Tether (1998) argue that, with the exception of France, science parks within the European Union have contributed little to direct employment and their contribution to technology transfer has been difficult to estimate.

Considering all of these studies, researchers such as Bakouros, Mardas and Varsakelis (2002) and Massey and Wield (2003) ask the question; “Are science parks high tech fantasies?”

While science parks and business incubators are distinct organizations within the entrepreneurial value chain that provides the social environment, technological and organizational resources, and managerial experience to help startup companies grow (Phan, Siegel and Wright, 2005), business incubation has a closer link to the concept of entrepreneurship (Aernoudt, 2004) and the focus of this research. Furthermore, the institutional, political, environmental, academic and practical context of this thesis has a stronger affinity for business incubators than science parks. Thus, for this thesis, inspired by Hackett and Dilts (2004), a business incubator will be defined as;

*A facility, either physical or virtual, that develops and supports the growth of startup entrepreneurial ventures by providing vital resources such as physical working space, networking, coaching, mentoring, business consulting, financial resources, and other links to professional services.*

Having defined what is meant by ‘business incubator’ and clarified the terminologies surrounding the concept, the next section will move on to discuss the types of business incubators, as this thesis is focused on a particular type of business incubator: technology business incubators.

### 2.5.1 A Taxonomy of Business Incubators

As described in the previous section, business incubators vary in their mode of operation, focus, and structure. Thus, a consensus on the literature of business incubators is hard to reach because of the multiple taxonomies developed around the concept. This section illustrates how services rendered by business incubators vary widely in their types, motivations, focus, and structure before intently focusing on a particular type of incubator.

Business incubators come in different forms. Allen and McCluskey (1990) identify four different types of incubators in a business incubator continuum: i) *For-profit property development incubators*, whose primary aim is to gain some real estate appreciation; ii) *Non-profit business incubators*, with a primary focus of creating jobs and promoting entrepreneurship; iii) *academic incubators*, with an aim to commercialise research knowledge from universities, while providing local economic development benefits; and iv) *For-profit seed capital incubators*, who function as seed fund managers to a portfolio of companies located in a place.

Classifications of incubators also differ depending on geography. A notable study by Aernoudt (2004) identifies three types in Europe: Anglo-Saxon, German, and Latin. The Anglo-Saxons count the real estate quality of their facility to be more important than proximity to the university. They are profit-driven and have a good number of service companies, such as insurance and accounting firms in their facility. The German standard emphasises innovation in their business incubators, which are collectively known as innovation centres. They provide startup advice, office space, technical and technological-oriented services with the aim of supporting regional economic development, creating jobs, promoting entrepreneurship, and fostering technology transfer. Consequently, they operate as nonprofits. The Latin form, on the other hand, emphasises business incubators as tools for economic and regional development; thus, they are hands-on with the startup companies and follow up with the company through its launch phase. The main weaknesses with this classification are its missing link in providing financing for startup companies and its biased focus on the European region.

However, Thierstein and Willhelm (2001) take a broader approach by classifying business incubators into a *continental European model*, primarily publicly funded with a focus on regional economic development and forming innovative networks; and an *Anglo-Saxon model* whose focus is on creating science-based companies through collaboration with research institutions, such as universities. The latter approach can be seen at work in regions like the United States and United Kingdom. Cultural classifications of business incubators could be problematic, considering that every region, continent, and population contains numerous, varied cultures, making adaptation almost impossible (Barbero et al., 2012).



Some other researchers discuss the classification of business incubators based on their financial sponsorship type; that is, publicly or privately funded (Gertner, 2013; Kuratko and LaFollette 1987). Publicly funded incubators include university incubators and regional incubators. While university incubators are more concerned with commercialising scientific research, regional incubators have a keen focus on providing jobs and contributing to their community. Privately operated business incubators, on the other hand, either directly invest in incubated companies for a later return or claim charges on rents and other rendered services (Lumpkin and Ireland, 1988). Although Allen and McCluskey (1990) identify another classification of business incubators as *public-private partnership*, Dechang, Qiang and Honwei (2010) argue that a majority of established incubators are publicly sponsored by government organisations, though this study was based on just one case study of a particular business incubator in Shenzhen, China. Abetti (2004) found that the number of publicly funded business incubators is much higher in Finland; he argues that published studies show 90% of incubators are not for profit, as they rely on direct (cash) and indirect (subsidised services) funding from central, regional, local government, foundations, and higher education institution sponsors. Furthermore, Al-Mubarak and Busler (2010), after studying business incubator members of the NBIA, argue that 78% of business incubators worldwide are sponsored by academic institutions, governments, and economic development institutions.

A more prominent classification of business incubators is based on their objectives or stakeholders. This view is supported by Thierstein and Wilhelm (2001), who argue that the difference between business incubators is how their infrastructure is structured to suit their incubated firms. Table 3 below illustrates a typology of firms that includes a wide range of business incubators, with different philosophies, focus groups, and objectives. Based on an analysis by Aernoudt (2004), the classification aims to combine conceptual analysis with economic reality.

Table 3: Typology of business incubators

<b>Incubator Typology</b>	<b>Main Philosophy: dealing with</b>	<b>Main Objective</b>	<b>Secondary</b>	<b>Sectors involved</b>
<b>Mixed incubators</b>	Business gap	Create startups	Employment creation	All sectors
<b>Economic development incubators</b>	Regional or local disparity gap	Regional development	Business creation	All sectors

<b>Technology incubators</b>	Entrepreneurial gap	Create entrepreneurship	Stimulate innovation, technology startups and graduates	Focus on technology, recently targeted, e.g. IT, speech, biotechnology
<b>Social incubators</b>	Social gap	Integration of social categories	Employment creation	Non-profit sector
<b>Basic research incubators</b>	Discovery gap	Bleu-sky research	Spin-offs	High tech

Source: Aernoudt, 2004

As table 3 illustrates, business incubators vary widely in their primary objective and philosophy. For example, the primary objective of a mixed incubator is to fill a business gap. Therefore, it does not focus on specific industries. In the same vein, economic development incubators do not focus on specific industries, because their general philosophy is guided towards creating regional economic development by creating new businesses. Basic research incubators and technology incubators, on the other hand, focus on specific industries, such as high-tech and new-technology-based firms respectively. With a philosophy of fostering entrepreneurship and commercialising technological research, their primary objective is to develop and support innovative ventures based on technological products, services, and solutions. Lastly, social incubators fill a social gap, with a primary objective of creating employment through non-profit organisations.

A different classification is offered by Al-Mubaraki and Busler (2011), who provide a summary of business incubators based on their goals, services, and types. Although Al-Mubaraki and Busler (2011) do not present a categorized table as in table 3 above, after a case study of 10 business incubators in developing countries, an overview of their diversity is presented, together with their goals and services. Al-Mubaraki and Busler (2011) mention areas of business incubation omitted by Aernoudt (2004), such as manufacturing incubators, web-related incubators, incubators aimed at encouraging women into entrepreneurship, and incubators structured to provide some form of complimentary benefits to their sponsoring organisation.

Furthermore, Al-Mubaraki and Busler (2011) outline the many services that business incubators offer to their tenant firm, ranging from providing access to bank loans and investors to providing professional training of business etiquette and presentation skills. Together, these studies indicate that business incubators are comprised of different elements and consist of a

wide range of typologies. For instance, there is a newly introduced type of business incubator, the green business incubator, whose focus is to develop sustainable green companies (Noltes and Masurel, 2013).

It illustrates how vast the field of business incubation is and how difficult it is to put incubators into a box, as it is not uncommon for them to overlap in sponsorship, tenant firms, objective, philosophy or motivation. Nonetheless, this thesis will place emphasis on technology business incubators discussed in depth in the next section. Table 4 presents an updated taxonomy of business incubators, adapted from (Hackett and Dilts, 2004).

Table 4: Summary of types of Incubators from literature. (Author's own).

Author and Year	Types of Incubator	Classification Criteria
<b>Allen and McCluskey, 1990</b>	For profit property development Not for profit development Corporation Academic	Based on value added
<b>Aernoudt, 2004</b>	Mixed Economic development Technology Social Basic research	Main philosophy Main objective Secondary Sectors involved
<b>Grimaldi and Grandi, 2005</b>	BICs (Regional Development) University Technology Corporate Independent	Institutional mission Industrial sectors Location Origin of ideas Phase of intervention Incubation period Sources of revenue Services Management team
<b>Becker and Gassmann, 2006a; Becker and Gassmann 2006b</b>	Fast-profit incubators; market incubators; leveraging incubators; and in-sourcing incubators.	Source of technology Type of technology
<b>Carayannis and Von Zedtwitz, 2005</b>	Regional business University Virtual Independent Company internal	Vertical scope Segment scope Geographical focus Industry focus
<b>Hedner et al., 2011</b>	1) Technology incubator, 2) Incubation of services, 3) Incubation of mixed-use type 4) Manufacturing incubation, 5) Web-related business incubation, and 6) Community revitalization incubator	Categories based on program objectives
<b>Casillas et al., 2012</b>	Basic research incubator University business incubator Economic development incubator The private incubator	Classification based on geolocation (Spain) and unique features of the Spanish innovation system.

Regardless of the taxonomies associated with business incubation, researchers have shown that, fundamentally, business incubators play an important role in fostering entrepreneurship (Aernoudt, 2004; Al-Mubarak and Busler, 2013). Autio and Klofsten (1998) conclude that the local context in which a business incubator operates also influences how the incubator is structured, its philosophy and its main objective, which reflects on the kind of services and support it offers to its tenant firms.

One way of measuring the performance of business incubators is assessing if it has met its objectives and purpose. Consequently, Barbero et al. (2012) divided business incubators into four categories: *basic research incubators*, *university business incubators*, *economic development incubators*, and *private incubators*. Considering one of the main reasons business incubators exist is to increase the survival rate and lifespan of new ventures, Chan and Lau (2005) advise that business incubators should strive to target their support services to the stage of development at which the incubated firm is situated. Incubator success would vary across the diverse typologies of incubators. Therefore, their success should be measured by the objectives they have set out for their tenant firms. For instance, investment opportunities will vary across the types of incubators; likewise, job creation will occur at an uneven rate. Moreover, business incubators should be judged by key milestones, such as the number and performance of graduate firms, rather than simply counting jobs created. Another milestone suggested by Aernoudt (2004) is the provision of seed financing and business angel networks; networks are an important part of the incubation process (Soetanto and Jack, 2013). Perhaps most importantly, the satisfaction of the tenant firms would be an important criterion for assessing the performance of business incubators.

Based on this discussion of several types of business incubators in the literature, it seems imperative to have a clear direction and focus of what sort of business incubator is the subject of this research.

As explained earlier, one of the main purposes of the existence of business incubators is to enhance innovation and promote entrepreneurship. Technology business incubators explicitly aim at incubating business ventures with high or advanced technology content (Somsuk, Wonglimpiyarat and Laosirihongthong, 2012). The first incubator of this kind was developed in the USA by the National Science Foundation (NSF) in 1973, as an experimental programme to “enhance entrepreneurship education, development of new technologies in existing companies, and the establishment and nurturing of new businesses” (Campbell and Allen, 1987, p.179). The concept, which has grown more popular over the years, is sometimes

referred to as technology incubation, technology business incubation, or university incubation in academic literature and practice.

At a time when new knowledge, intellectual property, and technological prowess are essential ingredients of any industry and the economy at large, technology incubators emerge as an important link in the value chain. Technology business incubators are sometimes referred to as university technology business incubators. The major difference between these two terms is their affiliation with university institutions, and thus, in some studies, they are used interchangeably. While the former (technology business incubators) do not necessarily have any formal links with a university or other higher education institution, university technology business incubators are mostly affiliated with universities or possess a strong link to higher education institutions. In this thesis, however, technology business incubators will be used in its broad sense to refer to both groups of incubators.

As pointed out in the introduction of this chapter, technology entrepreneurship is mostly a regional phenomenon that thrives on the knowledge, resources, and support of the local region. However, the key ingredients for a region to be able to support innovation and entrepreneurial culture, leading to transformation, include the presence of tangible resources (such as sound professional system, transparent capital market, advanced telecommunication infrastructure, and transportation) as well as intangible resources (such as novel ideas which are region-specific, role models, informal forums and environments, safety nets, gateways to large markets, and leadership) (Venkataraman, 2004).

This view is complemented by Lindholm Dahlstrand's (2007) study of 350 new technology firms in Sweden to analyse technology-based entrepreneurship and its importance for economic growth. Lindholm Dahlstrand (2007) argues that, for a region to reap the benefits of technology-based entrepreneurship, it is important to have certain infrastructure and knowledge in areas such as technology, marketing, and business, as well as existing educational and corporate organisations which act as training grounds for future technology entrepreneurs within the region. In principle, technology business incubators embody these resources in a facility which tenant firms are meant to benefit from (Smilor 1987).

Drawing on a range of sources, some researchers, with empirical evidence, have set out in different ways to argue the emergence of technology business incubation as a strategy to foster innovation-based economic development at state and local level. For instance, Phan et al. (2005) argue that incubators are distinct organisations in the technological entrepreneurial value chain responsible for transforming technology-based business ideas into efficient economic gains. In an investigation into technology-focused business incubators to determine their crucial role in the North East region of England, a survey of 17 incubators by Wynarczyk

and Raine (2005) found that the incubators were adding value to the economy and meeting economic development objectives. However, aside from the small sample of investigated incubators, which makes the generalisation of this study narrow, selection bias is another potential concern as the research was commissioned and funded by an interest group from the same region.

In a similar study, focusing on the effectiveness of technology incubators in Italy, Colombo and Delmastro (2002) found that, in comparison to off-incubated firms, on-incubated firms showed higher growth rates. Considering this study was carried out on technology business incubators located in a science park, Chan and Lau (2005) point out that its effectiveness is not conclusive, suggesting that an appropriate assessment model should be developed. Nonetheless, Lewis and Edward (2001, p.24) conclude that "business incubation can be considered a cost-effective economic development strategy for state and local governments in terms of public sector cost per job."

Other researchers propose that, in addition to creating jobs, promoting entrepreneurship, and increasing investment in innovation, business incubators also create incentives for highly skilled individuals to reside in the host region (Aernoudt, 2004; Al-Mubarak and Busler, 2011; Lewis and Edward 2001; Somsuk et al., 2012).

Most technology incubators have an ownership structure that is led by public organisations and operated as non-profit institutions. O'Neal (2005) notes that technology incubators with a for-profit model are on the decline, as 49.2% are led by public organisations, and 38.5% are private non-profit entities. In contrast to O'Neal, Tamasy (2007) argues that technology-oriented incubators should be run as private organisations, without public funding, because of their cost of operation and uncertain returns and impact. Perhaps a public-private partnership in establishing and operating technology business incubators would be more beneficial to tenant firms and better for regional economic development. This view is supported by Aerts, Matthyssens and Vanderbempt. (2007) who found that, of the 140 incubators investigated, 80% were self-sufficient thanks to financial support from universities, R&D organisations, banks, and other private institutions.

The funds were beneficial at the initial stage of starting up, after which the incubators diversified their income source, one of which was through tenants' rents. Nevertheless, 29% of the incubators were operated as for-profit institutions. Furthermore, a quantitative study by Barbero et al. (2012) on incubators in the Spanish region of Andalusia argues that, although performance measures differ in incubator typologies, the performance of private incubators and basic research incubators is outstanding compared to university incubators, which performs just satisfactorily.

As was mentioned in the introduction to this chapter, business incubators exist to curb the high failure rate among startup firms. Generally, small businesses are known to have a short life span, typically due to a lack of managerial skills and minimal access to capital (Allen and Rahman, 1985). Edmiston (2007) notes that the failure rate of small businesses is somewhat greater than that of larger businesses, amounting to about one and one-half times higher than large firms. Although it is difficult to define what exactly is meant by 'failure' among new firms, statistics point to the fact that the risk is quite high for both entrepreneurs and investors.

Technology-based ventures are particularly risky because of their innovativeness, application of novel non-traditional business models, most often being capital intensive, and their sluggish ability to make a profit (Jang, 2009). For instance, a study by Mason and Harrison (2002) of 128 UK startup exits reports a highly skewed distribution of returns, with 34 percent being a total loss, 13 percent break-even or a partial loss and only 23 percent producing returns of 50 percent or above.

A more recent study by Shikhar Ghosh--a senior lecturer at Harvard Business School--of about 2,000 US companies that received venture funding between 2004 and 2010 places the failure rate of high-potential firms at about 30 to 40 percent (Gage, 2012). Similarly, in the UK, 75% of newly formed technology ventures do not survive beyond three years (Evers et al., 2013). Consequently, local capital lenders, such as banks, venture capitals, and other financial institutions become weary because of the high risks involved with such investments.

Technology incubators aim to fill this space by providing initial-stage financing through business angel networks which manage and provide seed or pre-seed money to startup companies, as well as managerial and technical expertise (Rubin, Aas and Stead, 2015). However, as Aernoudt (2004) points out, the links between incubators and startup financing are underdeveloped in practice. A reasonable approach to tackle this issue would be to first identify the general role that technology business incubators play in serving their incubated firms. Phan, Siegel and Wright (2005) highlight the need for research to identify what incubators offer and how it is different from what is already on offer; for example: "How are technology incubators different from venture capital firms?" and "What is the nature of the resources and capabilities of technology incubators?"

In the section that follows, the general roles and function of technology business incubators are discussed together, with their effectiveness on their incubatees. After which, some key findings and issues will be raised, leading us to the contextual piece of this thesis.



### 2.5.2 General Roles of Technology Business Incubators

Typically, technology incubators function as support mechanisms that work with new technology ventures, markets, and venture capitalists with the aim of providing essential resources necessary for survival (Phan, Siegel and Wright, 2005). According to Mian (1996), 'networking' forms a major component of business, capital, and social inputs. Soetanto and Jack (2013) go on to express that, although networks are an essential part of the incubation process, business incubators should channel networking activities towards capturing tangible resources, as well as intangible resources, by improving interaction among incubated firms in the incubator.

On the other hand, technology business incubators are viewed by Soetanto and Geenhuizen (2005) as 'intermediary agents' between firms and non-corporate institutions. Therefore, one of the roles of technology business incubators is to create linkages between incubated firms and potential sources of both tangible and intangible resources. In a recent study, Rubin, Aas and Stead (2015) found that incubators from Austria and Israel were summarised to be technological knowledge bearers, market knowledge bearers, and financial resource bearers. Technology incubators function as a tool which enables young firms to learn, develop, and launch their business ideas to test with the market. Thus, technology business incubators could be viewed as breeding grounds for new and innovative companies to minimise their risk of failure (Löfsten and Lindelöf, 2005).

In their survey of 17 incubators in North East England, Wynarczyk and Raine (2005) outlined that a successful technology business incubator ought to have a minimum size of 50,000 sq. ft. of space for the potential of the incubator becoming self-reliant, be located within easy travel distance, possess the ability to locate major players such as business links, chamber of commerce, and local authority for additional support to the incubator. They should also have easy access to a wide range of business support, provide full access at any time of day, good security and mail handling services. A major drawback to this study is its narrow focus on the technology incubators rather than what the incubated firms require to succeed. A more comprehensive study would have investigated more incubators within the region to determine how the services rendered by the incubators met the expectations of the tenant firms.

Hackett and Dilts (2004) suggest that, in order to determine the real impact of incubators on venture development, researchers should focus on the process of incubation rather than the incubator facility. Moreover, an in-depth focus on how technology business incubators impact technology entrepreneurship would be valuable to the literature at large. Another service that technology incubators provide is venture funding, directly or indirectly, either as a way of seed funding or exposure to individuals and institutions with financial resources (Smilor, 1987).

Traditionally, researchers argued that one of the major functions of a technology incubator which differentiates it from other incubators is its ability to transfer and commercialise technology and draw resources from research laboratories and other higher education institutions, such as universities. Chen's (2009) study utilises regression analysis to test a hypothesis in a sample of 122 new technology ventures in Taiwan. The study indicated that an incubator--as well as venture capital--supports and plays a moderating role in competence in technology commercialisation and new venture performance. Mian (1996) asserts that university-related input, such as laboratories and equipment, student employees and even the university image, adds major value to technology incubators affiliated to universities. Similarly, the reason for university and technology incubator relationship in a study of six technology startups in Hong Kong by Chan and Lau (2005) is that universities can provide technology startups with both software and hardware support in the form of consultation and advice, as well as access to laboratory equipment and facilities. In their study, Rothaermel and Thursby (2005) highlight that some incubators are set up primarily to commercialise a technology from a sponsoring university.

However, there are limits to how effective incubators are at commercialising technology from universities and research labs, providing venture capital funding, or providing access to professional services. In their study of the role of business incubators in Portugal, Ratinho and Henriques (2010) found that the overall contribution of business incubators to economic development was modest at best.

Some researchers have argued that the functions and roles of technology incubators vary widely from country to country. For instance: in Belgium and Spain, incubators were initially structured to attract branches of multinational corporations; in Germany the target was clearly to build innovative startups; on the other hand, in France and the Netherlands, the university incubator model was promoted more (Aernoudt, 2004). Grimaldi and Grandi (2005) argue that the rationale behind an incubator's role and function lies in their ability to target different types of client companies, having different objectives and requirements. However, business ideas do not all have the same potential and thus do not require the same resources. Moreover, it depends on their structural characteristics, the size of the target market, the specific industry involved, the degree of innovativeness, and specific phase of the business development cycle (Grimaldi and Grandi, 2005)

Table 5: Summary of the general role of technology business incubators. Compiled by the author.

<b>General Roles of Technology Incubators</b>	<b>Representative citation</b>
<b>Links new technology ventures to industry experts</b>	(Phan et al., 2005; Soetanto and Geenhuizen, 2005)
<b>Networking with on- incubated and off- incubated firms</b>	(Mian, 1996; Soetanto and Jack, 2013)
<b>Access to tangible and intangible resources</b>	(Soetanto and Jack, 2013)
<b>Provision of seed funding to tenant ventures</b>	(Rubin et al., 2015; Smilor, 1987)
<b>Subsidized space for coworking</b>	(Wynarczyk and Raine, 2005)
<b>Commercialisation of new technologies</b>	(Löfsten and Lindelöf, 2005; Rothaermel and Thursby, 2005)
<b>Provide relationship with research labs and universities</b>	(Chan and Lau, 2005; Chen, 2009; Mian, 1996)
<b>Market knowledge</b>	(Rubin et al., 2015)

### 2.5.3 The Impact of Technology Incubators on the Venture Creation Process

The fundamental role of incubators is to provide essential resources for their incubated ventures. In spite of extensive knowledge about the role and function of technology incubators, it is crucial to examine their impact and value on the performance and entrepreneurial process of their tenant firms. Additionally, it is important to ask what and how technology business incubators have impacted the technology entrepreneurship process. Since technology incubators exist to increase the lifespan of new technology ventures, the value and impact of the incubator services are measured by how well the startup companies perform, both within the business incubators and after graduation from them. As a result, we discuss the impact of technology business incubators through the lens of other researchers.

In 1985, Campbell, Kendrick and Samuelson (1985) published a seminal paper that underlined four substantial values that business incubators added to their ventures: i) diagnosing the needs of their incumbent ventures and tapping into the experience of a diverse group of professionals and specialists for solutions; ii) selecting, providing, and monitoring acquisitions in addition to coordinating other business services needed by the ventures; iii) providing access to capital for product development and other business services from third party experts; and iv) providing access to a network of business development expertise. According

to Campbell, Kendrick and Samuelson (1985), business incubators can help their ventures gain access to a network of business development experts, which includes financial institutions, accountants, lawyers, colleges, management consultants, government agencies, local business associations, and venture capitalists. While this study was one of the first major publications that distinguished the value business incubators' services provided, it fails to give any additional detail to further explain how these components function or how they are connected to the venture's entrepreneurial process. Moreover, the study is not based on empirical data; thus, the type of business incubator referred to is unknown, making this study somewhat outdated.

A few years later, Smilor (1987) investigated the incubator system by conducting a national survey and in-depth interviews with 50 incubator managers. The study prescribed two broad components that aid incubators to nurture new firms: i) support systems (secretarial, administrative, business expertise, and facilities); and ii) affiliations to universities, government organisations, the private sector, and non-profit organisations.

Smilor (1987) notes that the knowledge internally obtainable by the incubators as a result of the network built through the latter component is leveraged into their tenant companies by actors. These actors include the incubator director, manager or president, a board of directors, and an advisory council and a network of consultants. In addition to dispersing knowledge, these actors also provide the link to other individuals, institutions, and agencies outside the incubator which can offer financial assistance, further special expertise, and business support (Smilor 1987). The study goes further to discuss the selection process for admitting entrepreneurs and their new ventures, highlighting how important it is for successful incubation. The selection criteria used by incubators in the study, which are decided by the incubator manager, include the ability to create jobs, pay operational expenses, provide a comprehensive business plan, present a unique opportunity, be a startup company, be located and owned locally, and be high technology oriented. The major drawback with this study is that it captures the perspective of incubator managers only and does not account for the perspective of incumbent or graduated entrepreneurs. While the study discusses the selection process and the actors involved in the incubation process, it fails to provide a relation to analyse what impact they had on the entrepreneurship process of the new ventures. Also, like Campbell, Kendrick and Samuelson (1985) the study did not classify the type of incubators being studied, although as part of the selection criteria, new companies were required to be high-technology oriented.

Mian (1996) analysed the value-added contributions of university technology business incubators (UTBIs) to tenant firms. Based on a national survey of six representatives of UTBI

facilities in the US, the study found a positive impact of UTBIs on tenant firms. However, one limitation of this study is its emphasis on physical attributes, such as shared space, labs and workshops, and library resources. It fails to take into consideration the importance of intangible value-added services, such as managerial support, physiological motivations, networking, and mentoring schemes. However, this limitation creates an opportunity for future research to explore. One example includes an assessment of the performance of tenant firms in technology business incubators, using intangible resources from the incubators. The study sample had a weak response rate of 32%, which raises the question of generalisation. Nonetheless, the study provides some standards for future policy implications and further development of technology incubators.

The findings of this study are supported by Rothaermel and Thursby (2005), who argue that an incubator's absorptive capacity is an important factor in transforming university knowledge into firm-level competitive advantage. Mian's emphasis on the role of university technology incubators on venture performance continues in a later work; *Assessing and managing the university technology business incubator: an integrative framework* (Mian, 1997). This study employs an integrative framework to conduct a comparative evaluative study using data from previous works. The model found that general growth in revenue and employment was positively affected during the incubation period. Furthermore, a positive impact was noticed in all dimensions tested in the integrative methodological framework and concludes with a set of elements acknowledged for assessing UTBIs against the aforementioned performance dimensions (Mian, 1997).

Another comparative study, by Colombo and Delmastro (2002), evaluates the contribution of technology business incubators to the formation of technology-based companies and their growth. The study, based in Italy, collects and compares a sample of 45 technology-based firms in an incubator to another 45 off-incubator firms. The results show some evidence that technology incubators and their tenant firms possess better value in comparison to off-incubator firms. Although innovative activity was only marginally different between on- and off-incubator firms, incubated firms were found to have a better post-entry growth, based on the number of employees in comparison to off-incubator firms. Additionally, the report indicates that incubated firms had better links with other facilities and higher institutions within the area and showed better output measures in terms of survival and growth rate. One question that needs to be asked, however, is whether a similar result would emerge if the same study was conducted in a different region, country, or continent with different government policy, labour market, institutional infrastructure, and attitude to entrepreneurship.

Wiggins and Gibson (2003) take a broader perspective by assessing the business incubation scene in the US, with a keen focus on the widely acclaimed, successful Austin Technology incubator in the USA, whose businesses have generated a cumulative \$1.4 billion in revenues and created over 3,000 jobs. The study concludes with suggestions for business incubators in the technology industry if they must succeed: establish clear metrics for success; that is, clear criteria on how to measure performance; provide entrepreneurial leadership, from director to receptionist staff, all possessing an entrepreneurial attitude; design and deliver clear value-added services to client firms in consistent, timely, and efficient fashion; develop a rational selection process for new companies, with room for exceptional individuals or situations; and ensure that tenant companies have access to both financial and human resources. According to Wiggins and Gibson (2003), evidence from the Austin Technology Incubator illustrates that incubators can be an economic development tool. Jobs created by these incubator firms increase the tax base, boost the commercial value of real estate space, increase local business infrastructure, and spiral to job creation in other sectors. Although this is a seminal study on the impact of technology business incubators in a region, one criticism of much of the literature on technology business incubators is its diversity and the challenge of replicating a similarly successful model in a different region, with different policies and laws. Fundamental to the success of the Austin Technology Incubator is the coalition between university, government, and business leaders in the region. Regarding its methodological shortcomings, the author's sample is limited to a single incubator only.

Drawing from a sample of 17 incubators operating in the North East of England, Wynarczyk and Raine (2005) examine the crucial role of business incubators and their contribution to the local economy. The study illustrates that the incubators contributed to the economic region by meeting economic development objectives, provided pro-active business development services; and added capacity to enhance the development, growth and survival of both the incubators and their ventures. Additionally, a benchmark for future development of incubators around the region is summarised under (i) location of the business incubator in an urban area with high-density population, (ii) superior performance of mixed incubators, (iii) comprehensive business support, (iv) flexibility, (v) job creation, and (vi) ownership structure. As noted in section 3.4.2 above, the limitation of this study is its biased sample selection; also, since the study was sponsored by an institution with a vested interest, the position of the authors is questioned. It also seems that Wynarczyk and Raine (2005) place great emphasis on the space and facilities of the incubator, ignoring other important functions. This might have been due to the way the UKBI defines a business incubator.

Ratinho and Henriques (2010) set out to investigate business incubators as tools for economic growth in Portugal, a converging economy. Utilising a qualitative case study approach, the

study reports that most Portuguese business incubators were unplanned and failed to reach their goal of creating and developing new ventures. The impact of the business incubators was described as “modest”, as their contribution to creating jobs and creating economic growth were barely visible. Furthermore, the study suggests that the determinant of incubator success lies in their university links; that is, access to university facilities and research labs, suitability of management, such as the expertise and experience of the incubator manager; the type of services rendered; and innovative management ideas. Ratinho and Henriques’ (2010) investigation once again fails to acknowledge other intangible resources that the incubator offers. Instead, a narrow focus is placed on university links and the suitability of management. Moreover, it appears that the understanding of the functions of technology business incubators in Portugal is very limited.

Another study in 2010, by Scillitoe and Chakrabarti (2010), studies how the role of counselling, from incubator management and networking interactions, benefits new technology-based firms within business incubators. The study was conducted on 42 respondents from two countries, consisting of 28 US technology ventures associated with 11 US incubators, and 14 Finnish technology ventures associated with 6 Finnish incubators. Valuable insights emanate from the study, which highlights the supportive roles of counselling and networking interactions on business and technical assistance. Furthermore, the study offers specific measures of venture assistance by technology business incubators, such as testing and learning buyer preference as a function of business assistance and learning the technological know-how as a function of technical assistance. The strength of this study is that it considers the perspective of the founder of the new technology firm as well as the incubator management. It also gives an in-depth explanation of the type of business and technical assistance tenant firms can expect from technology incubators, and insights on mechanisms technology business incubators can use to provide support. The weakness of this study, however, is that it excludes other external actors in the incubation process, such as business consultants, government agencies, private organisations and universities. Additionally, the study is limited in scope as it takes samples from only two countries, which are known developed countries with sophisticated technological prowess which the author cites as a value for nurturing innovative technological firms. A more comprehensive study would feature technology business incubators from less developed economies, analysing what sort of assistance is given to their tenant firms and what new technology ventures expect to gain from the business incubators and how they differ from developed countries.

A more recent study by Rubin, Aas and Stead (2015) set out to examine the contribution of technology incubators to economic development by shifting focus from the incubator’s performance to its internal processes and relationships. Based on eleven case studies, eight

in Israel and three in Australia, the internal relationships between incubator management and their firms were classified into three knowledge bearers; i) technological knowledge bearer; ii) market knowledge bearer; iii) financial resources bearer. The study found that shared technology knowledge aided collaborations and were useful in developing products and services, as well as increasing technical know-how among incubatees. Regarding market knowledge, both incubatees and incubator management shared their experience and knowledge concerning markets, commonly absent in new technology ventures. Financial knowledge, on the other hand, was drawn upon as incubatees were able to tap into the networks of the incubator's management as well as from interactions with fellow incubatees operating in the same field. Furthermore, the study found that graduated incubatees were very active as sources of knowledge to on-incubator firms. Although this study is useful in classifying how interactions within the incubator among management and other incubatees contributes to the tenant firms, it again fails to take into the consideration other external actors in the incubation process, even though it mentions the knowledge-added-value from graduate incubated firms. Additionally, the study is one-sided as it considers only the CEOs of the incubators, without any reports from the tenant firms. Rubin, Aas and Stead (2015) assume all entrepreneurs are the same, without taking into account their individual experience and background and how these affect their ability to partake and benefit from interactions happening within the incubator. This is a weakness, as the technology entrepreneurship literature suggests that entrepreneurs are varied, due to their diverse background and previous experience, which play a crucial role in their ventures (Gimmon and Levie, 2010; Marvel and Lumpkin, 2007).

While most studies in this field have focused on technology business incubators and their impact in developed countries, very few researchers have emphasised the role technology business incubators play in developing countries. These studies are important to review as they tackle a region which is generally neglected. Moreover, this thesis focuses on a developing region in sub-Saharan Africa, forming a contribution to the limited technology entrepreneurship and business incubator research in the region.

In a study by Akçomak and Taymaz (2004) to assess the impact of technology business incubators on tenant firms, the case of a developing country is in focus. The study examines 48 on-incubator technology firms and 41 off-incubator firms through face-to-face interviews in Turkey. Akçomak and Taymaz (2004) found that technology incubators in Turkey play important roles in assisting new technology ventures at their most vulnerable stages. There were significant differences between on-incubator firms and off-incubators. For instance, on-incubator firms have better economic performance regarding output growth, employment growth, and R&D development. On-incubator firms were also found to have better financial



assistance and support, which was stated to be crucial to the firm's development. Contrary to Scillitoe and Chakrabarti (2010), Akçomak and Taymaz (2004) argue that the effects of the entrepreneur characteristics, business networking, and interaction are not strong enough to explain the performance differences between on-incubator and off-incubator firms. A major drawback of this study is that it fails to mention what form of assistance the on-incubator firms received that set them apart from off-incubator firms. Also, the study takes a single approach that considers the entrepreneur perspective only, leaving out the incubator management and other actors in the incubation process.

Buys and Mbewana (2007) examine the contribution of technology business incubators to the development and promotion of small to medium enterprises in South Africa. The study, focused on the Godisa initiative, a conglomerate of technology incubation centres located in different parts of South Africa, with the sole objective of creating new businesses and new employment. Buys and Mbewana (2007) argue that, in a country such as South Africa, conducive environments for business incubation are characterised by the following key success factors: access to science and technology facilities, access to funding, quality of entrepreneurs, stakeholder support, supportive government policies, competent and motivated management, financial sustainability and networking. While this study is useful in providing a set of industry guidelines for incubator managers to improve clients, it fails to provide any empirical evidence to how these factors have influenced the entrepreneurship process of technology ventures; thus, it lacks depth.

A systematic review of the impact of business incubators in developing countries by Akçomak (2009) concluded that successful incubators: can clearly state what their mission and goals are; have clear selection, entry, and exit criteria; employ incubator managers with profound business experience; monitor their firm; provide strategic services; focus more on intangible services; provide the right network; and have self-sustainable operations. The study provides a descriptive case analysis of developing countries, including India, Brazil, China, and Turkey, based on previous research, and found that incubators in developing countries have certain weaknesses such as: i) excessive focus on tangible services; ii) over-reliance on government, both in terms of promotion and funding; iii) non-qualified personnel and unskilled managers; and iv) lack of creativity and proper planning. The strength of this study is that it provides a comprehensive review of previous literature on business incubators in developing countries and suggests how these incubators can provide better services to their tenant firms. However, a major weakness of this study is that it does not articulate the type of business incubator and what impact they have actually made in these countries. Moreover, the study is conceptual and is not based on any empirical research.

Özdemir and Şehitoğlu (2013) examine the effect of technology business incubators to venture firms in Turkey filling the gap for empirical research of technology business incubators in developing countries. The study, which analysed the state of technology business incubators known as technology development centres in Turkey, acknowledges that although technology incubators play an important role in supporting startup companies, their performance should be measured in broader terms. Özdemir and Şehitoğlu (2013) argue that, in developing countries, challenges posed to technology incubators are directly proportional to the status of the local economy and financial environments of the country and are specific to each country. Although this study presents valid points regarding the state and performance of technology incubators in developing countries, its study is based on previous empirical data carried out by Akçomak and Taymaz (2004). This has not enabled any further understanding of how the technology incubators function in a developing country and how they have influenced the technology entrepreneurship process in Turkey.

A more recent study by Choudhury et al. (2014) provides a framework through which technology incubators can harness their potential as tools for entrepreneurship development. Focusing on Nigeria, the study examines 37 technology business incubators and concludes that, although the initiatives of technology business incubation in BRIC countries (Brazil, Russia, India, and China) have had a positive impact on job creation, wealth creation, and economic development, the opposite is the case in Nigeria. Choudhury et al. (2014) note that this inadequacy is a result of the following factors: i) limited number of technology incubators, as there are only 37, meaning 1 in each state; ii) poor support for tenant firms; iii) lack of measurable targets and objectives for the technology incubators; iv) weak operational structure; v) dominance of government and lack of involvement of the private sector; vi) non-viability of existing incubators; vii) refusal of tenant firms to graduate from the incubators; viii) nepotism and favouritism in placement; and ix) changing policies and constraint of funding to technology incubators. In other words, for Nigeria to realise its vision of economic transformation and sustained rapid socio-economic development in the year 2020 (also known as Vision 20:20), the study proposes a framework for technology incubators. The framework combines the technology incubator model for developing countries by Scaramuzzi (2002) and Nigeria's Vision 20:20 model and suggests ways that the country can achieve its vision: i) existing government owned technology incubators should form partnerships with private institutions and render all operations and management to the private organisation; ii) educational institutions should be involved to provide both tangible and intangible assets; iii) multinational organisations should be implored to support and create their own technology incubators as part of their corporate social responsibility; iv) locally developed contents and innovations should be promoted and commercialised; v) incubators should create and

maintain a proper entry and exit time frame. While this study provides useful insight on how a developing country can achieve its vision of becoming a global economy by harnessing the full potential of technology business incubators as tools of entrepreneurship development, the study has a number of weaknesses. First, its source of data is questionable, considering a content analysis of only a few government sites and not detailing the state of the technology incubators in the country. Secondly, the authors fail to discuss how the recommendations for technology incubators would impact the technology entrepreneurship process of the nation as well as help the nation achieve its vision. Finally, the study approach is descriptive and discursive, with no empirical research, which creates a gap for further research to explore with empirical analysis and offer an objective assessment of the situation.

#### 2.5.4 Key Findings and Issues from the technology Incubator studies

Following the above review of technology business incubators and their impact, some key findings emerge. In any technology business incubator, the main actors involved are the entrepreneurs who own the technology ventures, the incubator management who manage and ensure the incubator delivers on its services, and the external network of private organisations, financial institutions, governments, and other business consultants and experts. There are three main relationships between these actors that enable incubators to meet their goals: i) the relationship between the entrepreneurs and the incubator management; ii) the incubator management (on behalf of the entrepreneur) and the external network; and iii) the entrepreneur and other entrepreneurs within the incubator. Key components in the process include selection, business assistance, and technical assistance. Different studies report the selection criteria to include the ability to create jobs, pay the incubator's operating expense, present a business plan, innovative idea and opportunity, be a startup, be locally located and owned. Business support is driven by both internal and external factors; the technology incubator management and their external network respectively. This support ranges from entrepreneurial education, to access to networking opportunities, business development advice, financial advice, administrative support and access to private corporations (Phan et al., 2005; Soetanto and Jack, 2013; Wiggins and Gibson, 2003).

One major factor that distinguishes technology business incubators from other types of incubator is their ability to commercialise new technologies. As a result, technical assistance is offered in the form of collaborations between tenant firms, skills training, seminars and workshops offered by the incubator management, innovative solutions and ideas provided by the incubator management, and access to educational facilities such as university labs (Rothaermel and Thursby, 2005; Rubin et al., 2015; Scillitoe and Chakrabarti, 2010). The

impact of these technology incubators is a hotly debated topic among researchers. Generally, technology incubators have been shown to improve the lifespan of their tenant firms (Mian, 1997). Other impacts include seed investment, as well as assistance in raising capital from external investors; enhanced growth rate of tenant firms' job creation; and improved economic development of the region they are embedded in (Colombo and Delmastro, 2002; Wiggins and Gibson, 2003).

From the studies reviewed, some key issues arise which have left a gap in understanding how technology business incubators facilitate the development of technology entrepreneurship. First, across business incubator studies and within technology entrepreneurship studies, there is a lack of in-depth study of the relationship between technology business incubators and technology entrepreneurship. Although there is extensive research on technology incubators and technology entrepreneurship, they are generally presented as independent of each other. This is puzzling, because technology business incubators encompass the entire technology entrepreneurship process and seek ways to contribute to functions and components of the process. These contributions are the impetus young and growing tenant ventures rely on to become successfully independent.

Second, very few studies consider the perspective of the technology entrepreneur, as most studies are designed around the incubator facility and its management. This is astonishing, considering that the technology entrepreneurship process begins with the entrepreneur, who is responsible for coming up with innovative ideas and exploring opportunities (Duening, Hisrich and Lechter, 2009). Furthermore, there is a failure to account for how the characteristics, background and previous experiences of the technology entrepreneur affect new venture creation in the context of the technology incubator. This is very important as the talents, skills, experiences, and actions of the entrepreneur are predominantly significant where technological advancements are central to the venture (Beckman et al., 2012) and can influence the value they receive from the technology incubator.

Third, despite the recognition that technology incubators have a positive impact on the region in which they are embedded through the creation of jobs, technical knowledge, new firms, and economic development, the majority of the studies focus on developed countries, repeating and debating over and over the impact that these incubators have had. Perhaps future research can focus more on developing countries, particularly in the African region, where most studies are descriptive, lack depth, and fail to provide empirical evidence. This is important as the literature highlights the highly region-dependent nature of technology entrepreneurship (Lindholm Dahlstrand, 2007; Li et al., 2008; Shane and Venkataraman, 2003).

Finally, very few studies attempt to explain the influence of technology business incubators beyond provision of resources. They loosely explain the implication of the resources and how the resources are bundled and utilised by the entrepreneurs, and then their ventures. The majority of the studies discuss the impact of technology incubators on a broader scale of job creation and economic development but ignore how it directly impacts the individual entrepreneurs and the venture creation process, particularly in developing countries. These studies would be more useful if they highlighted how the resources provided by technology incubators influence the entrepreneur's ability to come up with innovative ideas, raise capital, build and launch products to the marketplace, and build a company around the product or service.

Although the above studies perform a good job of shedding light on technology incubators and their impact, the problems systematically analysed above highlight the need to research these issues further. The next section discusses the theoretical motivations behind this thesis.

## **2.6 A Resource-Based View Perspective on Technology Entrepreneurship and Business Incubators**

The Resource-based view (RBV) theory plays an important role in addressing the critical roles of internal and external resources to an organisation. One prominent feature of entrepreneurial ventures is their ability to gather and manage scarce resources to create value in the form of products or services. Thus, the RBV theoretical perspective can inform and further extend current research on entrepreneurship (Alvarez and Busenitz, 2001). In this study, RBV is adapted to entrepreneurship and applied as a theory of sustainable competitive advantage, rather than a theory of the firm. This is because entrepreneurial ventures are dynamic in how they are created and operated, in comparison to firms, which are more structured and predictable entities (Kraaijenbrink et al., 2010). This section will therefore discuss how the resource-based view theory can be adapted to technology entrepreneurship and technology incubators. It begins with a brief description of the RBV theory and how it has been adapted to entrepreneurship. This is followed by a discussion of how RBV is adapted to technology entrepreneurship and technology incubators in this thesis.

Although the resource-based view theory has developed into a dominant paradigm in strategic management research, earlier studies on RBV acknowledged entrepreneurship as an elaborate part of its theoretical framework (Liang et al., 2010). RBV posits that unique combinations of resources held by a firm can be mobilised and managed to produce products

and services to achieve sustainable competitive advantage (Barney, 1991, Grant, 1991). These resources include *physical capital* resources, such as the physical technology used by the firm, a firm's plant or equipment, geographical location and access to raw materials; *human capital* resources such as training, experience, judgement, intelligence, relationships, and employee insights; and *organisation capital* resources, such as a firm's operation strategy, coordination and control of systems, reporting structure and the relationship between the firm and its external environment. The idea is that resources which cannot be easily purchased, require an extended period of learning or require a change in the corporate culture are unique to the enterprise; thus, competitors might find it difficult to imitate. It is argued that the discrepancies in performance between firms depend on having a set of unique capabilities and inputs (Conner, 1991). Resource heterogeneity stands as one of the most basic conditions of the resource-based theory and it assumes that some resource packages and capabilities essential to production are distinct across firms (Barney, 1991).

However, the theory suggests that heterogeneity, although necessary, is not all that is sufficient for sustainable advantage. An additional condition to competitive advantage occurs when there is a situation of resource immobility, which is the inability of competing firms to obtain resources from other firms (Barney, 1991). According to Barney, a firm's resources can provide a sustainable competitive advantage if it fulfils the following criteria: i) Valuable – be of strategic value to the firm; for example, exploiting opportunities or neutralising threats; ii) Rare – unique to the firm and difficult for competitors to obtain; iii) Imperfectly imitable – difficult to acquire, ambiguous, and socially complex, to make it tough to perfectly replicate; and iv) Non-substitutable – difficult to be exchanged with a different resource to achieve the same result.

In this thesis, the theoretical precepts of the resource-based view are used to examine the technology entrepreneurship process within technology incubators. Technology ventures require certain resources for survival and growth, which technology incubators aim to make available. If the resources provided to technology ventures by incubators are valuable, rare, inimitable and non-substitutable (VRIN), they will help the ventures to achieve sustainable competitive advantage, thus improving their chance of survival, growth and eventual success (Mian, 1996a). Researchers to date have not treated this subject in much detail. Most studies in this field have only focused on one aspect; that is, technology entrepreneurship or technology incubators. The impact of technology incubators on technology entrepreneurship is understudied, particularly in developing countries. Consequently, the aim of this thesis is to provide exploratory knowledge of how the technology entrepreneurship process leverages the resources provided by technology incubators.

A seminal study by Alvarez and Busenitz (2001), entitled *The Entrepreneurship of Resource-based Theory*, extends the boundaries of the resource-based theory to include the cognitive ability of individual entrepreneurs to recognise opportunities, and combine and organize resources to achieve an outcome. They view these abilities of the entrepreneur as a potential source of competitive advantage for their ventures. Consequently, the entrepreneur's role is dynamic in nature and their ability to constantly adapt to changing circumstances is, in itself, a resource to the firm (Coleman et al., 2013). The study by Alvarez and Busenitz (2001) builds upon earlier theory on human capital by Becker (1975), which asserts that the characteristics and qualities of an entrepreneur are an additional advantage to the entrepreneurial venture. Consequently, taking an entrepreneurial perspective to resource-based theory, resources are identified as an integral part of entrepreneurial founders, who embody a bundle of heterogeneous resources that allow them to create new entrepreneurial opportunities repetitively through the firm. However, a limitation with this explanation is that it emphasizes the individual entrepreneur as the superhuman who possesses all the cognitive ability for an entrepreneurial venture to have a competitive advantage. While this is true to an extent, it does not fully explain how entrepreneurs proceed through the venture creation process beyond discovering opportunities.

RBV has been found to be useful in explaining incubators, university spin-offs, ethnic entrepreneurship, green entrepreneurship, and social entrepreneurship, among other phenomena. For instance, in incubator literature, a study conducted by McAdam and McAdam (2008) explores the longitudinal use of the unique resources provided by university science park incubators to high-technology based firms at different stages of the business. The study examines incubators from a resource-based perspective, by including incubators as an additional resource available to high-technology ventures. In the study, the fact that the incubators were attached to universities was counted as more advantageous. The reason for this is that, in addition to the resources provided by the incubator, such as the incubator facilities, business advice, and a cluster of similar businesses, proximity to a university provides access to knowledge, advanced facilities and a skilled labour force, which can be valuable in several ways to the firms. The availability of such unique resources to the firms delivers knowledge, expertise, networks and cost-effective access to leading-edge research. As such, the new firms can begin trading quickly without large overheads. The study found that the provision of these unique resources as practical support did help entrepreneurs to commence trading quickly.

Another important study, by Todorovic and Moenter (2010), employed the resource-based view theory to gather a better understanding of the specific resources that incubators provide to new businesses as they start up. In the study, incubators were acknowledged as institutions

that provide temporary supporting resources, such as shared working space, and business support to lead to the development of firm-specific advantage. Utilising an inductive approach, the study performed in-depth interviews with thirty informants to identify specific resources provided by the incubator. They found that incubators benefitted two distinct groups of tenant firms: one with growth needs and the other with cost minimisation needs. Businesses with growth needs require coaching and different forms of business support, while businesses with cost minimisation needs require some forms of infrastructure support and subsidy. While this study was useful in showing a dissimilar population of incubator tenants, it bears some limitations. First and foremost, it appears that the study was conducted only on the CEOs of incubators. It fails to take into consideration the opinions of the tenant entrepreneurs and their ventures in the incubators. The CEOs may have been motivated to present a picture that is more favourable of their incubator than in reality. Also, the study examined incubators in the USA only. Incubator actions differ in different political environments and socio-economic circumstances; thus, the type of resources provided to tenant firms at each phase could be different. Todorovic and Moenter (2010 p 35) suggest that future research “must consider other national entities and environments”.

A different study by M'Chirgui (2012) applies RBV to analyse how different resources available to business incubators lead them to pursue alternative strategies to attain competitive advantages in generating new technology or science-based firms. The study draws on the resource-based view theory to discuss the possibilities of tangible and intangible resources as significant predictors of the formation of new-technology science-based firms in incubators.

Resources are adopted as enabling factors provided by technology incubators to their tenant firms by Somsuk, Wonglimpiyarat and Laosirihongthong (2012). They classify resources into human resources, technology resources, financial resources and organisational resources and argue that these resources are essential for the survival and growth of firms within the incubator. Somsuk, Wonglimpiyarat and Laosirihongthong (2012), however, use quantitative methods to extract enabling factors provided by incubators from literature. They overlook the significance of interviewing incubator managers and their tenant firms to extract what these enabling factors actually are in their natural setting.

RBV has also been used to gain further knowledge and understanding in entrepreneurship. A study by Choi and Shepherd (2004) examines the decision of entrepreneurs to begin exploiting business opportunities from a resource-based view. They found that entrepreneurs are more likely to explore opportunities when they perceive a market demand for a new product, availability of better-developed technologies, greater managerial capability, and greater stakeholder support.



Powers and McDougall (2005) explore technology transfer in academic entrepreneurship through the theoretical lens of the resource-based view theory to illustrate that the level of R&D industry revenues, faculty quality, age of technology transfer office, and available venture capital fund are significant predictors of technology transfer performance.

Becker and Gassmann (2006) explain that understanding the resource flow in corporate incubators requires the management of i) resource flow between the corporate incubator and parent corporation; and ii) resource flow between the corporate incubator and the technology venture embedded in the incubator.

In a more recent study by Meyskens et al. (2010) to discover the relationships between entrepreneurship and social value creation from 70 social entrepreneurs, the study found that social entrepreneurs demonstrated a similar operational process to commercial entrepreneurs when viewed from a resource-based view. To be exact, “they combine and convert their tangible and intangible resources as part of their operational processes” (Meyskens et al., 2010 p.672). Furthermore, the study looks at social entrepreneurship through the lens of the resource-based view theory to support the notion that social entrepreneurs rely on resources as part of their value creation process.

Another study, by Coleman, Cotei and Farhat (2013), draws on the RBV theoretical perspective to explore the factors that affect the survival and exit routes of young service and non-service entrepreneurial ventures. They found that, although service and nonservice ventures may vary in industry structure, fundamentally, the resources that contribute to their survival are the same, such as education, previous experiences, and adequate levels of financial capital.

Together, these studies indicate that, similar to RBV, heterogeneous resource is also an underlying condition of entrepreneurship. As Alvarez and Busenitz (2001) conclude, combining resources such as entrepreneurial alertness, insight, entrepreneurial knowledge, and the ability to coordinate resources, is in itself a resource. Such an approach, however, fails to capture the entire process of venture creation beyond opportunity discovery. An entrepreneur could be exceptionally gifted at discovering great entrepreneurial opportunities because of a rich social network, relevant past experience and superior cognitive abilities. Nonetheless, discovering entrepreneurial opportunities although important is only the preliminary phase of creating a venture. The process of creating a product, service, or new venture requires much more than opportunities. It extends to gathering the necessary resources for delivering the product, service or new venture to the marketplace to create value. The process of entrepreneurship is not complete until it has successfully communicated value to customers in the marketplace through its products or service (Luke, Verreyne and Kearins,

2007). A more systematic approach would be to identify how resources are made available to entrepreneurs and how these resources influence the entire entrepreneurship process, from idea conception to market launch.

Second, most previous studies on investigating entrepreneurship from a resource-based view have been quantitative in nature. They quantify and analyse heterogeneous resources held by entrepreneurs using statistical instruments and procedures. This presents a static view of a social phenomenon and fails to uncover the process of dynamic interaction and interpretation of entrepreneurs with heterogeneous resources. A qualitative approach will uncover more comprehension in investigating and interpreting how entrepreneurs engage with heterogeneous resources in their natural setting.

Considering the explorative nature of this study, the resource-based view theory (RBV) is an important theory for understanding the interaction between technology ventures and technology incubators. Further, the RBV framework is useful in helping to understand the main argument for technology incubators, which is negation of market failure by providing access to key resources that are crucial for long-term viability of the new ventures. However, RBV, while influential in explaining the value add of resources to new ventures, it does not take into cognizance the dynamic nature of entrepreneurial ventures. It does not fully explain the social nature of entrepreneurial firms. This is because the resource-based view framework is mainly presented as a theory of the firm, due to its focus on structure, conduct, and performance (Kraaijenbrink et al., 2010). Firms are considered as entities aiming to gain above-normal profits in unmediated competition with other firms in a shared market. RBV assumes that firms are profit-hungry entities, led by boundedly rational managers operating in markets that are predictable to a reasonable extent and heading towards equilibrium (Bromiley and Papenhausen, 2003; Leiblein, 2003).

Technology ventures are dynamic in how they are created and operated and often function in dynamic markets where there are many uncertainties (Agarwal, Audretsch and Sarkar, 2010). Thus, the application of RBV as a 'theory of the firm' in this thesis would be limited as it would fail to capture the fast-changing environment that is known with technology entrepreneurship. Moreover, that RBV is a 'theory of the firm' is imprecise. A theory of the firm usually means a theory of existence, structure and scope of firms (Kraaijenbrink et al., 2010). In that sense, it is argued that RBV is more a theory of sustainable competitive advantage (SCA) than a theory of the firm (Foss, 2011). In an important commentary following a dialogue amongst scholars in organisation science, Foss (1996) concluded that RBV is, indeed, insufficient as a theory of the firm. His argument was that RBV explains why firms are better at creating rent than individuals with a focus on coordinative and integrative capabilities of organisations (Foss,

1996; Dosi, Faillo and Marengo, 2008). In other words, RBV does not explain why firms exist; rather, it refers to the potential of a firm to create and appropriate more value than the competition.

This raises the issue of what may be meant by “competition”. In this thesis, competition refers to other technology ventures that have not been incubated in an incubator. In that case, it is possible for more than one venture to exercise SCA within the incubator. The other issue is that of creating and appropriating value. A firm creates and appropriates value when it creates and captures surpluses for producers or consumers (Foss, 2011). In this thesis, value is created for a technology venture when it is able to acquire resources that are otherwise scarce, difficult and expensive to acquire outside of the incubator. It is for these reasons that the application of resource-based view in this thesis is as a theory of sustainable competitive advantage and not a resource-based view of the firm.

#### 2.6.1 RBV Perspective: Technology Entrepreneurship

As the primary concern of this thesis is to understand the technology entrepreneurship process in the context of technology business incubators, it is important to understand how the resource-based view of technology incubators influences the technology entrepreneurship process. Technology entrepreneurship is embedded in the theory of entrepreneurial opportunity identification and development, which identifies an entrepreneur’s personality traits, social networks, and prior knowledge as antecedents of entrepreneurial alertness to business opportunities (Ardichvili, Cardozo and Ray, 2003). However, the role of an entrepreneur cannot be limited to simply being “alert” to business opportunities, thanks to their personality traits, social networks, and prior knowledge.

The concentration on the super hero abilities of the individual entrepreneur was born out of entrepreneurship literature because the existence of an entrepreneurial venture first starts with the vision of the entrepreneur (S. Shane and Venkataraman, 2000a). This school of thought is, however, oblivious to evidence that suggests a substantial number of new ventures are founded and grown by entrepreneurial teams (Kamm et al., 1990, Harper, 2008); that is, a group of individuals with an entrepreneurial mindset and common goal that can only be realised by certain combinations of entrepreneurial actions (Harper, 2008). Speaking on venture growth, Birley and Stockley (2000) assert that, if a new business is to grow at a desired rate, the individual entrepreneur founder is unlikely to manage the entire process alone – there must be an execution team in place, even from the start.

Second, concentration on the individual entrepreneur fails to acknowledge the importance of being embedded in the right environment and surrounded by the appropriate network of individuals and institutions, such as financial backers and policy makers. Entrepreneurs do not work in isolation; it is a social role, embedded in a social context. According to Jelinek (1996 p.799), technology entrepreneurship is a “quintessentially social activity that requires joint efforts”. It leverages the existing corporate and educational institutions, which act as training grounds for future entrepreneurs. As a result, it is incomplete to conclude that the success of an entrepreneurial venture lies solely on the individual entrepreneur; this is not to discount the capabilities of the individual entrepreneur, but to reiterate the social element of technology entrepreneurship, which is central to the sustainable growth and success of an enterprise (Lyons, 2002, Hoang and Antoncic, 2003, Witt, 2004, Korsgaard and Anderson, 2011).

Finally, the extant focus on the individual superhero entrepreneur is motivated by an arguable over-concentration by literature on the opportunity discovery. Following Scott Shane’s work, *A general entrepreneurship theory: the individual-opportunity nexus* (2003), management research on entrepreneurship has made entrepreneurship almost synonymous with opportunity discovery. However, there is more to entrepreneurship than the discovery of opportunities; there is the exploitation of those opportunities through gathering and deploying a bundle of relevant resources; there is complementing those resources with appropriate sales and marketing tactics; and there are continuous management and leadership functions to maintain growth and success.

In the case of technology ventures in Nigeria, opportunity discovery is perhaps the easiest part of the puzzle. Entrepreneurs then have to figure out ways of developing their product or service, marketing and managing expectations and growth. Nigeria is plagued with many infrastructural and environmental issues, which makes growing a business difficult. This is the reason why incubators are a welcome mechanism in such a region. As discussed above, (see section 2.6.1), incubators surround individual entrepreneurs with the appropriate network of resources they require. They also provide the entrepreneur with other benefits of being embedded in such a social setting, such as knowledge, collaboration, and support

In the context of RBV, technology entrepreneurship involves the ability of an entrepreneur to attain their goal and create a technology venture by being able to acquire, combine and manage resources. It could also be viewed as the ability of a technology venture to manage scarce resources to achieve their mission and objectives. Recognising potential opportunities and accumulating resources can be considered as a process of mutual interaction, in which resources are tools by which an opportunity comes to life. As Liu et al. (2004) explain,

technology entrepreneurship is the way in which entrepreneurs draw on resources to exploit emerging technology opportunities. Overall, there seems to be some evidence to indicate that technology entrepreneurship and the resource-based view of sustainable competitive advantage are interdependent (Bailetti, 2012). They both are concerned with how to create and capture value by explicitly concentrating on how resources can be used to create competitive advantage.

Accumulating vital resources is an essential part of creating a new technology venture. Hemphill (2005) argues that technology entrepreneurship involves identifying potential high-technology intensive opportunities, putting together resources such as human capital and cash, and using instantaneous decision-making skills to manage rapid growth. Entrepreneurship scholars have suggested different resources that are essential to launching a new venture, such as human capital, financial capital, partnerships, innovativeness, organisational structures, technology know-how, and knowledge transfer capabilities. As Garnsey (1998) points out, one of the crucial tasks of a new venture is to access, mobilize and deploy resources. Resource-based theory embraces both tangible and intangible assets as important sources of capabilities that reveal operational behaviours and resources in the venture-creating process. Tangible resources include financial, physical, human, and organisational resources (Barney, 1991; Grant, 1991). According to Barney,

Physical capital resources include the physical technology used in the firm, a firm's plan and equipment, its geographic location, and its access to raw materials. Human capital resources include the training, experience, judgement, intelligence, relationships, and insight of individual managers and workers in a firm. Organisational capital resources include a firm's formal reporting structure, its formal and informal planning, controlling, and coordinating systems, as well as informal relations among groups within a firm and between the firm and those in its environment. (p.101)

Financial capital includes access to funds and financial opportunities. Intangible resources include organisational culture, values, leadership/management styles, intellectual property, contracts, reputation, trade secrets, knowledge, creativity, invention, market access, innovation, and technical skills (Grant, 1991; Duening, Hisrich and Lechter, 2009).

In technology entrepreneurship, the resources available to the entrepreneur and their venture at the initial stages of the venture creation process can be vital in determining the survival of the venture. As suggested by Bamford, Dean and MacDougall (2000), early decisions and start-up conditions in the early stages of a venture have lasting effects on the venture's long-term performance. There are two major explanations for this.

First, the new venture has to survive the regional environment in which it is embedded. According to RBV, to accomplish this, the venture ought to be able to deliver value to its customers, possess rare qualities unavailable to competitors, be hard for competitors to imitate, and not be easily substituted by other resources at the same cost.

Secondly, the formative stage of a venture is the period where organisational structures are put in place to maintain the continuous activity pattern of the venture. They can be identified as the routines and cultures that guide the managerial decisions of the firm and are initially set in place by the founders (Aspelund et al., 2005). Failure to meet these two requirements puts the venture at a high risk of eventually becoming unsuccessful. This view is supported by Aspelund, Berg-Utby and Skjevvdal (2005), who conducted a longitudinal study on eighty Norwegian and Swedish technology ventures to investigate the extent to which the resources controlled by the entrepreneurs at the formative stage of the venture affect the venture's ability to survive. The study provides support for the proposition "that initial internal resources are antecedents of a new, technology-based firm's survival" (Aspelund et al., 2005 p. 1343).

This is an important finding, as it emphasises the importance of early access to key resources and management for new businesses seeking to introduce a form of new technology to the marketplace. However, there are some limitations to this study. It fails to take into the consideration the entrepreneurial alertness of the founder. As discussed in chapter 2, an entrepreneur's prior experience, social network, and cognitive abilities are important to the performance of the venture, particularly in the creation process. Secondly, the study considers survival as the sole outcome of a new venture creation process. Technology entrepreneurs seek to create wealth with their venture, as well as deliver value and create employment for their local region. Perhaps the major limitation, like most previous studies on RBV and entrepreneurship, is that they fail to outline how, and in what circumstances, entrepreneurs get access to these resources. These resources are known to be scarce and difficult to find. Although certain regions have better infrastructural setups that create ease of access to these resources, it still remains a big question to the average entrepreneur: "Where can I get all these resources for my business?" This difficulty is even more pronounced in emerging and developing regions, with lacklustre infrastructural development. Furthermore, previous studies have not explored the implications of these resources for the entrepreneurs and their ventures. Consequently, this thesis argues that technology incubators are resource banks tasked with disseminating resources to entrepreneurs and their tenant ventures and seeks to understand how these resources provided by technology incubators influence the entrepreneurs and their venture creation process.

## 2.6.2 RBV Perspective: Technology Business Incubators

Technology incubators from a resource-based view imply that the resource environment created by business incubators could potentially be a major determinant of survival and success of the technology venture. Resources provided by technology incubators are individually valuable, rare, inimitable, and non-substitutable to each firm, thus giving the tenant venture a competitive edge over other ventures operating in the same industry or sector. Competition is not between other ventures within the technology incubator, but rather, other non-incubated ventures operating in the same industry or incubated by a different technology incubator.

Past literature on the development of technology ventures in technology business incubators suggests that the incubation process includes providing both business and technical assistance (Scillitoe and Chakrabarti, 2010). As mentioned above, business assistance includes business planning, personal recruiting, marketing, management, accounting processes, legal expertise, access to financial capital, and access to business experts (Smilor, 1987; Mian, 1996b; Hansen et al., 2000; Scillitoe and Chakrabarti, 2010). On the other hand, technical assistance includes access to university research activities and technologies, laboratory and workshop space, access to technical contacts for technology transfer processes, research and technology supply pipelines, intellectual property protection and technology skills (Mian, 1996b; Hannon, 2005; Scillitoe and Chakrabarti, 2010).

Essentially, effective incubator management is the ability of an incubator to provide access to the necessary resources for tenant firms to thrive. The resource-based view perspective on technology business incubators emphasizes that successful development and sustainable growth can be achieved through specific resources and capabilities provided by incubators to new technology ventures (Somsuk et al., 2012).

A second stream of resource-based view literature relates to distinguishing the types of resources. Wernerfelt (1984) defines a resource as anything which could be thought of as a strength or weakness of a firm. Resources and capabilities are bundles of tangible and intangible assets (physical capital, human capital, financial capital, and organisational capital) controlled by a firm to help choose and implement strategies (Barney, 1991, Grant, 1991). In the context of technology business incubators, resources can be categorised into

- i) *Human resources; - attributes of the founding team, the incubator management, and access to persons with expert knowledge and skills;*
- ii) *Technological resources –specific products and technology, equipment, highly specialised skillsets, business technology experience and intellectual property rights;*

- iii) *Financial resources –various financial support available to tenant firms, such as angel investors, venture capital firms, bank loans, grants, and other financial organisations; and*
- iv) *Organisational resources –company culture, management structure, process and hierarchy responsible for managing all the resources (Somsuk et al., 2012).*

In addition, it is important to explain the capacity in which these resources are disseminated by technology incubators.

### *Human Resources*

Human resources refer to how incubators manage the personal attributes of the founding team of an entrepreneurial venture. This is directly related to the discovery and idea generation phase of the technology entrepreneurship process and is associated with the selection process. Further human resources could be in the form of the technology incubator's management team and staff (Somsuk et al., 2012).

Business incubators who are keen on developing and building successful companies are particular about the type of entrepreneurial team or founder they admit into their incubator. This is known as the selection process. The selection process provides the opportunity for the incubator to evaluate, recommend and select tenant firms (Smilor, 1987). Consequently, admission criteria are set in relation to the mission and objective of the incubator. Examples of criteria for tenant company selection include the ability to create jobs, pay operating expenses, present a written business plan, have a unique opportunity, be a start-up company, be locally owned, have fast-growth potential, and be technology oriented (Campbell et al., 1985, Smilor, 1987).

The criteria for tenant selection are important and may vary with the mission and objectives of the incubator. Assessing the Austin technology incubator in the US, whose businesses have generated a cumulative \$1.4 billion in revenues and created over 3,000 jobs, Wiggins and Gibson (2003) argue that technology incubators ought to develop a rational selection process for new companies. Similarly, Akçomak (2009) suggests that successful incubators are able to state clearly what their mission and goals are; and have clear selection, entry, and exit criteria. Having clear selection criteria helps an incubator to judge what sort of additional resource it can provide for the tenant company (Smilor, 1987). However, it is possible for some ventures to display exceptional qualities that are in contrast to the selection criteria of the incubator. Even though incubators should display flexibility by admitting such ventures, having a clear set of admission criteria increases the likelihood of graduating companies that will be successful (Aerts, Matthyssen and Vanderbempt, 2007).



An incubator's management team and staff are key players in helping tenant firms develop and commercialise their technology product or service. They are able to provide entrepreneurial education, practical business expertise, management counsel, coaching and mentoring (Somsuk et al., 2012). Additionally, they can provide tenant firms with access to financial resources, managerial and business skills, and market information; all of which are important to the technology entrepreneurship process. The knowledge, skill, and experience of the incubator management team directly influence the level of resources a tenant firm can derive from the incubator (Akçomak, 2009)

### *Technology Resources*

This refers to how incubators are able to provide access to certain technology equipment, products, special skills, and highly specialised experiences. Technology resources in the form of technical assistance provided by technology incubators are imperative in every phase of the technology entrepreneurship process. Researchers suggest that one of the major functions of technology incubators is to transfer and commercialise new technologies from research laboratories and other higher education institutions, such as universities. Chan and Lau (2005) argue that, through technology incubators, universities can provide technology start-ups with both software and hardware support in the form of consultation and advice and access to laboratory equipment and facilities.

Technology entrepreneurs usually require assistance with specialised skills and technological know-how for their ventures. They also require access to certain facilities to help them develop their products and services. Technology incubators possess the ability to provide such facilities and technical know-how, usually at lower cost to the entrepreneur compared to setting up on their own (non-incubated firms). Rubin, Aas and Stead (2015) suggest that incubators derive technological knowledge through their association with universities and the experience of the incubator management and stakeholders. Knowledge internally obtainable by the incubators as a result of the experience and network built through the incubator's stakeholders is leveraged into their tenant companies by actors. These actors include the incubator director, manager, or president, a board of directors, an advisory council and a network of consultants.

### *Financial Resources*

Access to financial support is vital in successfully commercialising technology products and services. Technology incubators create different avenues for tenant firms to get financial support, through angel investors, venture capitalists, debt financing organisations or government organisations (Smilor, 1987, Carayannis and Von Zedtwitz, 2005). Some incubators are able to provide their tenant firms with start-up capital, after which they create

platforms for them to raise more funds from external investors. Additionally, they help tenant ventures with the financial knowledge involved in raising and managing money.

Most incubators develop relationships with the venture capital industry and invite them to view the products and services created by their tenant firms. This is done through “demo days”, which are specific days set aside to showcase new products and services made by tenant firms. This is particularly important for the incubated ventures, who are exposed to potential funding that could accelerate their success, as well as gathering some professional feedback. Additionally, this process is also important to venture capitalists, who are rarely interested in start-up companies because they require a great deal of help, have a high risk of failure, are naïve in managerial and market experience, and consume a lot of time (Smilor, 1987). Nevertheless, some venture capital firms set up a fraction of their funds for investments in new companies that have a proven track record and some level of managerial experience and market competence. Consequently, as a company goes through the technology entrepreneurship process in the incubator, it can be introduced to the venture capital community as having shown some level of experience and proven itself in the marketplace. Incubators are also able to educate technology entrepreneurs on how venture capital firms operate and think.

In addition to providing a direct link to funding sources, incubators educate tenant firms on how to manage their finances. They also help tenant firms with applications for loans and grants from banks and other social organisations, as well as providing access to individuals who can accelerate the process. Capital is the lifeblood of new technology ventures and is a scarce resource. Incubators can be a source of and provide access to seed capital, which is increasingly becoming the method used by federal governments to support and fund new businesses (Abetti, 2004).

### *Organisational Resources*

This refers to how incubators are able to help shape the structure, routine and systems of tenant ventures as well as put processes in place to manage all other resources. The term ordinarily refers to how a venture carries out formal and informal planning and puts systems in place, such as formal reporting systems, information generation and decision-making systems (Dollinger, 2005).

Essentially, the organisational resources of a firm refer to the assets available to the firm for production and development purposes. It is possible that some of these resources resides in an individual. In technology entrepreneurship for instance, most entrepreneurs are very technical and understand the technical side of their ventures but lack the business acumen to commercialise their products. As such, Ganotakis (2012) highlights the need for technical

entrepreneurs to complement their technical skills and knowledge with managerial capabilities. In other instances, the organisational resources of a venture reside in teams, departments or functional, such as marketing, operations, or finance.

Subsequently, incubators are able to source co-founders and pair them to balance the founding team of the venture. They also assist entrepreneurs in setting clear metrics for measuring the progress of their ventures. The pool of industry experts available to the incubator can help technology entrepreneurs develop clear missions and objectives and design the organisational structure for their business. Organisation structures can be directed towards boosting innovation, marketing, or implementation. The suitability of the organisational design depends on the complexity and foundation of the local environment of the venture (Dollinger, 2005). It also depends on the lifecycle of the venture. A venture might be more attuned to innovation at the formation stage of the venture creation process, while, at the launch phase, the venture might be more attuned to marketing.

Incubators also help their tenant ventures manage their human capital. Aside from the knowledge provided through the incubator management, as discussed in the human resource section above, they assist their tenant ventures in hiring the right staff for their ventures. To achieve this, some incubators post vacant positions of their tenant firms on their website and sometimes take part in the screening and evaluation process. Moreover, organisational resources provided by incubators help tenant firms manage their internal resources, including human, technology, and financial resources.

In this section, the process of technology entrepreneurship in the context of technology incubators has been explained through the lens of the resource-based view theory. The RBV theory was discussed and extended to entrepreneurship, highlighting how entrepreneurial opportunity recognition and organisational capabilities are regarded as resources. Further to that, technology entrepreneurship was viewed through the lens of a resource-based view to explain that a mutual interaction exists between opportunity recognition and bringing together resources. Finally, the resource-based view perspective of technology business incubators explained how technology incubators create an environment of resources which can help tenant firms through the technology entrepreneurship process to successful development and growth of new technology ventures. In the section that follows, the technology entrepreneurship process framework is developed further to illustrate the relationship between technology entrepreneurship and technology incubators.

## **2.7 Technology Entrepreneurship and Technology Incubators: A Schematic Diagram**

In the pages that follow, a schematic diagram is unveiled that provides an expository narrative of the relationship between technology entrepreneurship development and technology incubators. A schematic diagram is a drawing with visual representation of significant components and elements within a process (Butler-Kisber and Poldma, 2011). They help map out emergent thinking in research and aid the formulation of analytic ideas as they are being conceptualised (Maxwell, 2012). The TE-TI schematic diagram I present in figure 1 below illuminates the various components and inter-relationships between the venture creation process and resources provided by technology incubators.

The review of the literature on technology entrepreneurship and business incubators highlighted the importance of exploring the role of technology incubators in disseminating resources to technology entrepreneurs and their ventures. This is because entrepreneurs are at the core of exploring opportunities, organising resources and managing the technology venture. Moreover, this thesis seeks to explore the development of the technology entrepreneurship process within the context of technology incubators. However, most research on technology incubators discusses the impact of technology incubators on a broader scale of job creation and economic development but ignores how it links to the process of technology entrepreneurship development, particularly in developing countries. As a result, the technology entrepreneurship process that is opportunity recognition, product development, and launch discussed in chapter 2 is incorporated in the diagram and the technology entrepreneur is mapped at the centre of these processes.

Additionally, the TE-TI schematic diagram illustrates how the technology entrepreneurship process interacts with resources provided by technology incubators. Human resources provided by technology incubators are particularly useful in helping technology entrepreneurs to organise their ideas and recognise other opportunities, as well as supporting product development and the launch of the venture. Technology resources are particularly important in helping entrepreneurs to develop their products or services and are directly linked to the product development phase of the entrepreneurship process. Financial resources, which are the lifeline of new technology ventures, are particularly important in product development and the launch of the new venture. Finally, organisational resources provided by incubators help the technology entrepreneur to manage all other resources, even after graduating from the incubator.

Furthermore, a review of the literature on technology incubators in Nigeria found that most studies have failed to conduct a proper investigation of tenant firms, entrepreneurs, and other

stakeholders. They completely ignore the socio-economic impact of the region on the entrepreneurship process and the key players involved in both the technology entrepreneurship and incubation process. As a result, the TE-TI schematic diagram demonstrates how socio-economic factors, regional stakeholders and key players co-operate with incubators and the resources they provide to their tenant firms. In most cases, a new technology venture is the ultimate outcome of the entire process and is thus added to the framework.

Finally, the diagram illustrates how the resources provided by the incubators are linked to the process of business incubation, which includes the selection process, business assistance, and technical assistance. All of these components are housed in the technology incubator, whose role is to ensure that there is a steady relationship between i) the entrepreneurs and the incubator management; ii) the incubator management (on behalf of the entrepreneur) and the external network; and iii) the entrepreneur and other entrepreneurs within the incubator. Collectively, a holistic schematic representation of the interaction between the venture creation process and the resources provided by technology incubators is presented (see figure 1 below) to guide the empirical study of this thesis.

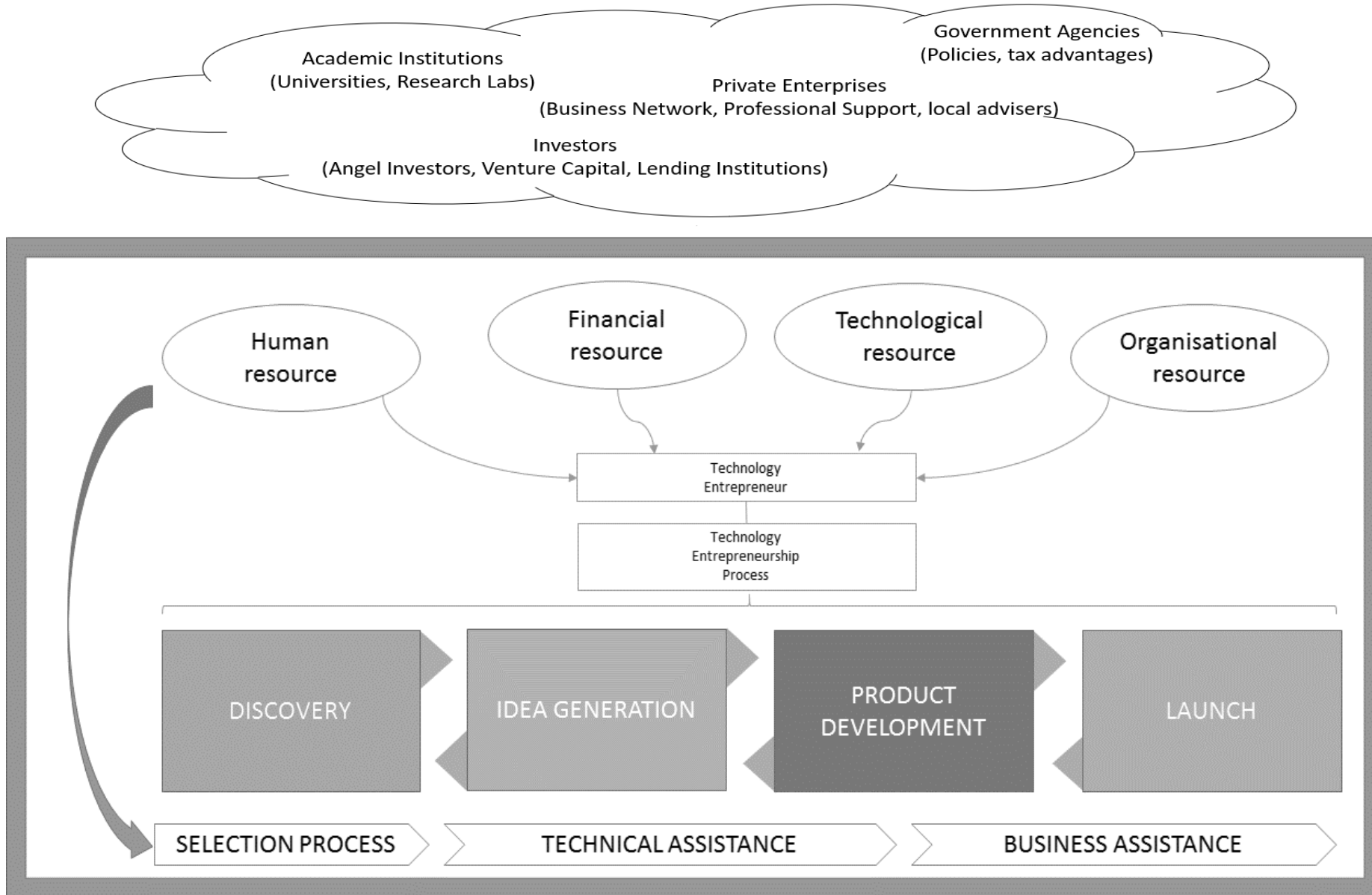


Figure 1: TE-TI Schematic diagram mapping the interrelation between the venture creation process and resources provided by technology incubators

## 2.8 Summary

This chapter examines the domain of technology incubators by reviewing the literature on definitions, types and impact of incubators. Overall, the findings highlight the impact and value of technology business incubators to client firms, stakeholders, the region, and economic development. While some findings report a great deal of impact, other researchers have reported a more modest effect. Regardless of the degree of impact, it is worth noting that technology business incubators have some significant level of influence on client firms, which varies from tangible to intangible resources, and from region to region. The study of technology incubators and technology entrepreneurship leaves some gaps in the literature. Technology incubators and technology entrepreneurship are studied in isolation, even though they are obviously intertwined. Furthermore, most of the studies revolve around the incubator management rather than the entrepreneurs, who are central in the process of creating a new venture. Also, most of the research originates from more developed economies, leaving out developing countries, where the process of venture creation is different as culture and economic circumstances are different.

The chapter also underlines the theoretical framework that informs this study. The resource-based view framework will provide a conduit with which the relationship between technology incubators and the venture creation process is assessed. Fundamentally, technology incubators facilitate the process of venture creation from opportunity recognition to launch. This is done through the provision of essential resources by the incubators. In the context of RBV, technology entrepreneurship centres around the ability of entrepreneurs to be alert to opportunities and able to seek and bundle resources for their venture. In the context of technology incubators, RBV explains how valuable resources are disseminated to tenant ventures.

Emphasis should be channelled to determining the extent of impact these incubators have on their tenant firms and what level justifies the involvement and support of government and charitable organisations. Also, there is little or no literature that explains the implications of the resources provided by incubators and what they mean for technology ventures and entrepreneurs.

In view of all that has been mentioned so far, this thesis will focus on the role of technology incubators in the context of a developing country and what impact it has on the venture creation process.

# CHAPTER 3: Technology Entrepreneurship in Nigeria

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## 3.1 Background Information on Nigeria

It is essential to address and understand some background information about Nigeria in order to put the contextual outline in the right perspective. Nigeria is a federal constitutional republic that consists of thirty-six states and a Federal Capital Territory, Abuja, bringing it to a total of thirty-seven states.

### 3.1.1 Geographical Location

The Federal Republic of Nigeria is located in the western part of Africa and shares borders with the Republic of Niger to the North, Chad and Cameroon to the East, the Republic of Benin to the west, and the Atlantic Ocean to the south. While the official language is English, on account of its historical ties to Britain, there are 521 different languages spoken in the country. Nigeria possesses the advantage of a strategic location, in comparison to other developing countries in Africa. This includes a coastal megacity with an ocean port, as well as a growing consumer class, a tradition of entrepreneurship, and a young and growing population.

#### *Lagos: A Coastal Megacity*

Lagos is the only coastal megacity in Africa and, historically, this is synonymous with superior economic prosperity. In Nigeria, Lagos state is a favoured location for trade, tourism, and industry. A possible explanation for this might be that, as a megacity, Lagos has been the prime target for rural migration, as well an attraction to young, talented, and skilled individuals seeking greater opportunities. Thus, firms are more competitive in their offerings, and the large size of the consumer market means there is more access to delivery. Lagos state, which was the former capital of Nigeria, has a population of over 21 million people and is heralded as the commercial hub of the country and West Africa at large (Lagos State Government, 2011; Ogunlesi, 2014). This feat isn't a mere claim, as statistics from the National Bureau of Statistics reveal that Lagos has the highest number of enterprises in the country and generated over one billion dollars in revenue in the fiscal year of 2014 (N 276,163,978,675.95 to be precise) (NBS, 2014). Furthermore, the GDP of Lagos as a state is higher than all the countries in West Africa, as well as Kenya (\$66 Billion) and Tanzania (\$49 Billion) and is currently the 7<sup>th</sup> largest economy in Africa at \$91 billion (See figure 6 below). The large scale of Lagos puts it in a position to capture economic growth similar to other megacities around the world. However,



as Leke et al (2014, p.31) state, “urbanisation is not yet working in Nigeria, and today there are far more people in Lagos than jobs available in its productive sectors.”

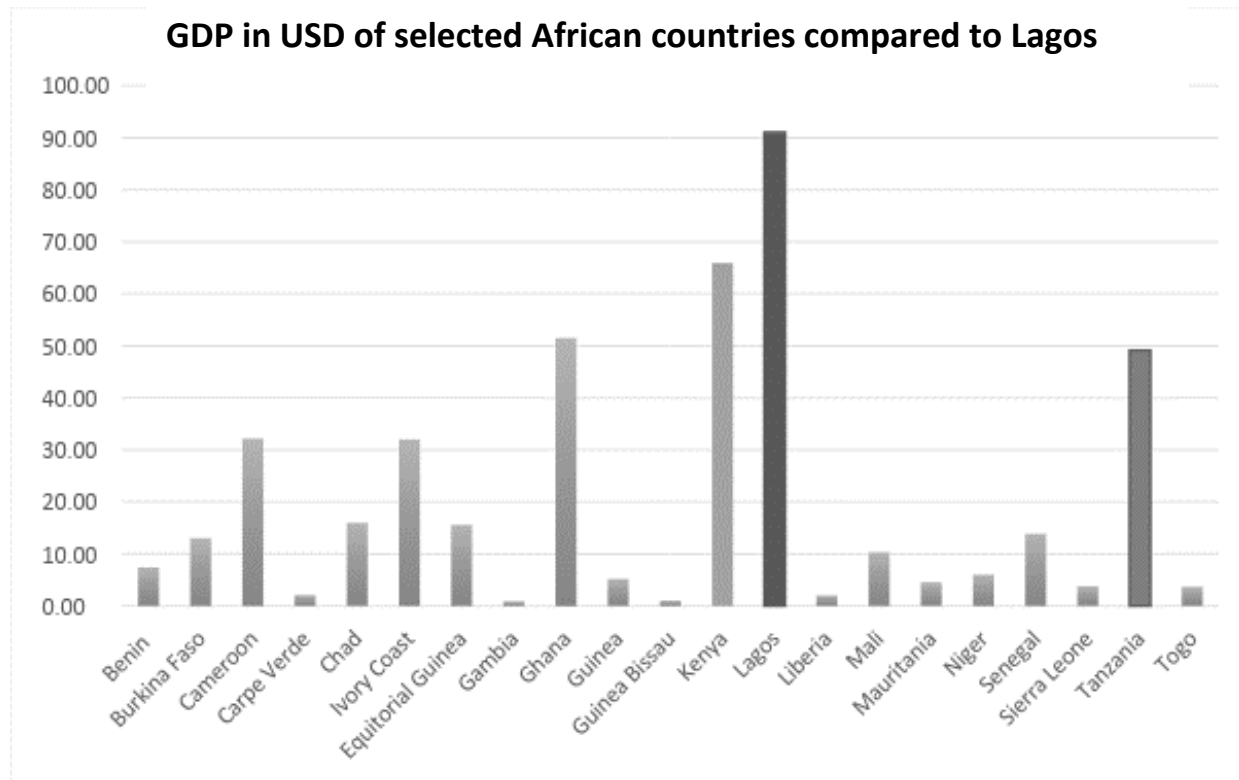


Figure 2: Chart showing the GDP in USD of selected African countries in comparison to Lagos

### 3.1.2 Population and Demographics:

Nigeria is Africa’s most populous country and one of the most populous countries in the world, with over 178 million people. The population is young, with 44% under 15 years and 43% between 15 and 49 years. Nigeria is divided into six geo-political zones: North-East; North-West; North-Central; South-East; South-West and South-South. Most of Nigeria’s population is concentrated in specific areas, particularly in the south. This is due to the large number of commercial opportunities that exist in the south-east and south-west regions, where Lagos is located. Statistics on rural-urban migration in Nigeria show that 60% of internal migrants live in urban areas. However, there is a significant difference in migrant levels from state to state. The economic space of Nigeria is influenced to a certain degree by the spatial distribution of population and urban migration. While states such as Lagos and the Federal Capital Territory, Abuja boast significant improvement and development of infrastructural facilities, other states in the country (particularly in the north) suffer from lack of basic amenities. For this same

reason, Lagos has grown to become one of the country's most populous and prosperous states, accounting for most of the country's economic and entrepreneurial activities. However, urban migration to states like Lagos has also created a burden on the amenities of the state.

#### *Large consumer market*

Nigeria's growing population can have large economic benefits. Country size and growth rates are closely associated. Having a large population means local companies can potentially develop economies of scale without worrying about exporting their goods and services. Additionally, the large population also means there are increased domestic players, which in turn increases domestic competitiveness and investments. Nigeria's size is also very attractive to foreign investors, which can be a major driver of growth.

#### *Entrepreneurial Population and Talented Diaspora*

Naturally, Nigerians are very entrepreneurial. According to the Global Entrepreneurship Monitor (2012), 44 percent of working-age Nigerians were involved in an early-stage business in the preceding three years, and 88 percent of Nigerians believe they have the required skills and knowledge to engage in entrepreneurship. Government programmes aimed at supporting entrepreneurship in the country have proven to be popular. For example, the Youth Enterprise with Innovation in Nigeria (YouWiN) programme receives about 60,000 applications, provides training for 6,000 entrepreneurs, and mentors 1,200 young entrepreneurs each year (YouWin, 2013). Also, Nigeria has over 17 million of its citizens living abroad and contributing remittance equivalent to 5 percent of its GDP (World Bank, 2014).

#### *Growing Young Population*

Nigeria's young population can be a huge economic advantage. Many countries have achieved economic success by capitalising on their young demographic. In the 1980s, China saw a point per year growth in its GDP as it added the contributions from those reaching working age. Another example includes Brazil in the 1990s, which relied on its young population to drive its growth (Leke et al., 2014). Nigeria still has a growing young population which is a huge benefit to its economy. However, this might also be a threat if the large young population are unable to find jobs.

### 3.1.3 Economic Situation

Nigeria is rich in mineral resources, particularly in oil, which accounts for more than 90 percent of the country's exports, which make up 25 percent of its Gross Domestic Product (GDP) and generate up to 80 percent of the government's revenue. This has led to the country's over-

dependence on oil, resulting in a substantially unstable economy (Agbaeze et al., 2015). This fact has been exposed with the recent deepening of oil prices, highlighting the need for Nigeria to diversify its other sectors of the economy to ensure continuous economic growth (Uzonwanne, 2015), even though the country has enjoyed robust growth averaging 7% in the past decade. Nigeria, like other oil-exporting countries, is facing a sharp decline in oil revenues due to the global slump in oil price, sluggish demand, increased production of shale oil and gas, and OPEC's decision to sustain the production levels of crude oil. The federal government of Nigeria has responded quickly to this shock by readjusting the 2015 federal government budget to enhance non-oil revenue collection and ensuring efficient expenses to result in a significant amount of savings (Barungi, Ogunleye and Zamba, 2015). However, the long-term challenge of the government is to focus on economic diversification and enhancement of non-oil sectors. The immediate past governor of the central bank of Nigeria, Sanusi (2010, p.33) argues that growth prospects can be achieved and sustained if Nigeria diversifies "away from primary products and away from crude oil and natural gas." As a result, there has been a strong push by the government towards diversifying the country's revenue sources.

Nigeria has surpassed South Africa as Africa's largest economy after it overhauled its gross domestic product (GDP) data for the first time in over two decades. This long-overdue process of recalculating the country's GDP is referred to as 'rebasings.' Nigeria's rebasing exercise in 2014 pushed its GDP to \$509 billion--a jump of 89 percent--putting it above South Africa at \$354 billion. The reason for this significant rise in GDP is the addition of new economic sectors to the country's output list, such as e-commerce, telecommunications, and media estimated to be worth billions of dollars (or 1.4% of the economy). Nonetheless, GDP growth is not synonymous with development and may not necessarily reduce poverty or unemployment, but rather forms a part of the requirements for development. As Yemi Kale of the National Bureau of Statistics advises (2014), while GDP depicts how rich a nation is, this is not necessarily the same as showing how rich the individuals in the nation are, due to the problem of unequal distribution of wealth.

The economic outlook of Nigeria has been staggered by poor power supply, lack of infrastructure, slow action on legislative reforms, an inefficient property registration system, obstructive trade policies, inconsistent regulatory environment, slow and unreliable judicial system, religious tensions, tribalism, insecurity, and persistent corruption (Dike, 2014). It is widely argued that the economic outlook of Nigeria is simply on paper and does not reflect its citizenry, as over 62 percent of its population still live in extreme poverty and unemployment is still at its peak (CIA Factbook, 2015). Nonetheless, the government has, through several policies, projects, and agencies, been working to develop stronger public-private partnerships to strengthen the weak sectors, so as to curb poverty and provide employment for its young

population (Tende, 2014). A report by the McKinsey Global Institute (2014) asserts that, in spite of the economic challenges that intrude in Nigeria, it is still well positioned for continued growth.

#### 3.1.4 Political Climate

Politically, having suffered years of instability, over a decade of military rule, coup attempts, and unrest, the fourth republic ushered in a much more stable political climate in 1999 through a democratic ruling system. On 28 March 2015, the republic of Nigeria had its fourth peaceful, free, and fair election which was widely commended across the world by international and regional observers, including the EU, the African Union (AU) and ECOWAS. General Muhammed Buhari of the All Progressives Congress (APC) won the election and is the current president of Nigeria. The APC, which was previously the opposition party, also won the majority of seats in the senate. Under the fourth republic, Nigeria has experienced steady growth. This is because of the measures adopted, such as reformation of the banking system to increase competition and improve service, and competitive tendering of public projects to curb corruption, although substantial challenges still remain in this area. Nigeria's reputation for corruption has improved since the 1990's, though it still sits in the bottom 25 percent of the world's transparency international corruption perception index, with a score of 136 out of 168 (Transparency International, 2015). Furthermore, while the military has stepped up its operations, the insurgency being carried out by the militant group Boko Haram still poses a security threat, particularly in the north eastern states.

### **3.2 Entrepreneurship Literature in Nigeria**

Entrepreneurship is one major factor that promotes economic development, generates employment opportunities, and creates wealth. As a result, several recent studies have emphasised how entrepreneurship could help Nigeria overcome some of its challenges. For instance, Duru (2011) suggests that Nigeria should assign a significant and increasing role to entrepreneurship in its effort to regenerate its economy. Oyelola et al. (2013) underscore the importance of entrepreneurship as a realistic tool for sustainable economic growth in Nigeria, given the experiences of developed nations like the US and fast-growth economies such as China and India.

Another study, by Mary, Ngozi and Simon (2015), discusses the role of entrepreneurship in the economic development of Japan, South Africa, and Malaysia and concludes that entrepreneurship is an indispensable tool for the significant advancement and transformation of Nigeria. Ibrahim (2014) argues that inclusion of entrepreneurship education in all disciplines would drive the growth of business startups among graduates and assist in solving the problem of high unemployment in Nigeria.

In another study, conducted by Ezeanokwasa and Nwachukwu (2014) to examine how effective entrepreneurship skills can reduce unemployment in Nigeria, it was found that effective entrepreneurship skills were crucial in improving the local standard of living and development of technical know-how that help in conveying much-needed technology for the rapid development of any country.

Findings from a quantitative study that investigated the role of entrepreneurship in building a future for Nigeria revealed that there is a substantial relationship between entrepreneurship development and unemployment reduction in Nigeria (Ajagbe et al., 2015). Though data from the Bureau of Statistics reveals that the total number of MSMEs (micro, small, and medium enterprises) in Nigeria stands at over 37 million, employing about 84% of the labour force, it still creates doubts over how much impact these enterprises are contributing to the socio-economic growth of the society. Most of the research up to now has been descriptive in nature, lacking empirical data to back up their claim of the level of impact of entrepreneurship on the Nigerian economy. As Adeoye (2015) points out, gathering empirical data to illustrate the impact of the level of entrepreneurship in Nigeria is almost impossible to achieve.

Nigeria still faces several challenges that impede the significant impact of entrepreneurship in the region, and numerous studies have attempted to articulate some of these factors. For instance, Njoku, Ihugba and Odii (2014) provide an extensive list of the challenges that face the Nigerian entrepreneur: lack of credit facilities, corruption, inconsistent government policies, multiple taxation, poor state of the country's infrastructure, inability to adapt to changing business environment, low quality of standard of education, security issues, raising capital, poor planning, poor product and services, necessity entrepreneurship, and political turmoil.

A qualitative study by Ofili (2014), conducted on 16 entrepreneurs of various sectors of businesses in Nigeria conforms to Njoku, Ihugba and Odii's (2014) lists of challenges that faces entrepreneurs in Nigeria. Respondents from the study listed challenges that include lack of skilled labour, lack of value system, economic inequality, poor transportation system, and weak judicial system. Oziegbe, Oleabhielle and Adeyemo (2015) summarise the challenges of entrepreneurship education into absence of infrastructural facilities, inadequate working capital, low standard of education, lack of adequate training. Adeoye (2015) argues that the

problems that hinder the development of the enterprise sector in Nigeria include unskilled manpower, technical know-how, finance and capital, marketing, administrative policies and support, corporate entrepreneurship enabling environment and women entrepreneurship.

While these studies are useful in outlining what challenges the typical Nigerian entrepreneur faces, the majority fail to specify practical solutions that would improve the situation. Methodologically, they are limited because they are either descriptive in nature or conduct the empirical research with very small samples. Moreover, the over generalisation of much published research on the issue of entrepreneurship for economic development in Nigeria, or the challenges facing entrepreneurship in Nigeria, has become a problem. As a result, this thesis takes a focal look into technology entrepreneurship in Nigeria and examines the effect of technology business incubators on the process of developing technology entrepreneurship in Nigeria.

What follows is a discussion on the state of technology entrepreneurship in Nigeria, considering this is still a very novel field of research. After this, a critical analysis of the literature on technology business incubators in Nigeria is deliberated upon, which leads to the research questions and aims of this thesis.

### **3.3 Technology in Africa**

Historians argue that the industrial revolution of the West was propelled by colonisation of resource-rich foreign lands and the exploitation of native labour (Acemoglu and Robinson, 2013). For instance, opportunities provided by cheaply produced raw materials, such as cotton, sugar, tea, coffee, and minerals--including vast quantities of gold from Africa and Latin America--were used to generate the capital and raw materials that ushered in the industrial era. On the other hand, the rise of the Asian Tigers, which are the four highly developed economies of Hong Kong, Singapore, South Korea and Taiwan, has been generated by the application of technology to traditional ways of conducting business and enterprise, and Africa is on the same path (Versi, 2013). The pace of global technological innovation is rapid, and Africa is not sitting out on the sidelines; Africa is a participant in this global phenomenon through technology transfers. In mobile banking, for instance, Africa is known to be at the forefront of an innovative form of banking known as mobile banking. Countries like Nigeria, Kenya, and South Africa are not just on the receiving end of technology transfer, but also manufacturers and exporters of innovative technology (Ondiege, 2010). This study by Gono et al., (2016) assessing the adoption and impact of ICT in South African SMEs concluded that

South African SMEs are confident and mature users of information and communication technologies with increased sales and enhanced procedures that points to the growing capacity of SMEs benefitting from ICT.

Essentially, it is thought that, with the initiation of new technology, Africa is poised to leapfrog centuries of industrial development and benefit from the achievements of the information age. Although still lagging behind due to poorly developed infrastructure, technology leapfrogging has been among the most striking “good news” stories from Africa (Gatune and Najam, 2011). It is a widely held view by governments and industry professionals that the appropriate deployment of technology can help African countries solve some of their developmental challenges. A report produced by the African Development Bank (AfDB) and the World Bank, with support from the African Union, suggests that “information and communication technologies (ICTs) have the potential to transform business and government in Africa, driving entrepreneurship, innovation and economic growth” (Yonazi et al., 2012, p.12).

A probable explanation for such optimism is the exponential increase in the adoption of mobile communication technology in Africa. This view is supported by Etzo and Collender (2010), who conclude that mobile phones have significantly impacted many lives in Africa. Through the advent of mobile technology in Africa, millions of Africans now possess the ability to communicate instantly and relatively cheaply with family, friends, business associates, and other services. The use of mobile phones in sub-Saharan Africa has grown at staggering rates over the past decade. In 1999, only 10 percent of the African population possessed mobile phone coverage, predominantly in North and Southern Africa. By mid-2014, there were over 608 million mobile connections in sub-Saharan Africa equivalent to a penetration rate of 68%. Smartphone connections are set to grow to 525 million by 2020. As of the end of 2013, growth in the mobile ecosystem in Sub-Saharan Africa had directly supported 2.4 million jobs plus an additional 3.7 million indirect jobs (GSMA, 2014).

According to the GSMA report (2014) on the impact of the mobile economy on sub-Saharan Africa, the mobile industry has directly contributed \$75 billion to Africa’s growing economy or 5.4% of the region’s GDP. This contribution originates from mobile operators, infrastructure service providers, retailers of mobile products and services, handset manufacturers and mobile content creators.

However, the direct contribution of ICTs to the African economy is secondary when compared to indirect contributions and growth in other sectors. As a result, the sub-Saharan region of Africa remains the fastest growing, thanks to economic growth and the increased affordability of mobile services. In spite of all this remarkable growth, by 2020, less than half of sub-Saharan Africa will have a mobile subscription, compared to the global average of six out of

10 people by the same date (GSMA, 2014). Etzo and Collender (2010) point out that the poorer population of the region continues to be the least likely to get access to mobile phones and restrictive regulations in certain countries also limit the full participation of many. However, Aker and Mbiti (2010, p. 30) note that "as the prices of both mobile handsets and airtime continue to fall, the mobile phone will complete its transformation from an elite status symbol to a necessity for adults at nearly all income levels." With a constant internet penetration growth rate, this simple technology has provided an opportunity for both the rich and poor, irrespective of their location in the city or villages, to perform important daily tasks, from mobile banking, to checking agricultural information, accessing health data, or communicating with loved ones abroad.

In general, while technology is not the panacea to most of Africa's problems, it can definitely play a significant role in aiding its development. Gatun and Najam (2011) hold the view that the success stories and exciting prospects of new technologies are good news for Africa.

Contrary to this view, Alemna's (1999) paper on the impact of new information technology in Africa argues that the adoption and utilization of information and communication technologies (ICTs) are not as widespread as in developed countries. Moreover, most African countries lack the infrastructure to support new technologies, which has hindered the region's effort to rapidly embrace new technologies such as the internet. Similarly, in a research paper by Alzouma (2005), new technology adoption as a way of economic and social development in Africa is described as a myth. It offered the following illustration of issues that hold back Africa's adoption of new technologies:

*Access:* a digital divide, not just between countries but also within countries and their citizens in rural and urban areas, educated and uneducated and men and women, not to mention the dead infrastructures in rural areas, limited access to technologies such as the internet in urban areas, and the lack of skills to interpret, run equipment, and apply the technologies in certain areas.

*Content and language:* With content perceived to be created in the 'West,' Africans might stand only to be receptors or passive consumers, missing out on contributing or creating their own. The disparity between knowledge might lead to individuals thinking of themselves and defining themselves in new ways. Also, since most literature on the internet is in English, it increases the chances of a digital divide for not just illiterates, but also non-English speaking countries in Africa.

*Identity and culture:* In areas where the education of girls has been neglected for a long time, technology adoption is likely to be dominated by the male populace. New technology creates a status which contributes to a digital divide even between Africans.



According to Alzouma (2005), the conditions, problems and struggles of Africa do not suddenly change because of the arrival of the internet. ICTs cannot leapfrog basic problems that Africa faces, such as poor education facilities in rural areas, health-related problems, illiteracy, or poverty. The paper goes on further to describe new technologies as a potential tool of intimidation, contributing to widening the gap between those who possess everything and those who do not, thereby excluding the poor and illiterate.

A major criticism of Alzouma's work is that ICT is not a 'miracle worker.' Admittedly, ICT is not the remedy to Africa's numerous problems. However, ICT can play a vital role in the developmental plans of Africa. Thompson and Walsham (2010, p.113) propose that developmental ICT is the "the conception, development, implementation, and use of ICT as an explicit vehicle for furthering developmental aims – where ICT functions both as enabling artefact and enabled a set of social behaviours." Walsham describes ICT as an enabler for development in four dimensions:

*ICT as an institutional infrastructure enabler.* In most African countries where there are inadequate or dilapidated institutional infrastructures (such as health services, legal institutions, transport networks, and education) while ICT might not directly become a solution for transport networks and legal institutions, new technologies can play significant, non-operational enabling roles in areas such as public health, communication and even transportation. An example is WhereisMyTransport, a South African web-based, end-to-end transport infrastructure service that reports everything from routing and scheduling to real-time notifications on delays and accidents.

*ICT as a governance, accountability and civil society enabler.* Increased participation of citizens and governments on the web can lead to more openness and increased transparency. For instance, Budgit--a Nigerian digital venture--simplifies the Nigerian budget, making it easily accessible and understandable to the general public. A similar trend has been replicated even more recently in other parts of Africa. Websites such as [www.bribenigeria.com](http://www.bribenigeria.com), and social movements such as the twitter handle, #bringbackourgirls now exist as tools to fight and expose corrupt practices and create awareness. Also, most African governments recognise the power of new technologies and also use them positively.

*ICT as an enabler of service production and economic activity.* Where most African countries struggle with informational challenges such as assembling supply chains and difficult market access for small business owners, ICT has the potential to bypass uneven social, economic, or geographical topographies to generate economic opportunities and trade through the use of mobile and web technologies, thereby

improving economic development, as asserted by the eTransform Africa report. An example is Delivery Science, a Nigerian-based Internet Company that takes care of the science behind e-commerce deliveries by providing big data applications that help e-commerce and logistics businesses track and manage their deliveries.

Although Africa still lags behind in science and technology (Cloete and Maassen, 2015), the opportunities technology brings are enormous and can be seen in some areas. For instance, mobile technology has brought many possibilities to the continent. Mobile technology has made it possible for both rural and urban settlers to connect with individuals, information, markets and services (Brown et al., 2003).

Oshikoya and Hussain (1998) describe how information technology can help control and sometimes eradicate health problems plaguing the continent. With moderate investment in medical hardware and software, hospitals can create on-call tele-radiology systems or offer remote consulting over the internet. For instance, with solutions such as M-Pedigree, a user can determine the authenticity of their medication. The service works with technology providers and pharmaceutical companies to protect consumers from the disastrous effects of counterfeit pharmaceutical products (GSMA, 2014). There are many other ways information technology solutions and applications in the health industry have provided service. These range from health information systems being developed to strengthen health delivery, to disease surveillance systems, and computer programs used to project future health problems in a geographical area.

In education, ICT solutions can provide a little boy in remote Africa with information access at an insignificant cost. It also provides teachers with better tools and information to better inform their pupils and students at whatever level they find themselves. In the political sphere, availability of cell phones as a communication technology allows political groups to overcome collective action problems more easily and improve in-group cooperation and coordination (Pierskalla and Hollenbach, 2013).

The rapid adoption of mobile phones in Africa has far exceeded expectations. In 1999, for example, Safaricom in Kenya projected that the mobile phone market in Kenya would reach three million subscribers in 2020. Safaricom, alone, currently has over 14 million subscribers (Aker and Mbiti, 2010). Essentially, access to mobile phone and other technological solutions has the potential to increase the welfare situation and economic development of African nations. Evidently, as shown by the GSMA report (2014), it is possible that ICT can boost Africa's economy. The emergence of the mobile industry in sub-Saharan Africa has brought new opportunities for technology entrepreneurship. It's not necessarily about the mobile handsets or the cheap computers and tablets themselves; it's more to do with the applications

and information they can deliver. The growth in the mobile industry has stimulated the establishment of a number of hubs, incubators, and accelerators across the region, from Cape Town to Kigali, Lagos, and Nairobi, to harness technological ideas and transform them into successful ventures. Although they are still in their early stages, these hubs have the potential to support and grow successful technology businesses across the region. Consequently, this thesis aims to empirically discover the roles of incubators in the development of technology entrepreneurship in Africa's largest economy, Nigeria, and in its commercial capital, Lagos state.

Conclusively, while technology shows promising signs of improving the economic situation of African countries, it is not the answer to many of Africa's problems in the health, education, transport and communication industry. Nonetheless, the application of new technologies to these industries would go a long way in addressing some of the challenges. Consequently, addressing these socioeconomic issues requires entrepreneurial efforts, which we delve into in the next section.

### **3.4 The State of Technology Entrepreneurship in Nigeria**

This study is focused on Nigeria because of its vibrant technology entrepreneurship activities. Nigeria is sometimes considered the 'silicon valley' of Africa because of the existence of multitude of growing successful technology ventures (Obasemo, 2015). Some examples of these are: Iroko TV, Jobberman, Andela and Hotels.ng. IrokoTV, dubbed the 'Netflix of Africa' whom closed several funding rounds of investment in excess of US\$30m (Fick, 2016); Jobberman which has grown into one of Sub-Saharan Africa's most popular job search engines with more than 1.5million visitors monthly and one of the companies in Nigeria's technology space enjoying venture capital backing. It was 100% acquired last month by the \$167million-valued One Africa Media (Asegbeloyin and Ndiomewese, 2015). Andela, another Nigerian technology venture has raised \$40 million so far in seed funding (Shieber, 2017). It is backed by investors including DBL Partners, Chan Zuckerberg Initiative, GV, Spark Capital Amplo, Salesforce Ventures, and Africa-focused TLcom Capital. Hotels.ng which started in 2012 has now grown into the biggest online hotel booking agency in Nigeria, using seed investment of \$225,000 from SPARK in 2013. It became another beacon of success in Lagos technology space when it announced its first funding round of \$1.2million from EchoVC Pan-Africa Fund, a seed-stage technology fund, and Omidyar Network (Ibukun and Ackerman, 2019).

In addition to growing technology ecosystem, Nigeria is one of Africa's leading destination for venture capital investment. In 2017, \$560m was invested into African new technology ventures by VCs focused on African markets. South Africa, Kenya and Nigeria continue to dominate as investment destinations accounting for 76% of total (Kazeem, 2018) . In 2018, a report by Disrupt Africa reported that Nigeria has emerged as the premier investment destination for venture capital in 2018; with 58 new technology ventures raising a total of US\$94,912,000. South Africa fell behind with 40 businesses raising US\$59,971,000; while Kenya ranked third in terms of the number of technology venture that attracted new venture capital funds (Disrupt Africa, 2018).

The ventures mentioned above are just a few examples of successful technology ventures in Lagos, Nigeria. Although it may be challenging to reflect Nigeria's development of technology entrepreneurship with other sub-saharan countries as cultures and political climate differs. However, in many ways, Nigeria can be used as a representative symbol of technology entrepreneurship development in the region of sub-saharan Africa, as it is the country with the largest economy and population in Africa.

Nonetheless, In Nigeria, the field of technology entrepreneurship is still very much in its early stages. A research study carried out by VC4Africa (2015), the biggest online community of African entrepreneurs and investors, revealed Nigeria to be one of several countries acting as technology venture hotspots of Africa. The research, which tracked 104 investments in start-ups across Africa, named Nigeria as the top destination for investment, spotting an upward trend in technology entrepreneurship in the country in coming years.

In spite of this, there are very few academic studies on technology entrepreneurship in Nigeria. The first serious discussion and analysis of the state of technology entrepreneurship emerged in the 1990s, when Adjebeng-Asem (1990) examined some factors that had led to the state of technical entrepreneurship in the country. The study highlighted negligence by bureaucrats and ruling class Nigerians of the part played by technological innovations within small-scale informal enterprises in establishing technology-based industries in more developed countries, such as Britain and the United States. At the time, there was a clear divide between the 'formal' and 'informal' sector, particularly in employment, with the former consisting of medium to large-scale enterprises that employed not less than ten people, made up of private and public business establishments, Federal and state government companies, departments, ministries, and agencies. The informal sector, on the other hand, comprised small-scale organisations involved in the production of goods and services, employing less than ten people (Adjebeng-Asem, 1990). The study used empirical data from a previous study that examined blacksmiths of Ife (Western part of Nigeria) and other parts of Nigeria and found that, fundamentally, the

efforts of these small-scale blacksmiths had been ignored and considered inconsequential. Furthermore, the paper highlighted some critical factors in the social structure of the economy that undermined the potential of technical entrepreneurship, such as drive, tenacity, dynamism, natural aptitude, and sheer will to survive, in the socio-economic development of the country. Adjebeng-Asem (1990) suggested that the Nigerian government should address these shortcomings and organise a systematic evaluation of the potential and capability of the sector, particularly the assembly plants in the eastern part of Nigeria, and investigate ways of helping improve their skills and the quality of their products and services.

It seems possible that these results were due to the state of Nigeria at the time, considering the country was just thirty years into independence and in full control of its booming oil industry. Additionally, the sample selection of blacksmiths in rural Nigeria raises questions of the author's understanding of technical or technology entrepreneurship, as the study fails to define the boundaries of technical entrepreneurship. Nonetheless, the study happens to be the only one to provide an overview of the state of technology entrepreneurship in the country at the time. However, the political turmoil that engulfed the country in the 1990s left Nigeria in a deplorable state, with little to nothing done to improve the standard of living of its population, help small and medium businesses, or invest in infrastructure.

Over the past decade, much more information has become available on the state of technology-based entrepreneurship in Nigeria. A prominent study by Aderemi et al. (2008) examines the mechanisms used in learning, as well as the factors that influence the choice and performance of women in technological and non-technological, small-scale enterprises and identifies self-conceptualization, friends, business contacts, internet, and radio as some of the learning mechanisms. On the other hand, relevant programmes on television, attendance at trade fairs, government-organised programs, seminars, and workshops had a substantial impact on the choice of technological ventures by women. The study, which was conducted on 210 technological and non-technological women's businesses in south-western Nigeria, found that while unemployment was a major motivation factor for women to start non-technological businesses, the case was different for technological businesses. According to the studies, women are more inspired to start a technology-based business based on personal interest rather than unemployment (Aderemi et al., 2008). Additionally, it was revealed that age, role model/mentor, educational background, previous experience, and socio-cultural factor are significantly responsible for the choice of ventures, either technological or non-technological, although the learning mechanisms of television, trade fairs, and seminars were more relevant to technological ventures.

While this prominent study is useful in understanding some of the motivations and learning mechanisms for both technological and non-technological ventures, it has some limitations. Once again, the study fails to define what it refers to as technological and non-technological ventures, raising questions about the author's understanding of technology entrepreneurship. It also fails to consider how any of the motivation factors or learning mechanisms influence the entrepreneurship process (idea generation, raising capital, product launch, marketing, and building an organisation). Another weakness is its limited scope of focus on just women in entrepreneurship.

A significant analysis and discussion of the subject of technology entrepreneurship is given by Siyanbola et al. (2011) who present a framework for developing technology entrepreneurship in developing countries. The study, which asserts that "technology entrepreneurship is the creation of new ventures to exploit technological innovation and discoveries", highlights the roles of technological entrepreneurship in socio-economic development. Siyanbola et al. (2011) list the main principles as follows;

- Technology entrepreneurship is an instrument used to introduce technological innovations into the marketplace. Where there are breakthroughs in research and development laboratories, it is the place of a technology entrepreneur to commercialise the product or service.
- Technology entrepreneurship possesses the capability of improving a country's technological know-how. As technology entrepreneurs make efforts to start ventures, commercialise products, and introduce innovative services, learning takes place either by direct involvement or simply through observation, thus improving the region's knowledge of technological activities.
- Through the efforts of commercialising new technologies from research laboratories, patents are generated, which is one way to measure a country's technology capabilities and development.
- Technology entrepreneurship serves as a platform to bring about the successful diffusion of technological innovation in an economy.
- For technology entrepreneurs to be successful in their ventures, they thrive to meet the necessity of market needs which brings about socio-economic development.

Siyanbola et al. (2011), from their study, present a framework for technology entrepreneurship development. The framework suggests that technology entrepreneurship facilitates the innovation process by creating the impetus that drives each step in the process (idea generation and screening, discovery, feasibility study, development of prototype, patenting and approval, production, marketing, and adoption), and dictating the mode and quality of value creation from those steps. Additionally, the framework suggests that technology

entrepreneurship is enabled by favourable policies, institutions, financial and institutional support. The main weakness of this study, however, is that it is conceptual, rather than based on empirical data, which creates a gap for future studies to expand on the subject and contribute to the literature.

One other important aspect of technology entrepreneurship in Nigeria is the nature of the technology firms. As discussed in section 2.2.1, technology firms differ in their structure, use of technology, and functions, although this thesis takes a more holistic view of technology firms. Nonetheless, in Nigeria, most firms rely on already developed technologies, making them mostly technology-based firms. For instance, Aderemi, Ilori et al. (2008) include food, beverage, water processing and packaging, mining and quarrying, building and construction, woodwork and furniture making, garment making, metal fabrication, and ironworks as part of technological industries they studied. This is contrary to what is known in more developed countries, where technology industries consist mostly of high-tech manufacturing companies, internet and biotech companies. In a study of new-technology-based firms and venture policy in Nigeria, Daramola (2012) argues that new-technology-based firms (NTBFs) in Nigeria are businesses that utilise technological innovation or exploit an invention, with ICT being the major driver. According to Daramola (2012), these firms cut across oil and gas, financial services, health, education, and any other sector that employs technological solutions and is characterised by medium-low technology, low-technology and knowledge intensity service groups. While this system of classification is valuable in understanding the characteristics of new-technology firms in Nigeria, it is now out of date, as it fails to consider the fast-growing internet sector and its influence on other industries. For instance, the table below is an overview of the top technology ventures in Nigeria by investment raised or revenue generated. These ventures are solving real problems with unique solutions.

Table 6: Top technology ventures in Nigeria. Source: Individual Company sites, technology websites and the Nigerian Stock Exchange. Compiled by author

Company	Business Description	Headquarter	Staff	Revenue	Capital raised	Founded
Interswitch	Electronic transaction switching and payment processing company	Lagos	200-500	>\$50 million		2002
Irokotv	Media streaming platform is the largest licensor and distributor of Nollywood movies	Lagos	50-200		\$25 million	2010
Jobberman	Leading online job portal	Lagos	100-200		Acquired	2009
Konga	Leading online retailer and marketplace	Lagos	500-1000		\$78 million. Valued at \$200 million	2012
Paga	Pioneering mobile money platform	Lagos	50-100		\$13 million	2009
Hotels.ng	Biggest local hotel booking website in Nigeria hosting over 4,000 hotels on its platform.	Lagos	100-200		\$1.45Million	2012
Zinox	Original Equipment Manufacture of Nigeria's internationally certified branded computers with the Naira keyboard	Lagos	101-1000	>\$158 million in, 2010		2001
Wild Fusion	Digital marketing agency offering clients in Africa, strategy, digital advertising, social media, Online media and mobile services. Wild fusion was Google's first certified Adwords partner in West Africa with offices in Ghana, Kenya and Nigeria	Lagos	11-50	\$6 million in, 2013		2010
Omatek	First factory to locally assemble Computer cases, Speakers, Keyboards and Mouse, other than Computer systems and Notebooks in the whole of Africa. Publicly traded	Lagos		\$6 million (2015)		1990
Jumia	One of Nigeria's largest online retailers	Lagos	500-1000		\$211 million	2012
Mtech	Africa's leading mobile content and media interactivity provider	Lagos	21-200			2001
eTranzact	first global and fully integrated financial switch, payment Processor, mobile banking and payment solution	Lagos	51-200			2003
MainOne	Provides wholesale telecommunication-bandwidth services and land cables for telecom operators and internet service providers.	Lagos	500-1000		\$40 million	2005
Globacom	Nigerian multinational telecommunications company	Lagos	1001-5000	\$1.178 billion		2003
Gamsole	African based mobile game production company	Lagos	50-100			2012



Two important elements emerge from the table above. First, the majority (if not all) of Nigeria's technology companies operate from their headquarters based in Lagos. This contributes to why this research is focused on Lagos state. Second, it can be seen that ninety percent of the technology companies in Nigeria were founded within the millennium, with more technology ventures launching within the last five years. The increase in technology entrepreneurship activities in this region has caught the eye of foreign investors. Adeyeye, Jegede and Akinwale (2013, p 377) note that "since, 2000, the sector has witnessed increasingly steady growth due largely to wholesale and retail telecommunication." Consequently, an influx of venture capital has been noticed in Nigeria. However, little is known about how and what mechanisms this capital are been used to help the development of technology entrepreneurship in the region.

Having discussed and analysed the state of technology entrepreneurship in Nigeria, it is important to now consider what government initiatives have gone into the development of technology entrepreneurship.

#### 3.4.1 Government initiatives towards entrepreneurship in Nigeria

Government initiatives through policies, seminars, or workshops play a vital role in enabling the metabolism of technology entrepreneurship in any region. In Nigeria, tremendous effort has been made by the Government towards resolving the issue of entrepreneurship in general, but with very little focused attention to technology entrepreneurship and new technology-based firms (Daramola, 2012). Nonetheless, there is a consensus among researchers that most of these initiatives have delivered few to no results as their implementation is seen to be poor at best. According to Njoku, Ihugba and Odii (2014), the history of government initiatives that support small and mid-size enterprise and entrepreneurship traces its way back to 1964. Sanusi (2003) and Njoku, Ihugba and Odii (2014) list some institutions and agencies set up by the Nigerian government to aid the development of entrepreneurship and SMEs:

*Industrial Development Centres:* set up to provide assistance to small-scale businesses and provide them with a solid foundation and industrial development. They aim to do this by establishing centres across the nation to carry out activities such as appraisals of loan applications, training of entrepreneurs, applied research of industrial products, and assistance with purchase and installations of machinery. The first

industrial development centre was established in Owerri in 1962 and 22 others have been created since then.

*Advisory agencies like SMEDAN (Small and Medium Enterprises Development Agency of Nigeria):* established in 2003 to promote the development of small enterprises in Nigeria. They exist to facilitate access to resources required for development by small and mid-sized entrepreneurs and investors.

*Small Scale Industries Credit scheme (SSICS).* The scheme, established in 1971 by the federal and state government, is set up to offer a credit fund on liberal terms to small and medium enterprises.

*NERFUND (National Economy Reconstruction Fund).* This fund was set up by the federal government in 1990 to provide long-term loan services (5-10 years) to small and medium enterprises. The loan facility was set up at minimal interest rates to encourage SME development. Between 1990 and 1998, NERFUND issued \$144.9 million to support 218 projects.

*World Bank Assisted SME Loan Project.* The government of Nigeria in 1989 negotiated a program of financial assistance with the World Bank to complement other sources of funding to small and medium enterprises. This facility equated to \$207 million for on-lending to SMEs through participating banks.

*Fiscal and Monetary policies, including:* Pioneer status or income tax relief act, import duty relief, capital allowance to aid capital reformation, tax relief for investment in economically disadvantaged local government areas, imposition of tariffs on foreign goods to ensure effective patronage of locally made goods, export promotion incentives, foreign exchange facility, and mandatory credit allocation of between 10% and 20%

*Other government initiatives include:* SMIEIS (small and medium industries equity investment scheme); The Nigerian Agricultural and rural development bank credit scheme and seed capital for small businesses; entrepreneurship development centres in six geopolitical zones of the country; people and community banks; The Nigeria Industrial Development Bank; The Nigerian Bank for commerce and industry; and the National Directorate of Employment.

However, despite the numerous human and financial resources invested in these initiatives as listed above, they have been unsuccessful in producing the desired results, due to poor implementation (Njoku, Ihugba and Odii, 2014). For instance, the IDCs were poorly implemented and were inadequately equipped and funded. The success of the Small-Scale

Industries Credit scheme (SSICS) was constrained by the deficiency of executive power to monitor projects. As a result, many unrealisable projects were funded, leading to massive repayment default. Suffering from operational problems, two of the industrial development banks - The Nigeria Industrial Development Bank and The Nigerian Bank for commerce and industry combined with *NERFUND (National Economy Reconstruction Fund)*, were dissolved and absorbed into a newly established Bank of Industry in 2002 (Sanusi, 2003).

The failures of these initiatives are due to poor management, mishandling of funds for the objectives of initiatives, false implementation and existence of the initiatives, poor and dishonest staff in management, and unqualified and incompetent officials to implement the objectives of the initiatives. Similarly, Tende (2014) attempted to assess the level of government programs and policies for the development of entrepreneurship through the EDP (Entrepreneurship Development Program) - NDE (National Directorate of Employment) initiative and found that the initiative had no significant effect on the development of entrepreneurial activities in the country. Moreover, beneficiaries of the program did not derive satisfaction from the government program and initiative. Considering this evidence, the issue in Nigeria is not a lack of government initiatives to support entrepreneurship, but rather a case of improving the implementation and delivery methods of the policies and initiatives.

#### *Government Initiatives towards technology entrepreneurship development in Nigeria*

In regard to technology entrepreneurship, perhaps the most prominent initiative is one set by the National Information technology Development Agency (NITDA), an agency operating under the Federal Ministry of Communication Technology. Recognising the value of technological innovation, the national information technology policy was approved in March 2001 to carry out the government's vision of making the country a technology powerhouse and a key player in the information society, using information technology as the engine for sustainable development and global competitiveness (NITDA, 2014). Below are some highlighted parts of the policy to be implemented by NITDA, relevant to the focus of this thesis; that is, technology entrepreneurship (NITDA, 2014):

- To encourage local production and manufacture of IT components in a competitive manner.
- To create an enabling environment and facilitate private sector (national and multinational) investment in the IT sector.
- To stimulate the private sector to become the driving force for IT creativity and enhanced productivity and competitiveness.
- To encourage government and private sector joint venture collaboration.

NITDA proposes to implement its policies by establishing IT parks as incubating centres for the development of software applications at national, state and local levels. Another initiative of the Federal Ministry of Communication Technology is the 'local content development' initiative (ONC, 2014) which stipulates some guidelines:

- Promote and facilitate the commercialisation of university research activities in order to engender and encourage entrepreneurship and skills development out of Nigerian universities.
- Establish technology incubation programs, technology venture communities, ICT clusters and other IT development networks to stimulate the growth of the sector.

Finally, the concept of technology incubator centres is a part of the cluster development strategy developed in 2007 by the Federal Ministry of Commerce and Industry as part of Nigeria's industrial development strategy. The government's intention was to set up technology incubators in collaboration with educational and research institutions in order to build graduates with skills and dexterities needed to launch their ventures (Iwuagwu, 2011). This is exemplified in the work undertaken by the government in Abuja, the capital of Nigeria. A project known as 'Abuja Technology Village' is underway and is poised to be the preferred destination for technology research, development, and commercialisation of technology-driven businesses of varying sizes in Africa. The technology park concept follows the global vision of using technology clusters as a reliable tool for bolstering economic development, given Nigeria's firm place as the technology hub of Africa and an emerging prominence in the global economy (ATV, 2015).

Nonetheless, preliminary investigations reveal that the ability of the government to successfully implement the policies and ideas thus far has been poor. For instance, a government body -- National Board for Technology Incubation -- dedicated to facilitating the establishment and operation of technology incubation centres in Nigeria, lists 27 technology incubator locations in the six geopolitical zones of Nigeria – northeast, northwest, north-central, south-east, south-south, and southwest. The overall mandate of the board established in 1993 was to ensure that technology-related businesses are effectively linked with the right talents, technology, business knowledge, and capital through technology incubators. However, in reality, the twenty-two years of existence of the board has yielded no useful result. Aside from product concepts and ideas listed on its website as results of its efforts, there are no technology ventures established, neither are there any functioning technology incubators.

This is evident in Bubou and Okrigwe's (2011) work on technology incubators in Yenagoa, Bayelsa. They note that construction of the incubator facility was yet to begin, due to a lack of funding. Perhaps the initial concept of locating a technology incubator in a region known for

petroleum drilling was an inappropriate act by the government of Nigeria. As Bubou and Egai (2010) note, "There is a lack of entrepreneurialism in the Niger Delta region of Nigeria, more so, Bayelsa state." Considering all of this evidence, it seems that the Nigerian government is unable to implement most of its ideas and policies on technology incubation. Consequently, privately operated technology incubators have risen to the challenge.

The evidence presented in this section suggests that the Nigerian government recognises the impact of technological entrepreneurship on an economy. Additionally, they have drummed up initiatives and ideas to foster the development of technology entrepreneurship in the region. However, they are incapable of implementing most of these ideas and policies. Thus, the need arises to investigate the critical role of technology incubators as instruments for promoting technology entrepreneurship in Nigeria. As Choudhury et al. (2014, p.351) note, "*there is need for urgent stimulant of SMEs using technology incubation centre (TIC) as veritable engine, considering the experience of nations with success stories*" Most importantly, it is essential to investigate how privately-operated technology incubators influence the development of technology entrepreneurship in Nigeria. The next section critically evaluates, describes and synthesises literature on incubators in Nigeria.

### **3.5 Literature on Technology Incubators in Nigeria**

Very little is known about the overall state of technology entrepreneurship in Nigeria, particularly technology incubators and their influence on technology development. Even though it is clearly a part of the national informational technology policy to be implemented by NITDA, and a clear obligation of the industrial development policy, only a few researchers have been able to draw on any systematic research into their existence or the state of their wellbeing. This may be due to the poor implementation strategy of the policies and over-involvement of the government, including other reasons as discussed in section 5.2.1 above. Table 7 provides an overview of all the literature on business incubators in Nigeria, including the perspective, methodology, incubator type they link to, and research questions. Each of these studies is reviewed in more depth below highlighting, its strengths and weaknesses.

Table 7: summary of findings of literature on technology incubators in Nigeria. Source: Author's own

Representative Citation	Perspective	Incubator Type	Methodology	Research Aim/Finding
<b>(Adegbite, 2001)</b>	Incubator facility Informal exchange with entrepreneurs	Industrial business incubators Technology business incubators. Government sponsored Incubators	Questionnaire survey, on-site inspection, structured interviews	Reviews the development of business incubators in Nigeria. Presents 7 existing incubators (4 industrial business incubators and 3 technology business incubators)
<b>(Bubou and Okrigwe, 2011)</b>	Incubator facility	Government sponsored incubators. Technology business incubator.	Conceptual. Exploratory case study	To highlight the contribution of technology business incubators to regional development. Acknowledges that technology business incubators will help the start-up of new ventures in the technology sector and also promote technology knowledge transfer and improve regional development.
<b>(Obaji et al., 2012)</b>	Incubator facility	Government sponsored incubators. Technology business incubator.	Conceptual	Focuses on how the successful SME incubation model from other developing countries can be replicated in Nigeria.
<b>Akhuemonkhan et al., 2014</b>	Incubator facility	Government sponsored. Technology business incubator.	Conceptual. Analytical and discursive.	Attempts to disclose the potential of technology business incubator as tools for entrepreneurship development and realization of the vision 20:2020 in Nigeria. There are 37 technology incubators in Nigeria with weak socio-economic impact on job creation, wealth creation and industrial development.
<b>Edoho et al., 2015</b>	Incubator facility Tenant firms	Government sponsored and operated incubators	Survey and questionnaires	To assess various technological learning mechanisms through which tenant firms in the incubation system in Nigeria acquired the relevant capabilities (both technological and non-technological) that will sustain them after graduation. The study revealed poor interaction between the tenants and knowledge institutions and training programmes and facilities also played significant roles in technological capability acquisition of tenants firms.

Adegbite (2001) examined the development of business incubators in Nigeria by investigating the operation status of the seven existing incubators at the time. In the study, business incubators in Nigeria are broadly divided into two types: *Industrial business incubators*, general industrial centres for fostering new business ventures with an outlook of promoting entrepreneurship and stimulating industrial establishment in small-medium enterprises; and *Technology Business Incubators*, predominantly targeted at innovative, technology-oriented small and medium scale enterprises, capable of commercialising R&D findings from educational institutions, with an outlook of promoting technology innovation and entrepreneurship development. The study was based on a field inspection of the physical incubator facilities, structured interviews of the incubator managers, and informal discussions with entrepreneurs of tenant firms in the incubator. The survey revealed that there were only seven incubators operating in Nigeria; i) Yaba industrial Estate; ii) Matori SME Estate; iii) Isolo SME Industrial estate; iv) Eastern Nigeria Industrial Estate; v) Lagos Technology incubator; vi) Kano Technology Incubator centre; and vii) Aba Technology Incubator.

Adegbite (2001) highlights some of the challenges that face the incubators in Nigeria as; inadequate established incubators to meet the population of the country; refusal of tenants to leave the incubator facility; government-dependent structure and lack of participation of the private sector; existing incubators that are non-viable commercially; existing incubators with weak management structures; existing incubators with no proper selection process; inadequate support given to tenant firms; inconsistent government policies leading to unavailability of funds to operate the incubators; and failure of the incubators to set smart, achievable goals.

The study notes that the task of implementing industrial and technological business incubators in Nigeria was spearheaded by two federal agencies: The Federal Ministry of Industries and the Federal Ministry of Science and Technology, both aiming to increase the availability of business incubators across the country. However, the industrial incubators failed to achieve their primary objective of turning out successful enterprises, largely as a result of the refusal of tenant firms to give up their space even after outgrowing the incubator. Consequently, some tenant firms were resident in the incubator for up to twenty years, citing unavailability of suitable alternative locations as their reason for not being able to move out. Furthermore, the incubators were in the hands of weak management systems, “being run more or less as departments of the supervising ministry, with all the attendant red-taped and bureaucratic ineptitude” (Adegbite, 2001, p.160).

Similarly, technology incubators faced the same set of problems confronting the industrial incubators, such as reluctance of tenant firms to vacate the incubator, lack of funding by the

government to finish the facility to the proposed standard, poor organisation arrangements and weak management, leading to the inability of the incubator to generate funds from its operation. The main strength of this study is that it is the first to examine the state of business incubators and outline the number of business incubators in Nigeria. The principal weakness, however, is that it summarises business incubators with the tangible assets they provide, ignoring the intangible assets. The study also fails to include other actors in the incubator process. Methodologically, the study appears to lay more emphasis on the incubator facility than the entrepreneurs. They conducted structured interviews with the entrepreneurs, but they are closed in nature and do not yield detailed results.

In, 2011, a seminal study entitled *Fostering technological entrepreneurship for socioeconomic development: A case for technology incubation in Bayelsa State, Nigeria* by Bubou and Okrigwe (2011) sought to highlight the contribution of technology business incubators in Nigeria, focusing on the Niger-Delta region of the country. According to Bubou and Okrigwe (2011), the last count of incubators put it at 21 incubators across the country, with an objective of launching one in each state. However, this study adopted a case study approach focusing on the newly inaugurated Yanagoa Technology Incubation Centre. The study points out the objectives of the business incubator as follows:

- To design programs for entrepreneurs and keep them up to date with latest technologies
- To support entrepreneurs by providing technologically innovative materials and manufacturing processes
- To develop environments and centres capable of testing and inspecting products before launch in collaboration with research centres and other educational institutions
- To offer engineering services, such as process and product performance, monitoring, and improvement, as well as consultancy.
- To meet with research centres to offer production of improved tools for local consumption
- To foster entrepreneurial culture by upgrading and enhancing the application of sustainable indigenous technologies to ensure cost effectiveness and optimum production
- To efficiently provide links between talents, technology know-how, and capital in order to accelerate the development of new enterprises
- To promote economic diversification through the creation of dynamic enterprises in the agro-allied, information and communications technology and manufacturing sectors which will help the country's over-dependence on oil



The study also highlights key challenges faced by the Yanagoa technology incubation centre, which was actually yet to commence due to a lack of funding, and lack of links to knowledge generation and business development experts. While this study is valuable in investigating the complex phenomenon of technology business incubators in a developing country and in a real-life context, it had some limitations. It is conceptual and lacks empirical data to back up its claims. Selection bias is another potential concern, because the Niger Delta region of Nigeria is heavily involved in oil exploration and production and is not the first point of call for technology innovation in the country. This raises issues about the validity and reliability of the study. Moreover, as with most government-funded projects and initiatives in the region, the objectives of the Yanagoa technology incubation centre are rather superficial, considering that the basic infrastructure and support system for successful technology incubation were not in place. Another major concern is that the author bases the entire study on a technology business incubator that is yet to actually begin operation.

Recognising the flawed implementation of the incubation model in Nigeria, Obaji et al (2012) set out to improve on the existing incubation model by focusing on case study implications of other developing countries (China and Brazil) as a fundamental inquiry into the requirements for enhancing future versions of Nigerian incubation practices. The study concludes that, while Brazil's and China's dependence on government patronage has led to successful incubation models which have brought about employment growth and contribution to their respective GDPs, the case is different in Nigeria. The dependence of Nigerian incubators on the government for financial support has yielded no tangible result, as Nigerian governments have not kept their commitment to support the incubation initiative financially. Thus, policymakers ought to find a solution by reflecting a public-private partnership whereby the government will reduce its involvement in the active operation of the incubators and focus on providing a more conducive business environment. Obaji et al. (2012) also advocate for government policies as they relate to technology incubation to be properly implemented, rather than being exclusively on paper. Aside from basically describing how successful China and Brazil have been able in deploying technology incubators, the study offers no other constructive suggestion on how Nigeria can replicate what other countries have done. Perhaps the most serious disadvantage of this study is that it does not attempt to review the current state of technology incubators in Nigeria, but rather, bases its assumptions on Adegbite's study in 2001.

A significant analysis and discussion on the subject were presented by Akhuemonkhan et al. (2014). The study, which set out to explore the potential of technology incubation centres as tools for promoting entrepreneurship and development, found that, thus far, Nigeria has not been able to actualise its industrial policy objectives with regard to technology incubators, compared to the BRIC (Brazil Russia India and China) nations. According to Akhuemonkhan

et al. (2014), the under-achievements are the result of an inadequate number of technology incubators, poor support services at the technology incubators, lack of measurable targets, the weak structure of operations, government dominance, nepotism/favouritism in the allocation of places at technology incubators, and inconsistent government policies. Akhuemonkhan et al. (2014) cite that there are 37 technology incubators, with one in each state of Nigeria. Additionally, the study presents a framework to enable technology incubator development and offers some recommendations for successful technology incubation:

- Existing technology incubators should be managed through a public/private partnership between private institutions and the government
- Educational institutions should play a more active role in the incubation process
- Technology incubators in partnership with educational institutions should be sustained through links with industries and other tertiary institutions, regular workshops and seminars, investor forums and exhibitions.
- Multinational companies should be encouraged to work with technology incubators or establish their own as their corporate social responsibility
- Products and services emanating from the technology incubators should be commercialised and promoted and consumed locally and internationally for adoption by large corporations
- A proper selection process should be put in place.

This study is useful because, aside from highlighting the issues surrounding technology incubators in Nigeria, it also presents a framework for successful implementation of technology incubators. However, the study has some drawbacks. Methodologically, the study bases its source of data on government websites which, when accessed, do not provide any specific information about the incubators mentioned in the study. Perhaps, the proposed 37 incubators are just another weak policy of the Nigerian government, typical of those that have plagued the implementation of its policies and initiatives, which are actually only great on paper. Furthermore, Akhuemonkhan et al. (2014) base their outline of limitations on technology incubators on Adegbite (2001), which, by now, is out of date. One major limitation is its lack of empirical data, although the author implores that future research should engage in empirical analysis for an objective assessment of the situation.

In a more recent study on technological learning mechanisms in Nigeria's technology incubation centres, conducted by Edoho et al. (2015), the study found that incubators in Nigeria still lack the fundamental aptitude for providing the basic facilities required for a technology incubator to function properly. The study was conducted using questionnaires and interviews with six participants from a particular incubator, with a response rate of 83.3%. One

major drawback of this study is that it fails to take into the consideration the two major types of incubators in Nigeria as proposed by Adegbite (2001) - *Industrial incubators* and *technology incubators*. Additionally, the sample used in the study makes it impossible to generalise the study for technology incubators in Nigeria. Nonetheless, Edoho et al. (2015) conclude with some notable recommendations that should be taken into consideration by technology incubators in Nigeria. They suggest that establishing robust financial systems to provide capital for tenant firms will cushion the failure rate of the tenant firms; and secondly, research institutions and universities should work with incubators to commercialise new technologies and products.

A type of incubator completely neglected by previous researchers are the privately-operated incubators in Nigeria. This type of incubator is different from government-operated incubators in a number of ways. First, privately operated incubators are mostly funded by private individuals or organisations and, most importantly, operated by individuals or organisations. Second, this category of incubators appears to be stricter in adherence to their objectives and goals. Finally, these incubators are mostly based in Nigeria's commercial hub, Lagos. Based on a preliminary investigation, there are currently 10 privately operated incubators in Nigeria. They include: CoCreation Hub, L5 Lab, and Enspire all founded in 2009; Wennovation hub founded in 2011; IDEA Nigeria, and SPARK established in 2013; and 440NG, Leadpath, Passion Incubator, and Venture Garden Group, all established in 2014. It is possible that an incubator is funded by the government but managed privately. The functioning and management of the incubator are completely operated by private individuals or organisations. IDEA Nigeria is an example of this type of incubator. At the opposite extreme are the government sponsored and operated incubators. Virtual incubators, which are incubators without physical space, can be noticed in the operations of SPARK incubator in Nigeria.

### **3.6 Research Gaps, Aims and Research Questions**

Based on the above review of all the individual studies on business incubators in Nigeria, some key findings emerge. First, most of the studies, aside from Adegbite (2001), were conceptual and descriptive. They based their analysis on secondary data and offered no empirical data to back up their claims. Second, all the authors have focused only on government-sponsored incubators, which have repeatedly produced the same poor implementation results. These studies would be more relevant if a wider range of incubator sponsor types, such as privately sponsored and operated incubators were explored. Third,

none of the studies actually conducted a proper investigation of the tenant firms, the entrepreneurs, and other stakeholders in the incubation process. Fourth, all of the studies were carried out in small, concentrated areas, ignoring the well-known business hub of the nation or the capital state, Lagos and Abuja respectively. None of the studies makes any reference to how the technology incubators influence the development of technology entrepreneurship in the region. Overall, data in this field of research in Nigeria are based on data from 14 years ago, and considering how fast-paced the industry is, it is essential to investigate the phenomenon with more current empirical data.

### **3.7 Gaps and Aim of this Research**

The aim of this thesis is to understand technology entrepreneurship and the technology entrepreneur in a developing country, Nigeria, with a focus on investigating the impact of technology incubators on the technology entrepreneurship process. This chapter reviewed the literature on both technology entrepreneurship and technology business incubators and concluded with presenting existing gaps in the research surrounding the development of technology entrepreneurship and influence of technology incubators, particularly in developing countries. The review sought to establish the link between the technology entrepreneurship process and the roles of technology incubators to develop a schematic diagram that will form the basis of analysis for the research process. The TE-TI schematic diagram centres on technology entrepreneurship, complete with explanatory narratives to highlight and define the process of technology entrepreneurship and the players involved in its development. It is within this narrow band of inquiry that this study seeks to explore some critical factors attributable to

- i) the entrepreneur - the individual(s) responsible for conceptualising ideas, creating and launching new ventures. The primary focus will be to investigate how individual characteristics and entrepreneurial actions influence the process of venture creation within the technology incubator.
- ii) The entrepreneurial ventures – the economic outcome of entrepreneurial actions. This will specifically examine how entrepreneurs use resources provided by technology incubators and in what way these influence the formation of new technology ventures.
- iii) The technology incubator – the catalyst in the entire process. This investigates the role they play and how they impact the process of technology entrepreneurship.

### 3.8 Research Objectives and Justification of Research Questions

As outlined in section 3.6 above, the review of the literature on technology entrepreneurship and incubators demonstrates that there are gaps in research surrounding technology ventures and how they leverage the resources provided by technology incubators. As such, the research question which will guide the study is **How does the development of technology entrepreneurship in Nigeria leverage technology incubators?**

To answer the question stated above, the following sub-questions has been developed:

*Research Question 1: What are the qualities and experiences of entrepreneurs in technology incubators and how do these qualities affect their ability to start and grow a new venture in the context of the incubator?*

An understanding of the qualities and experiences of the types of entrepreneurs in technology incubators is missing in literature. Very few studies consider the perspective of the technology entrepreneur, as most studies are designed around the incubator facility and its management (Scillitoe and Chakrabarti, 2010). There are no studies on how the characteristics, background and previous experiences of the technology entrepreneur affect new venture creation in the context of the technology incubator. This is very important as the talents, skills, experiences, and actions of the entrepreneur are predominantly significant where technological advancements are central to the venture (Beckman et al., 2012) and can influence the value they receive from the technology incubator. This thesis addresses this gap by the research design which is centered on the individual entrepreneur found in incubators. It presents a typology of entrepreneurs found in Nigerian incubators and how these characteristics and experices shapes the way they interact with the resources provided to them by the incubators. Based on this gap, the second research question has been developed:

*Research Question 2: What resources are provided by Nigerian incubators and how do these resources help nurture and develop technology ventures in the region in the context of resource-based view theory?*

The literature on incubation summarise the resources incubator provide into infrastructural resource, technological resource, financial resource, and human resource; However, incubators differ in the types of resources they provide. This is because incubators differ in their objectives, structural setup and characteristics, the size of the target market, the specific industry involved, the degree of innovativeness, and specific phase of the business development cycle (Grimaldi and Grandi, 2005). There is a gap in the understanding of what resources are provided by incubators in sub-saharan African countries like Nigeria. Most of the studies in this area has been conseptual and descriptive lacking in empirical depth because most research studies are focused more on developed countries. Overall, data in this field of research in Nigeria are based on data from 14 years ago, and considering how fast-paced the industry is, it was essential to investigate the phenomenon with more current empirical data. This thesis addresses this gap by first contextualising the type of incubators in Nigeria and then investigated the resources they provide for their tenant ventures. Based on this gap the third research question was developed:

*Research Question 3: What are the resource implications for the technology entrepreneurs and their ventures?*

Once resources were identified, the review of the literature revealed a general lack of consensus on the impact of resources provided by technology incubators to entrepreneurs and their ventures. This is because very few studies attempt to explain how technology incubators function beyond provision of resources. They loosely explain the implication of the resources and how the resources are bundled and utilised by the entrepreneurs, and then their ventures. The majority of the studies discuss the impact of technology incubators on a broader scale of job creation and economic development but ignore how it directly impacts the individual entrepreneurs and the venture creation process, particularly in developing countries. This thesis addresses this gap by specifically discussing in depth the implication of the resources provided by technology incubators to Nigerian entrepreneurs and their ventures. This is important as the impact of technology entrepreneurship activites is highly dependent on the nature of the local region in which it is embedded (Lindholm Dahlstrand, 2007; Li et al., 2008; Shane and Venkataraman, 2003).

These questions are centred on three units of analysis; the technology entrepreneur, the technology venture, and the technology incubator. This will enable the entrepreneur to realise the set objectives of the research listed above.

Moreover, the central contribution of this study to literature is in how it provides new insights on the relationship between technology entrepreneurship and technology incubators. The study highlights the characteristics that make up the typical Nigerian technology entrepreneur, the resources that Nigerian technology incubators provide and the implications of these resources for the entrepreneurs and their venture.

Furthermore, this thesis will significantly address the empirical and knowledge gap in technology entrepreneurship and business incubators in Nigeria, a research area in dire need of updated empirical data, since the last empirical study was conducted about 15 years ago and focused only on government-operated incubators (Barbero et al., 2012; Akhuemonkhan, et al., 2014).

This study addresses Soetanto and Jack's (2013) call for more qualitative work with bigger samples on incubator research and tackles the phenomenon of technology entrepreneurship at a regional level, as suggested by Lindholm Dahlstrand (2007). Most importantly, the study addresses this phenomenon through a variety of lenses, capturing the perspective of various actors in the technology entrepreneurship process; a feature absent in previous studies of business incubators, particularly in the sub-Saharan region of Africa.

Having outlined the research objectives and questions clearly, the next chapter will describe and discuss the methods used in the study. Additionally, it will justify the underlying assumptions that have informed the choice of methodology and methods. The research questions outlined above, which focus on understanding in-depth processes between technology entrepreneurship and technology incubators, require a qualitative methodological approach, which seeks to understand, as opposed to predicting and manipulating (Gubrium and Holstein, 2000).

### **3.9 Summary**

This chapter reviewed the scope of technology entrepreneurship development in Nigeria and discussed literature on technology incubators in Nigeria. It demonstrates that there is a growing trend of technology entrepreneurship in Nigeria, with Nigeria leading Africa in the number of new technologies startups and startup investments. The government of Nigeria also recognises that technology entrepreneurship plays a key role in the development of the economy and has constructed policies and ideas to aid the establishment of technology ventures.

However, in implementing these ideas, the government has failed woefully. A review of the literature of technology incubators in Nigeria reveals that there is little to no activity in the incubator scene, bearing in mind that all of the studies have narrowly focused only on government-sponsored and operated incubators. This is somewhat paradoxical, as the majority of the literature on entrepreneurship in Nigeria recognises that leaving the government to execute ideas always ends up having negative outcomes. This is why, in this study, more emphasis is given to privately operated incubators, which are completely neglected by previous researchers. Moreover, the research will bring the state of technology entrepreneurship in Nigeria up to date and investigate how technology ventures bundle and utilise the resources provided by the technology incubators. The next section discusses the research design and methodology that is employed in this research.



## **CHAPTER 4: Research Design and Methodology**

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### **4.0 Introduction**

This chapter explains and justifies the methods used in this thesis. This research study is focused on providing exploratory knowledge on technology entrepreneurship in Nigeria. It also aims to provide an in-depth understanding of how the technology entrepreneurship process relies on the resources provided by Nigerian technology incubators. It explores the ways technology entrepreneurs position themselves and their ventures to benefit from the offerings of technology incubators; and how technology incubators strive to maximise their efforts to create, grow and develop new innovative ventures. With technology entrepreneurship as the focal point of study, this thesis is not merely an appraisal of what technology entrepreneurship entails, but a careful deliberation of how the process of technology entrepreneurship exploits the resources provided by technology incubators to further enhance its development in the context of a developing country, Nigeria.

This chapter explains and justifies the methods used in this thesis. The research questions outlined in chapter 3, which focus on how the development of technology entrepreneurship in Nigeria leverage the resources provided by technology incubators, require a qualitative research strategy. This chapter is divided into three sections. The first section of the chapter begins by discussing the research strategy and philosophical assumptions that guide the study. The second section outlines the stages involved in the research design; that is, sample and data collection methods, data analysis process, and research ethics. Finally, section three discusses and summarises the research process beyond the field work.

### **4.1 Research Strategy and Philosophies**

According to Seale (1999), researchers ought to reflect and clearly state their philosophical position when producing their work. This recommendation maintains that, in the social sciences field, the methods of enquiry are based on interrelated sets of assumptions regarding ontology, epistemology and the nature of the phenomenon to be investigated (Burrell and Morgan 1979). The relationship between these assumptions is what determines the philosophical standpoint of a research methodology. Moreover, it is important to take cognizance of the interconnectedness of these philosophical assumptions, worldviews, attitudes and beliefs as they are essential and deep-rooted in the researcher's point of view. They influence how the researcher engages with the study and comprehends social science issues such as entrepreneurship, the entrepreneur, enterprises, and external environments.

Burrell and Morgan (1979) argue that research philosophies make researchers conscious of the complexities of organisational study, thereby drawing attention to the impact of their research paradigms on knowledge construction. They assert that “all social scientists approach their subjects via explicit or implicit assumptions about the nature of the social world and the way in which it may be investigated” (Burrell and Morgan 1979 p. 1). It relates to, a) ontology of the phenomenon under investigation; that is, if the ‘reality’ being studied is external to the individual or a product of the individual’s consciousness and b) epistemological assumptions “about how one might begin to understand the world and communicate this knowledge to fellow human beings” (Burrell and Morgan 1979 p.1).

Healy and Perry (2000) describe ontology as the reality investigated by the researcher, epistemology as the relationship between the reality and the researcher, and methodology as the procedure of investigating the reality by the researcher. According to Downward and Mearman (2007), methodologies are combinations of different methods and the practice of implementation to interpret a phenomenon by the researcher. The methodology used in a research project is as a result of a set of ideas, or framework (theory, ontology) that identifies a set of questions (epistemology). Denzin and Lincoln (2011) note that the relationship between theory and methodology is important. It is essential that researchers use methodologies that are consistent with their philosophical standpoint and aims of the theoretical view being expressed.

In management research, there are broadly two perspectives of philosophical assumptions to research design. The first is the positivist approach. The positivist approach is one that emulates and applies the nature of natural sciences to the study of society, organisations and policy development. Their goal is to discover truth and they embark on this by controlling variables to disseminate explanations and validate hypotheses. The major focus for the positivist researcher is to uncover facts by generating hypotheses from existing theory that can be tested. This form of theory-testing research is closely associated with the deductive paradigm of research study.

The interpretivist approach (inductive paradigm) on the other hand shares the view that the main subject matter of social sciences – people and institutions - are fundamentally different from that of the natural world. Beyond explanation (positivist approach), human behaviours and actions need to be understood in the context of their environment (interpretivist approach). The goal of the interpretive researcher is to describe and understand the reality of a phenomenon within its social context. They view humans as actors in the social world, rather than simply reacting to objects in the natural world (O'Reilly, 2012 cited in, O'Reilly, 2016). As such, it is important to the interpretive researcher that they understand the actor’s point of view

and understand how people make sense of their world using their senses (Schutz, Natanson and van Breda, 1963).

The motivation for the use of theory by the interpretive researcher can be broken into three phases; *the theory as a guide* – this is a situation where the researcher creates an initial theoretical framework from previous knowledge, so as to form the initial basis of the research study and empirical work; the *theory as a process of interaction* – this is a situation where the researcher refuses to be boxed in by the initial creation of a theoretical framework, but rather preserves a considerable amount of openness in the data collection process, with a willingness to modify initial assumptions and theories; and *the theory as a final product* – in this situation, the theory takes the form of output from the research study, either as a concept, conceptual framework, propositions, or mid-range theory (Walsham, 1995).

Essentially, the preference for this research is the interpretive paradigm, because of its implicit assumptions. My intention with this study is not to realise objective quantification or statistical regularity but, rather, explore real experiences of the social actors, such as the entrepreneurs and the incubator managers, which cannot be simply scaled. The interpretive approach will afford me the opportunity to build deep understanding by involving myself with the technology incubators, generating insight and understanding of the development of technology entrepreneurship in Nigeria.

Furthermore, although this thesis is guided by previous theoretical knowledge and a schematic diagram, the interpretive approach permits me to engage and interact with the field data collection with an openness to modify preconceived theories from previous knowledge, in this case the resource-based view theory. My aim with this research, is to capture, understand and interpret the insider's view, rather than impose a view from the outside.

To carry out this research study, the researcher will be assuming the role of an 'involved researcher' by getting close and personally engaged in the research process, leveraging my knowledge of and interest in technology entrepreneurship activities. Walsham (1995) advises that it is important for researchers to clearly identify their role in an interpretive research process, considering interpretive researchers can either be an 'outside observer' or 'involved researcher.' However, it is important to note that neither of these roles can be viewed as that of an objective reporter. This is because, regardless of the role assumed by the researcher, the collection and analysis of the research data is subject to the researcher's interpretation (Walsham, 2006). As an involved researcher, it will be more plausible to gain easy access to my subjects of study, issues, and data allowing for an in-depth study. Furthermore, the researcher will be able to observe the subjects of study in action, as opposed to merely

accessing the opinions of individual subjects. However, the level of involvement will be neutral, so as to eliminate interpretive bias. This requires that the researcher is not aligned with a particular individual, group or organisation in the field of study, or concerned with financial gains.

Having established the philosophical assumptions that guide this research, what follows is a description of the research design and methodological techniques applied to data collection.

## **4.2 Research Design**

This section introduces the research the design and methodological techniques applied. To derive a logical and legitimate research design and methodology, it is important to first have clarity on the research requirement. The research question outlined in section 4.2 is subdivided into three parts. The first part focuses on analysing the technology entrepreneur and their peculiarity. The second part investigates the state of the technology incubators in Nigeria, and the resources they provide to technology entrepreneurs and their venture. The final part explores the implication of these resources for the entrepreneur and their ventures.

Although there have been studies conducted to measure the effect of business incubators, they have been predominantly focused on the incubator facilities alone (Wynarczyk and Raine, 2005), adopted a general approach (Colombo and Delmastro, 2002), a conceptual approach (Siyabola et al., 2011), highly specialised case studies (Wiggins and Gibson, 2003) or focused on a single aspect of the incubation process, such as the incubator manager, location, or administration (Soetanto and Jack, 2013). However, in developing countries, very little is known about technology entrepreneurship development and the nature and contributions of technology incubators remains unclear. These areas are relatively unexamined, particularly in the region of sub-Saharan Africa. Additionally, in Nigeria, Africa's largest economy, there has been no recent attempt at accurate empirical analysis and synthesis between technology entrepreneurship and the role of technology business incubators, which is the gap this thesis aims to fill. Consequently, in exploring the development of technology entrepreneurship in Nigeria and the impact of technology business incubators on the entrepreneurship process, this study can be classified as an exploratory study. It uncovers the complex nature of the phenomenon in question, seeking to gain fresh insight that could potentially lead to development of a new theory. The research design adopted, thus, reflects this.

This thesis employs a qualitative research strategy to provide a means to expose the subjective reality of the phenomenon under study; that is, to investigate the underlying mechanism that links the development of technology entrepreneurship to technology incubators. The justification for selecting a qualitative approach is based on its emphasis on inductive theory generation, interpretive epistemological orientation, and ability to capture complexity (Bryman and Bell, 2015), as described in the previous section. Additionally, as the researcher was keen to learn from the subjects of this study, a qualitative approach gave the ability to study and gain in-depth knowledge of how technology ventures operated in Nigeria, as well as how they interacted with incubators.

As Hindle (2004) suggests, in the entrepreneurship field, qualitative research methods are more suited to learning directly from the research subjects. This is because utilising a qualitative approach focuses on generating in-depth empirical knowledge of how a process functions from the participants involved with the study. Furthermore, Dana and Dana (2005) suggest that qualitative research is more appropriate for exploratory studies in entrepreneurship research, due to its evolving and flexible nature. These perspectives are in line with the general aim of this study.

My inspiration for this research was a need to sieve through the hype to understand the current state of technology entrepreneurship in Nigeria and the role played by technology business incubators. However, of greater interest to me, was the motivation to understand the prospects and challenges of new technology ventures in Nigeria, the characteristics of technology entrepreneurs, and the impact of the resources provided by incubators on individual entrepreneurs and their ventures. In addressing this important issue, the research needed to be able to investigate individual entrepreneurs, their ventures, the incubator spaces, and the broader entrepreneurship community. Consequently, this form of analysis incorporated some of the principal actors involved in the development of technology entrepreneurship and technology incubators, such as individual entrepreneurs, incubator managers, investors, and advisers.

It is important to specify the level of analysis employed. because it helps to narrow the scope of an investigation and focuses the research efforts. Moreover, defining the unit of analysis is critical in creating the research design. Thus, the core unit of analysis for this dissertation was a) the technology entrepreneur and their venture; and b) the technology incubator.

Furthermore, the researcher adopted the principle of triangulation, engaging both triangulation of the principal actors; and the triangulation of sources; that is, primary and secondary sources. Triangulation refers to “a means of representation based on the logic that we can move closer to obtaining an accurate picture if we take multiple measurements, using various

theories and levels of analysis” (Cox and Hassard, 2005 p. 116). Beyond ensuring validation and verification, triangulation as a technique is used to ensure robustness and comprehensiveness. This is because a single source would be insufficient to adequately explain the complex nature of technology entrepreneurship and technology business incubators. Triangulation in this thesis was obtained from the primary and secondary data sources outlined below;

- A) Primary Source: Primary data will be collected through semi-structured interviews with a targeted set of technology entrepreneurs concerning their ventures within a technology incubator. More interview data will be collected through a second set of semi-structured interviews from a pool of incubator managers, advisers and investors. On-site observation will also form a part of the primary data. The criteria set for data inclusion and how it will be obtained and processed is discussed in the sections that follow.
- B) Secondary source: Historical and biographical accounts of technology entrepreneurs, technology ventures, and incubators available in public documents, such as books, magazines, reports, websites, and other forms of media will form the secondary source of data.

### **4.3 Sample and Data collection**

Participants of this study were drawn from the main focus areas of this study; that is, the technology entrepreneurs and their ventures, and the technology incubators. The technology ventures were specifically based within a technology incubator; both privately operated and government operated incubators were involved. Privately operated business incubators are directly invested in their tenant firms for an eventual return or claim charges on rents and other rendered services (Lumpkin and Ireland, 1988). The reason for this is that, in Nigeria, as pointed out by several other studies (Adegbite, 2001; Bubou and Okrigwe, 2011; Akhuemonkhan et al., 2014), government operated incubators are mostly non-functional, mismanaged, or only exist on paper or in policies. In order to obtain valid participants for this study, it was preferable that the respondents were based in a privately-operated business incubator. Nonetheless, this study also included functional government-operated incubators that exist within the region of study. Based on preliminary investigation from public reports, institution websites, and reputable technology websites, there are about 11 privately operated

technology incubators in Nigeria, with about 75 tenant firms, and 26 government-operated incubators (See table 8).

*Table 8: A list of all private and government incubators in Nigeria as at time of study. Compiled from previous literature and technology websites*

INCUBATOR	WEBSITE	FOUNDED	LOCATION	NUMBER OF COMPANIES
<b>Co-Creation Hub</b>	cchubnigeria.com	2009	Lagos	13
<b>440NG</b>	440.ng	February 2014	Lagos	9
<b>Leadpath</b>	Leadpath.com.ng	February 2014	Lagos	7
<b>iDea (Government Sponsored)</b>	www.idea-nigeria.org	2013	Lagos, Calabar	6
<b>Wenovation hub</b>	Wenovationhub.org	2011	Lagos, Ibadan	8
<b>Passion Incubator</b>	www.passionincubator.ng	2014	Lagos	8
<b>Spark</b>	spark.ng	March 2013	Lagos	10
<b>L5 Lab (In joint venture with 88mph - South Africa's biggest incubator)</b>	www.l5lab.com	2009	Lagos	3
<b>Start Innovation Hub</b>	www.starthub.com.ng		Akwa Ibom	-
<b>Enspire</b>	enspire.org.ng/wp/	2009	Abuja	-
<b>Venture Garden Group</b>	venturegardengroup.com	2014	Lagos	11
<b>GOVERNMENT OPERATED</b>				
<b>North-Central</b>		2007	Jos	-
		2009	Ilorin	-
		1998	Minna	-
<b>North-East</b>		1999	Bauchi	-
		1999	Maiduguri	-
		2009	Jalingo	-
		2007	Yola	-
<b>North-West</b>			Gusau	-
		2009	Kaduna	-
		1994	Kano	-
		1999	Birnin-Kebbi	-
		1999	Sokoto	-
<b>South – East</b>		2009	Enugu	-
		1999	Nnewi	-
		2006	Owerri	-
		1996	Aba	-
<b>South – West</b>		2006	Ibadan	-
		2007	Abeokuta	-
		2012	Ile-Ife	-
		1993	Lagos	-
		2004	Akure	-
		2012	Ado-Ekiti	-

#### 4.3.1 Sample Population and Area

The empirical work was conducted in both Lagos and Abuja, the commercial and administrative capital of Nigeria respectively, with the arguments projected to be of broader significance to the entire country. However, majority of the studies was concentrated in Lagos state. This is because as illustrated in figure 3, 90% of the most successful technology ventures in Nigeria reside in Lagos while the remaining 10% are located in Abuja. At the time of this study most of the functioning and thriving technology incubators were based in Lagos. There was just one functioning incubator in Abuja which was useful for pilot studies.

Moreover, the rationale for the selection of Nigeria as a case study is significant since this research is concerned with a country where ventures are rather repetitive in character and innovation is rare. It accomplishes the conditions of a developing country where there are still deficiencies in institutional and environmental infrastructure. As Agbaeze et al. (2015) pointed out, Nigeria's over dependent on oil exploration resulted in a substantially unstable economy. As a result, the economy was exposed in 2015 when oil prices deepened highlighting an urgent need for Nigeria to diversify its other sectors of the economy to ensure continuous economic growth (Uzonwanne, 2015). Recognising these issues, the incoming government decided to focus effort on improving technology entrepreneurship activities in the country. Entrepreneurship is an indispensable tool for the significant advancement and transformation of any country including Nigeria (Oyelola et al., 2013; Ngozi and Simon, 2015), and technology entrepreneurship serves as a platform to bring about the successful diffusion of technological innovation in an economy (Siyanbola et al., 2011).

The focus on Lagos satisfies key factors required for economic growth; natural resources, human capital, capital goods, entrepreneurship, and policy setting (Bassanini and Scarpetta, 2002). Lagos is one of the well-known, vibrant cities in Africa, with a population of about 20 million people. It is often termed the commercial capital of Nigeria, with a growing middle-class population (see section 3.1). Lagos has been successful in growing a thriving technology entrepreneurship community.



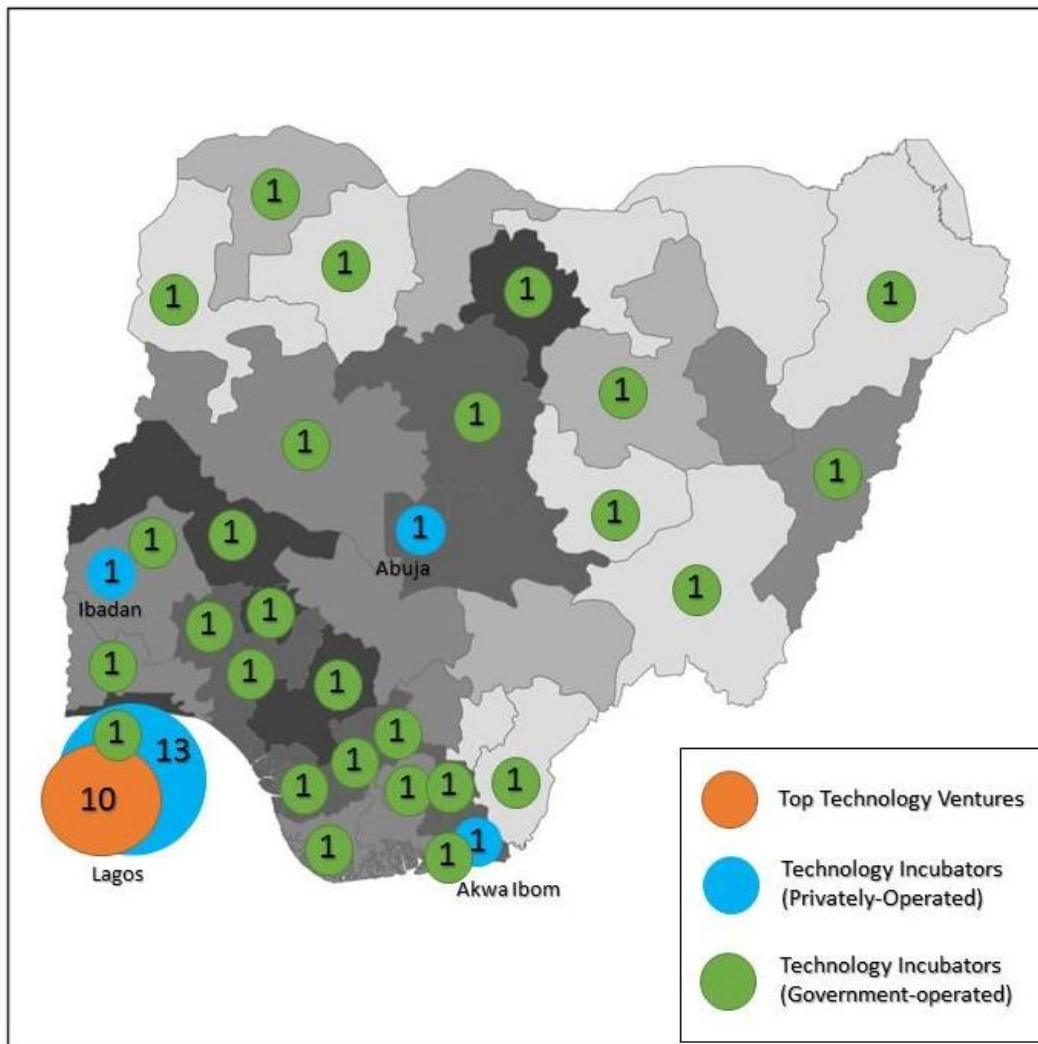


Figure 3: A Map of Nigeria showing Top Technology Ventures and Technology Incubators

The rationale for selecting the incubators was based on theoretical sampling on the likelihood that the cases will offer theoretical insights (Eisenhardt and Graebner, 2007). Moreover, in order to ensure consistency in the quality of the incubator sampled, the researcher established an inclusion criterion before commencing the field study. This approach of incubator selection is similar to another study whose aim was to understand how business incubators create a conducive environment for development of innovative ventures in Tunisia (Hichri, M'chirgui and Lamine, 2016). Inclusion criteria are a set of established characteristics with the intention of identifying subjects who will be included in a research study (Salkind, 2010). Salkind (2010) recognises that there are several benefits of a proper selection of inclusion criteria, including optimising the internal and external validity of a study and ensuring the homogeneity of the sample population. In light of this, the criteria below were set for selection of ventures and incubators in this study:

- Participant must be or must have been a technology entrepreneur resident in a technology incubator. As explained in chapter 2, for the purpose of this study, a technology entrepreneur is defined as the individual or group of persons responsible for the discovery and exploitation of technological ideas and opportunities leading to creation of a new venture.
- A technology venture in this study will be defined as a company that has been created or implemented to create, develop, and sell technology (technology-firm) or leverage technology (technology-based firm) as explained in chapter 2.
- To qualify as a part of the study, the venture must consist of a founder and at least one employee. This is to ensure that the new technology ventures have moved beyond the idea phase.
- The venture must be or must have been a tenant within a technology incubator.
- A technology business incubator will be defined as a facility, either physical or virtual, that develops and supports the growth of technology ventures entrepreneurial companies by providing support, such as physical working space, networking, coaching, mentoring, business consulting, financial resources, or other links to professional services. Overall, their main objective is to develop and grow new technology ventures by providing business and technical assistance.
- The technology incubator should have been in operation for at least a year. This is to balance the need for providing rich data, while recognising the circumstance that technology incubators are still very new concepts in Nigeria.
- Participant technology incubators should feature an incubator manager, board of directors and advisers that forms its management team.

Even though preliminary investigation showed the presence of a number of incubators within Nigeria, it was shocking to discover that, on arriving in Nigeria to conduct the pilot study, (discussed further in 4.5.2), a majority of these incubators were, in fact, non-functional. At the time of the visit, between June 2016 and September 2016, there were only two active incubators in Lagos. An incubator is said to be active when it has an active online presence; technology ventures present, with a goal to graduate them; dedicated workspace for the ventures; an incubator manager; financial backing, and is reported as active by other stakeholders. An interesting example was a visit to a particular incubator where the researcher requested to speak to the incubator manager: It was surprising to observe that the incubator manager was never around, even after several visits and, as a result, there was a clear lack of direction at this particular incubator. Individuals in the incubator were seen to be engaged in free activities, such as playing video games, sleeping on a couch and eating nuts in the

middle of the worktable. Several visits and attempts to get access to the incubator manager were fruitless and this incubator was marked as inactive.

For the purpose of this study, there were two active incubators which met the predefined inclusion criteria of this study and met the generally accepted definition of incubators as outlined in Chapter 2.5. The first active incubator – IDEA Hub is a privately-operated incubator, supported with government funding, while the second active incubator – Co-creation Hub is a privately-run incubator backed by private sources of finance.

In research, selection of representative samples from a population can be challenging (Newby, Watson and Woodliff, 2003). Sampling procedures in qualitative research are not rigidly or systematically set as in quantitative studies. As such, to gain in-depth insight into technology entrepreneurship and technology incubators in Nigeria, the researcher set out to interview as many respondents as possible that met the inclusion criteria. As incubators host technology ventures at various stages in their entrepreneurial journey, the researcher made sure to include a range of entrepreneurs from the very base of the pyramid to entrepreneurs who had graduated from the incubator.

In addition to entrepreneurs and incubator managers, other stakeholders were interviewed, including a scholar in the entrepreneurship field in Yaba College of Technology, who authored a well-referenced journal on technology incubators in Nigeria. The researcher also interviewed a venture capitalist, a technology journalist and an evangelist for Lagos technology entrepreneurial community. The general assumption of generalisation from a sample, as argued by some researchers (Polit and Beck, 2010), is neither possible nor desirable in qualitative research (Neergaard and Uihøi, 2007). The aim of qualitative research is not to obtain representativeness, but rather undertake useful study that will generate substantive information that will contribute knowledge and illuminate the phenomena being studied, and on this basis, facilitate naturalistic and analytical generalisation (Sandelowski, 1995).

Overall, 31 interviews were conducted involving: twenty-two (22) entrepreneurs, four (4) incubator executives, one academic, one angel investor, one technology journalist, a chief executive of a technology-education-focused non-governmental organisation, and a technology entrepreneurship evangelist. Of the twenty-two technology entrepreneurs interviewed, six had graduated from the incubator, so their discussion of their incubation experience and its impact on the post-incubation period was in retrospect. It is important to note that two of the entrepreneurs interviewed did not meet the preliminary criteria, as they were incubated outside of Nigeria. However, the researcher found it useful to interview them to provide some insight into how their incubation was different from what is available locally. Although not directly useful in analysing the local incubation process, they were however

useful in understanding the overall technology entrepreneurship landscape in Nigeria as stakeholders.

These interviewees were selected through purposive sampling (Bryman and Bell, 2015) and an unexpected snowballed list (Heckathorn, 1997, Bryman and Bell, 2015), gathered from speaking to participants and notable gatekeepers in the field. Purposive sampling allows the researcher to use their judgment to choose respondents with the proper knowledge and experience that will enable the researcher to sufficiently answer the research questions and thus meet the study objectives. Snowball sampling is a chain referral situation, where one participant leads to another (Noy, 2008). For instance, an incubator manager introduced me to a colleague who operated another incubator in a different state. The employment of the technique of intentional selection of participants in this thesis is based on the researcher's judgment in picking respondents that are considered relevant because of their experience, accessibility and knowledge of the subject area and goals of the study. Next is an overview of how the pilot stage of this study was conducted.

#### 4.3.2 Pilot Study

Pilot studies were conducted in June 2016, using methods such as interviews and on-site observation. In social science research, pilot studies can be used as feasibility studies; that is, a small-scale version of the actual field work study to test its practicality (Polit, Beck and Hungler, (2001). Also, pilot studies can be an instrument for pre-testing a particular research tool (Maxwell, 2012 p. 66 - 67). Pilot tests pre-inform and alert the researcher to potential pitfalls that could arise during their studies. It also informs the researcher on the practicality and suitability of selected methods and tools for the actual field study. De Vaus's (2013 p. 54) caution, "Do not take the risk, pilot test first" underlines the importance of conducting a pilot study.

For the pilot study in this research, the researcher visited incubators in the capital city of Abuja. Abuja happens only to have one functioning incubator that meets the criteria for this research. At the time of the visit, a new incubator had just launched and was hoping to begin the incubation process in August 2016. Although this incubator was visited, no formal interview was conducted on the premises. Another organisation which had the word 'incubator' included in its title, was visited. However, the on-site visit and a formal chat with its CEO revealed that, although the organisation had the name 'incubator' in its name, it operated only as a co-

working space. As a result, there was only one incubator operating in the whole of Abuja, which will be referred to as 'Abuja Incubator' for the purpose of this research. Abuja Incubator is the leading and only incubator in Abuja, driving technology entrepreneurship in the capital city. It began operation in 2009, but it began functioning actively as an incubator in 2013. Four entrepreneurs were interviewed in Abuja incubator as part of the pilot study. Their ventures covered sectors such as food and retail, business services, and education.

Useful lessons were learnt from the pilot study. For instance, the pilot studies revealed that most of the respondents were comfortable with speaking about their ventures, regardless of the location, which was mostly outside of the incubator. This meant the researcher had to be mobile and flexible. The researcher also quickly discovered that accessibility to certain participants would be a concern. Although the incubator manager was eager for the researcher to speak to the entrepreneurs, it was still up to the researcher to get in contact with each entrepreneur, which was indeed a difficult task. Although information of the tenant ventures was available online, direct telephone contact details were missing, and online contact forms to the entrepreneurs were not returned. It was also the case that the pilot study enabled me to have a clear understanding of the appropriate questions to ask during the interview, avoiding repetition where necessary. This improved the credibility of the research process. Furthermore, the pilot confirmed to me that the qualitative approaches employed were best to answer the research questions and achieve the research objectives as stated in the previous chapter. Finally, the pilot study revealed that there were no real issues with the research instrument, thus generating confidence to proceed.

Having discussed the strategy used in selecting the sample area, the data collection methods, and the pilot study, the next section discusses the field work exercise, detailing how the data were accessed, collected and treated.

#### 4.3.3 Data Collection

In order to get an in-depth understanding of the entire technology entrepreneurship process, data were collected by means of semi-structured interviews from the technology entrepreneurs and their technology ventures. Furthermore, another set of interviews was conducted on the technology incubators and their management team. This included investors, business professionals, and academic scholars. Additionally, government officials involved in technology incubators, either by setting business and technology policies or as investors, were included in the study.

The additional interview data from the incubator management team formed a substantial source of additional insight from highly knowledgeable actors in the technology entrepreneurship process, as well as helping to control for interpretive bias on the researcher's part (Eisenhardt and Graebner, 2007).

An interview guide (see appendix I) was designed and used as a guideline to address important areas in the research study from the perspective of the interviewee. Questions in the interview guide encompassed the research focus and have been extracted from the TE-TI schematic diagram presented in section 2.8.

In addition to conducting semi-structured interviews, on site observations were utilised to understand further the functioning of the technology incubator in its natural environment and setting (Blumberg, 2014). This involved joining in on team meetings, observing idea development meetings, pitching competitions and generally witnessing how the entrepreneurs and their ventures operate within the incubator. During the field work exercise, the researcher visited the incubator daily during working hours, from 9am to 5pm.

While interviews provided direct interpretation from the standpoint of the participants, on-site observation enabled me to understand and draw inferences on the perspective of the participants which could not be obtained by interview alone (Bryman and Bell, 2015). By observing the participants' behaviour in the setting of the incubator, and within events in the incubator, the researcher was able to complement and provide a narrative of the role of the interviewees. The table below is a summary of the empirical work and respondents:

*Table 9: Summary of Interview data I – Entrepreneurs and their ventures*

Entrepreneur	Type/Sector of Technology Venture	Incubator	Incubator location	Operated	Sponsored
Entrepreneur 1	Maternal care	Incubator A (Co-Creation Hub)	Lagos	Private	Private
Entrepreneur 2	Advertisement				
Entrepreneur 3	Gaming				
Entrepreneur 4	Transport				
Entrepreneur 5	Data interpretation				
Entrepreneur 6	Job / Internship				
Entrepreneur 7	Transport	Incubator B (IDEA)	Lagos	Private	Government
Entrepreneur 8	Education				
Entrepreneur 9	Tourism				
Entrepreneur 10	Education				
Entrepreneur 11	Property				
Entrepreneur 12	Telecommunication				
Entrepreneur 13	Transport				
Entrepreneur 14	Mobile				
Entrepreneur 15	Food	Incubator C (Enspire)	Abuja	Private	Government
Entrepreneur 16	Business services		""		

Entrepreneur 17	Food				
Entrepreneur 18	Education services				
Entrepreneur 19	Financial technology				
Entrepreneur 20	Logistics				
Entrepreneur 21	Engineering	Government Incubator	Lagos	Government	Government

Table 10: Summary of interview data II - Stakeholders

Incubator Management	Three incubator Managers One Operation Manager
Yaba College of Technology	Senior Lecturer and Training Coordinator at Centre for Entrepreneurship Development (Yaba College of Technology, Lagos Nigeria)
Investor	Head of Lagos Angel Network SEEDSTARS Country Manager
Media	Focus group of technology journalist from a top technology blog
Government	One official from the Lagos technology incubation centre
Other	CEO of a non-government organization focused on technology education for youths CEO of a business co-working space

#### 4.5.4 Data Collection Process

As indicated in the previous section, the qualitative method employed involved in-depth interviews with technology venture entrepreneurs, incubator managers and other technology entrepreneurship stakeholders. The research project benefitted from the researcher's local knowledge of the area under study and the particular environment of investigation. This is in line with the traditional nature of qualitative research, which focuses on understanding social reality in their own terms through provision of rich descriptions of people and interactions in their natural setting. As a result, the researcher's knowledge of the field of study renders a substantial advantage.

Initially, a semi-structured format of questioning was adopted. This consisted of strings of open-ended questions, following an interview guide which enabled me to plan and have a coherent flow of questions. However, in some cases, the interviews became unstructured and

the researcher had to follow the thread of the respondent's answers to determine the next line of questioning. This is not a disadvantage, as unstructured interviews allow spontaneous generation of questions in the normal flow of an interaction and can form a natural extension of participant observation during fieldwork (Patton, 2005).

During the interviews, discussions were allowed to develop naturally, although the researcher endeavoured to keep the conversation within the scope of the studies. In many cases, the interviews became quite personal and the respondent divulged some personal information and concerns. This is good practice, as it takes care of a defect identified with interviews, which is that interviews can be a one-way conversation. Conversely, having a conversation signifies that the interview is taking the shape of a two-way conversation. The average duration of the interviews was between 45 minutes and one hour. In the most part, notes were taken alongside the interview recording. Audio recording was used in all cases and most respondents were happy to be taped, except for one respondent who was quite rude and disrespectful to me. Needless to say, the respondent called me back to apologise for his behaviour. Below is an example of a typical discussion with an entrepreneur within an incubator;

Me: That's good. How long have you been in the internet incubator?

E13: I joined the system in, 2012 for the informally incubation was, 2010 that's when we started our partnership over the years.

Me: How did you get in?

E13: There was a competition where we came second that was how we formally got here, by virtue of that competition we won \$2000 we had to then to do small pilots and then we took it beyond there. That's when we got in.

Me: That's nice. What resources does the incubator provide for you?

E13: So, there is the space as we see here and there is internet facility under this par then there is this general infrastructure there is other support system in terms of mentorship in terms of access to networks in terms of finances.

Me: It makes me ask this question because, so I saw and hear from everyone that they provide physical. Now in the whole Nigeria where there is power, there is internet, and internet price are already fallen, what do you think would be the place of the incubator there?

E13: I think will then be maybe in terms of taking the business beyond-- in terms of scaling the business in terms of probably raising more money, in terms of accessing the larger networks of founder's access, if we take out the infrastructures then we need mentorships that there is the experience you can't take away from them

On-site observation was useful in the research study. It gave me a clear picture of the process of technology entrepreneurship and resources provided by the technology incubators. The researcher was privileged to sit in some meetings between incubator managers and tenant entrepreneurs and attended events hosted by the incubator. The on-site observation was also useful in understanding the environmental circumstances of technology entrepreneurship in



Nigeria. The environment, although noisy and chaotic, still bore a sense of optimism among the participants.

The research study was concluded after theoretical saturation was achieved, which is the stage in a study where any further sampling and data collection generates no new conceptual insights (Bowen, 2008). Many researchers have attempted to suggest some guidelines around sample size for qualitative research study. For instance, Sandelowski (1995) suggests that a qualitative sample size of ten may be adequate for sampling among a homogenous population. Creswell (2012) recommends five to 25 for phenomenological studies, while Morse (2000) suggests at least six. According to Charmaz (2006, p. 114), "(25) (participants) are adequate for smaller projects." Ritchie, Lewis and Elam (2003 p. 84) on the other hand, advise, qualitative samples often "lie under 50." Green and Thorogood (2013, p.122) state that "the experience of most qualitative researchers is that in interview studies little that is 'new' comes out of transcripts after you have interviewed 15 or so people." Furthermore, Neergaard and Ulhøi (2007) assert that, in reality, it can be difficult to determine the point of redundancy or saturation during a research study. Ultimately, as Sandelowski (1995) emphasises, deciding the size of qualitative research is essentially a question of judgment and knowledge in assessing the quality of the information collected against the purpose to which it will be utilised, the specific research method and purposeful sampling strategy employed, and the research outcome anticipated.

#### 4.3.4 Triangulation

As discussed in the methodology chapter above, triangulation is a potent procedure that assists validation of data through cross-checking from more than two sources (O'Donoghue and Punch, 2003). It refers to the application and combination of various research methodologies in the study of the same phenomenon. Combining the viewpoints of many observers, theories, methods and empirical materials, gives the researcher the ability to overcome the limitation or inherent biases that could rise from single method, single observer and single theory studies (Thurmond, 2001).

In this research study, triangulation began from the piloting stage and lasted throughout the duration of the study. For instance, responses from the entrepreneurs and the incubator management were cross-checked and analysed against each other. Responses from the stakeholders were also cross checked and analysed against responses from entrepreneurs and incubator managers. This sometimes resulted in harmonious or conflicting conclusions, as will be discussed in the analysis chapter below.

The on-site observation was also instrumental in understanding the natural setting and state of technology entrepreneurship in Nigeria. As a result, the researcher was able to gain a much broader and in-depth insight into technology entrepreneurs and technology incubators in Nigeria. Furthermore, the growth and development of technology entrepreneurship are often reported by technology-focused media websites (see detail in table 11 below). Throughout the research period, these media sites were constantly monitored, and they proved valuable as dependable sources, with extensive information for the research study. For instance, it so happened that while the researcher was in the field collecting data, there was an article (Ndiomewese, 2016) that was posted, inspired by a founder of a leading technology venture. The article sparked a debate in the technology community and was in line with some of the questions of this research study and became a reference point for subsequent interviews.

*Table 11: Nigerian Technology Media Websites. Source: Author's own*

<b>Website</b>	<b>Year founded</b>	<b>Rank in Nigeria tech</b>	<b>Audience</b>
Tech Cabal - <a href="http://techcabal.com/">http://techcabal.com/</a>	2013	#1	Developers, CEOs, Technology venture Founders and Investors
Tech Point - <a href="https://techpoint.ng/">https://techpoint.ng/</a>	2015	#2	Technology venture Founders, Developers and Gadget Lovers

Triangulation increases credibility, and in this research study, triangulation was conducted by 'methods triangulation', i.e., consistency of findings generated through different data collection methods, such as comparing on-site observation with interviews and interviews with written material; and by triangulation of sources; that is, consistency of different data sources with the same method, such as comparing the responses of different interviewees.

#### 4.3.5 Negotiating Access

A vital element of any research study is the issue of gaining access (Bryman and Bell, 2015). It was important to reflect meticulously on how and where to locate the entrepreneurs, incubator managers and other stakeholders. The initial idea was to visit the incubator and gain access through the incubator manager. This proved not to be as straightforward as initially thought. The pilot study revealed that it was possible for the entrepreneur not to be physically

present at the incubator. Although the incubator managers were happy for the researcher to speak to the entrepreneurs, it was up to the researcher to locate and speak with the entrepreneurs. Nonetheless, in cases where the entrepreneurs were present in the incubator, the managers were instrumental in making first introductions. This was important as it created familiarity with the entrepreneurs and enabled a swift interview process. Furthermore, the researcher was smart enough to present a detailed research overview in a graphical format. This was instrumental in portraying professionalism and know-how on the part of the researcher to participants. More importantly, it gave participants insight into the research study and their role in the project, which was found very refreshing.

Nonetheless, accessing certain individuals still proved abortive. Recognising the constrained time to complete the field work, the researcher resorted to locating and visiting the participants at their place of work, regardless of an invitation. A useful dimension of being an insider is the ability to understand the local system, attitudes and ways of conducting business. For instance, emails are not widely used as modes of communication; phone calls and sometimes just turning up at the premises resulted in more progress with several entrepreneurs. However, some entrepreneurs and stakeholders were still hard to reach, as they refused to return phone calls, emails, or texts. This was more common among the government officials, who had a very tedious, bureaucratic process that ensured the researcher was unable to reach the person of interest. Several visits to a venture capitalist were also fruitless. Despite the occasional setbacks in gaining access to certain individuals, the researcher was able to complete a sufficient number of interviews for the research study

Having discussed the data collection process and field work exercise, the next section explains the data analytical method employed in this study

#### **4.4 Data analysis**

The data were analysed using thematic analysis. Thematic analysis is a form of qualitative data analysis that develops insights from multiple data sources, and attempts to inductively cross reference, assess and interpret linkages to the foregoing research questions. This is achieved by a process of familiarisation, indexing, coding, charting, and mapping key issues, themes, and categories (Ritchie and Spencer, 2002). Marshall and Rossman (2014) identify four purposes of carrying out research: 1) exploration 2) explanation, 3) description, and 4) prediction. Consequently, this research was concerned with, a) exploring how technology ventures in Nigeria leverage the resources provided by technology incubators; b) explaining what is to be found from the analysis and evaluation of the characteristics of technology

entrepreneurs; c) describing what unique resources are provided by technology incubators in Nigeria; and d) diagnosing and predicting how the resources provided by the incubator are bundled and utilised by, first, the technology entrepreneur, and then their ventures.

#### 4.1 Analytical Approach

The data were analysed manually, using a 'framework' approach. The framework approach is an analytical method of qualitative data analysis that involves a process of familiarisation, identifying a thematic framework, coding, charting, mapping and interpreting data according to key issues and themes (Ritchie and Spencer, 2002).

When looking at the data analysis stages, the first step involved the process of familiarisation with the data. At this stage, the researcher was fully immersed in the data to gain an overview of the data collected. This process included listening to the recorded interviews, reading transcripts and studying observation notes. The recorded data were meticulously transcribed into written format for easy comprehension and analysis. The next stage is where the Interview transcripts underwent a process of collation and cleansing in preparation for analysis. This involved resolving quality issues, rectifying mistakes such as misspelling, duplication, and inconsistencies. The next step in the analysis involved identifying a thematic framework informed by the original research aims, emergent issues raised by interviewees, and analytical themes arising from recurring views or experiences. This was carried out by extensively analysing the interview transcripts 'line-by-line' to assign conceptual labels (codes) to verbal descriptions that represented a concept. The coding phase is the process of identifying a feature of the data that appears interesting to the researcher. It is "the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon" (Braun and Clarke, 2006, p. 18). The codes were then organised into meaningful categories based on shared concepts. As the analysis progressed, the codes were closely observed and examined to identify recurrence, similarities, differences or profound insights for themes to emerge. The codes were collated, analysed, sorted and appointed to a broader representative meaning, known as the theme (see appendix V). These steps did not automatically take place in set stages; rather the researcher shuffled between stages until new themes and insights emerged. The use of visual representations, such as shown in figure 4 below was useful at this stage to sort the different codes and spot emerging themes (see appendix IV). The final step involved interpretation and discussion of the emerged themes.

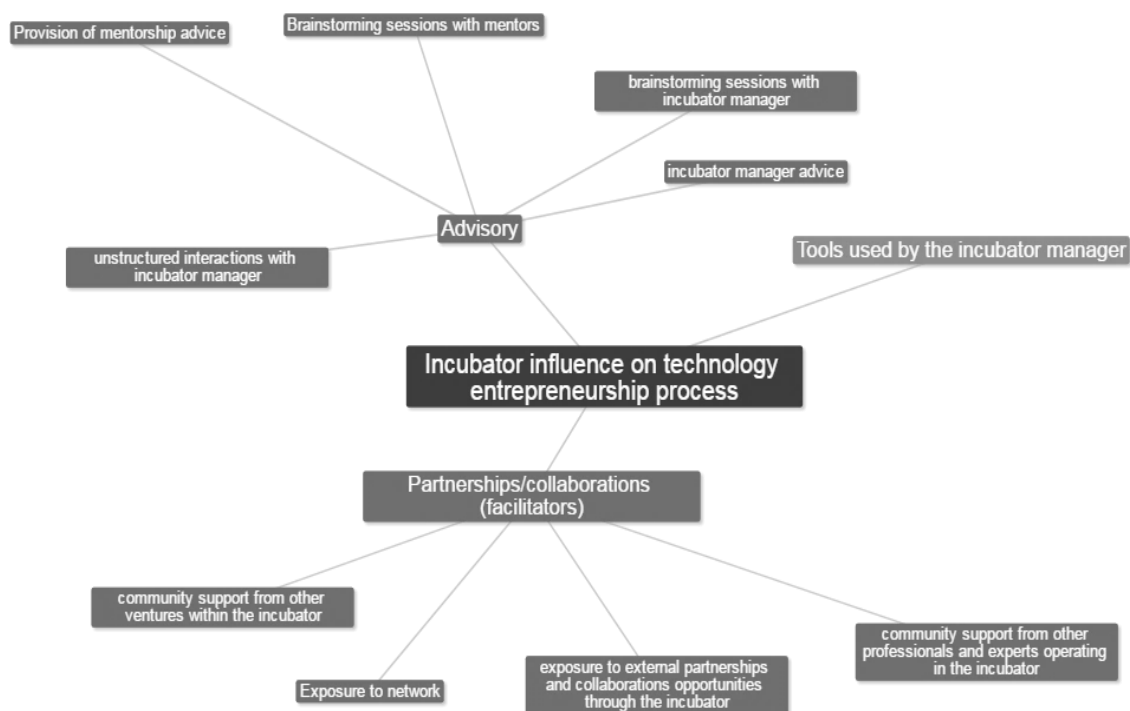


Figure 4: A visual representation of codes and themes on incubator influence on the technology entrepreneurship process

## 4.5 Quality and Validity

It is necessary for researchers to specify ways they ensure the quality and validity of their research. The measurement of quality and validity in qualitative research differs from quantitative research. The quality of a research study is linked to its reliability, while validity relates to the ability of the researcher to measure, identify, and observe the proposed phenomena. Furthermore, validity also refers to conceptualisations of potential threats to the research study and strategies and how they can be dealt with.

Possible quality and validity threats of this thesis included;

1. Participants becoming conscious of the fact they are being interviewed, tested or observed, which could lead to distorted outcomes as a result of withheld or misrepresented experiences. As an involved researcher, the researcher dealt with this

threat by ensuring participants were comfortable and felt free to disclose any experience relevant to the research study. The researcher created a very good rapport with the participants and guaranteed them absolute anonymity.

2. There was the risk of biased responses from participants within a particular incubator. This might have been in the form of exaggeration, misinterpretation, or misleading statements in the course of the interview. Observing the participants in the natural setting of an incubator enabled me to supplement and cross-reference the varying interview responses. Additionally, data from secondary sources helped me combat skewed responses that emanated from the interview.
3. Resident entrepreneurs within an incubator might feel pressured to speak in favour of the incubator and withhold any negative experience. This might be due to the presence of the incubator manager within the premises. Fortunately, all of the entrepreneurs were able to speak freely to me about their experiences. Moreover, we had private rooms to chat, which were away from the presence of the incubator manager.
4. There might have been self-interpretation bias that could have risen from interpreting the interview responses from participants. In this case, respondent validation was utilised to rule out the possibility of misinterpreting the meaning of participants' words or actions and their perspective. Where the researcher was unclear about a particular explanation, the researcher often returned to the respondent to get clarification.

A critical issue for researchers concerns the external validity (generalizability) of the results of their work. Generalizing relates to the inductive prediction of expectations on a larger population, based on observations of a sample from a specific population. However, Walsham (1995, p. 79) advises that generalizations in the social sciences "should be viewed as 'tendencies,' which are valuable in explanations of past data but are not wholly predictive for future situations." Inductive development of concepts, specific implications, and the rich contribution of in-depth insight is a primary interest of this research. Thus, this research will attempt to rigorously analyse, interpret and produce observations that are contextually unique and significant for the express purpose of formulating transferable expectations. These transferable concepts and implications can be applied to a similar context, such as developing countries and sub-Saharan Africa.

Internal validity was strengthened by the triangulation of data and extensive application of thematic analysis to diminish threats and leverage the methodological strengths (Creswell, 2003). The issue of reliability, which relates to dependability, is primarily concerned with consistency of measures or judgments. Reliability in this research is reinforced by careful selection of research participants, organised fieldwork notes and interview transcripts,

systematic processing of each data set, deliberate interactions with the primary subjects and the manner in which the data are elicited and captured.

#### **4.6 Research Ethics**

Research ethics were considered at every stage of the research process. Participants were informed of the purpose of the research, as well as how the research would be used for the needs of the thesis. The researcher also made them understand the importance of the research study to the wider community of technology entrepreneurs, investors, and other stakeholders. At the beginning of any meeting with a participant, the researcher presented a written document that stated the overview of the research and its objectives. Participants were given the chance to take part freely in the research process or decline if necessary. They had the liberty to withdraw from the study at any point without any negative consequence (Bryman and Bell, 2015).

Before the interview began, the researcher notified the interviewee of the types of questions that would be asked in the course of the interview and requested them to consent and sign a research ethics form (example in appendix II). The research ethics form requests the concurrence of the interviewees to participate in the interview and observation process, as well as seeking permission to use the interviews for internal and external examinations. Furthermore, the ethics form sought permission for original names to be used and subsequent publications produced; and requested consent for the utilization of an audio device for accurate data collection and transcription. The participants were notified when the transcripts were completed and sent a copy for verification and approval.

#### **4.7 Research Reflexivity and Participatory Ethics**

The perspective or position of the researcher shapes all research. As such, a researcher ought to be alert to their own thought and the source of their ideas. This is known as reflexivity. According to Malterud (2001, p. 483 - 484), "A researcher's background and position will affect what they choose to investigate, the angle of investigation, the methods judged most adequate for the purpose, the findings considered most appropriate, and the framing and communication of conclusions." Reflexivity challenges how a researcher's bias and knowledge of a particular study influence the outcome of the study. Integrating reflexivity with qualitative research

means the researcher is alert to how the diverse elements of their identities (for example, gender, race and class) become crucial during the research process.

According to Alvesson and Skoldberg (2000, p. 5), reflexivity is a continuous awareness of and attention to 'the way different kinds of linguistic, social, political and theoretical elements are woven together in the process of knowledge development, during which empirical material is constructed, interpreted and written.' It is important that the inevitable bias of a researcher is in some ways recognised and explored. Johnson and Duberley (2003 p. 1279) argue that, in order to understand ourselves as researchers and educators, "we must engage with ourselves through thinking about our own thinking."

In this study, reflexivity concerns were taken into consideration throughout the duration of this study. For instance, the researcher's exposure, background and ethnic heritage were important factors in understanding the attitude of participants and the study in itself. For instance, several previous studies in the field of technology incubators had identified more existing incubators in Nigeria. While this is partially the case, due to understanding of the local government, the researcher was quick to distinguish that, although, theoretically, these incubators exist, they are dysfunctional and misplaced. Secondly, there was a misconception about the definition of incubators. Essentially, the facilities were more of science parks than incubators (Discussed further in the discussion chapter below). Thirdly, these incubators were government backed and operated, which means that, like most government projects, they end up just being promises.

Knowing all these issues, the researcher still set out to investigate a government-backed and operated incubator in Lagos - the commercial capital of the Nation. This particular 'incubator' was mentioned and included in studies reported by previous researchers. The investigation involved speaking to the alleged incubator's officials and entrepreneurs. More importantly, several visits were made to the site of the facility to observe activities as reported by previous researchers. This task was important, as it enabled me to make informed conclusions about the state of government-operated technology incubators in Nigeria and how they impact the current study.

Knowing how reflexivity could potentially influence the trustworthiness of the research (Bryman and Bell, 2015), further precautionary measures were taken. The researcher was guided by Westerlund's (1991 p.21) suggestion that, in order to reduce the influence of reflexivity, a researcher "should aim at as pure a description as possible." Consequently, accurate representation of the data was ensured by reporting the responses of the participants as exactly and honestly as possible. Furthermore, the analytical approach involved constantly



filtering information from the participants, examining it through relevant theoretical lenses, and cross-validating it is using other sources of data, such as on-site observation.

The next section provides a summary of the research methods discussed above.

#### **4.8 Summary**

This chapter explained the methodological approach undertaken in this thesis. First, the rationale for selecting a qualitative research strategy was explained, which included the thesis's emphasis on understanding in-depth processes, inductive theory generation, and interpretive epistemological orientation. Second, the research design was discussed, including the methodological techniques applied. The research design was motivated by the need to gain insightful knowledge about the development of technology entrepreneurship in Nigeria and the role of technology incubators.

Analysis of prior research approaches in this area of research in Nigeria showed a skewed outcome which was obviously focused on government-funded and -operated incubators. Moreover, these studies based their results on empirical data which was mostly inaccurate and out of date. As a result, this research employs semi—structured interviews as the choice of methods best suitable for the research study, supplemented by participant observation and secondary sources of data. The combination of methods is chosen because of its ability to capture the complex reality of technology entrepreneurship and the role of incubators from the perspective of the entrepreneurs, incubator managers and other stakeholders.

Third, time was spent discussing the criteria for selection of participants. Participants were selected based on purposive sampling, on the likelihood that these participants would offer theoretical insights. Additionally, an interview guide was provided to direct and ensure the interview followed a reasonable order. Fourth, the region in which the study took place was described with a map outlining the locations of top technology ventures and incubators in Nigeria. At the time of the study, there were two active and functioning incubators in Lagos, Nigeria and these were the primary source of entrepreneurs and incubator managers for the study. Thirty-one (31) interviews were conducted and the research study was concluded once it reached a state of theoretical saturation. Table ... summarises the key issues that were studies, the data collected, their source, and analyses conducted.

Fifth, the pilot study was explained, which included discussion on the location and respondents who participated, as well as issues that influenced the rest of the field study, such as accessibility and methodological approaches. The issue of negotiating access was discussed. In the study, the researcher used initiatives such as presenting a visual summary of the research study, and uninvited visits to some entrepreneurs' offices. Sixth, the data analysis

was discussed. This involved a process of familiarisation with the data, generation of codes and searching for themes. This led to discussion of quality and validity of the research work, outlining potential validity threats and how they might be resolved. Seventh, the research ethics section explained how the research participants were treated ethically and informed on how the research might affect them. Finally, reflexivity is discussed, where the researcher discusses how existing knowledge of the environment of study influenced the outcome of the research study.

During the research, constant efforts were made to reinforce every aspect of the research process. However, some limitations still remain (discussed in chapter 8.4). The next three chapters - chapters 5, 6, and 7 - will report, analyse and discuss the findings of this study

Table 12: Table showing summary of key issues, data sources and analyses conducted

	<b>Key Issues Under Investigation</b>	<b>Data collected and source</b>	<b>Data analyses</b>
	Qualities and experiences of entrepreneurs in technology incubators	Conducted 21 semi-structured interviews of entrepreneurs across 3 incubators (See appendix 1 for interview guide – Part A))	Data is collated and analysed to develop a typology for Nigerian entrepreneurs in incubators using the MAD acronym (see chapter 6)
	Resources provided by Nigerian incubators for entrepreneurs <ul style="list-style-type: none"> <li>• Classification of incubators in Nigeria</li> <li>• Selection process</li> <li>• Resources provided</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted 4 semi-structured interviews of incubator management staffs (see appendix 1 for interview guide – Part B)</li> <li>• Onsite visit and observation</li> <li>• Leading technology websites and such as techpoint and techcabal</li> <li>• International report from World bank on tech hubs in Africa</li> </ul>	<ul style="list-style-type: none"> <li>• Analysed data to identify the classification of incubators in Nigeria</li> <li>• assessed the predominant selection process utilised by Nigerian incubators</li> <li>• Analysed the resources provided by the incubators.</li> </ul>
	Resource implications for the technology entrepreneurs and ventures	Interviews were conducted on technology entrepreneurs, incubators managers, and other stakeholders.	Analysed data to derive themes on resource implications on the entrepreneurs, resource implications for the venture creation process, and unintended outcomes of resources for both the entrepreneurs and their ventures.

# CHAPTER 5: Understanding Nigerian Technology Entrepreneurs

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## 5.1 Introduction

The general aim of this thesis has been to understand technology entrepreneurship and the technology entrepreneur in Nigeria, with a focus on investigating the impact of technology incubators on the technology entrepreneurship process. As previously established, the primary duties of incubators are to provide resources to tenant firms with the aim of helping them survive and thrive. This helped to form the theoretical base and schematic diagram (in chapter 2) that informed this thesis – examining how the process of technology entrepreneurship leverages the resources provided by technology incubators, using the resource-based view theoretical framework. The RBV framework states that a firm or organisation will gain competitive advantage if it is able to get access to resources that are valuable, rare, inimitable, and non-substitutable. Adapted to entrepreneurship by Alvarez and Busenitz (2001), RBV suggests that the ability of an entrepreneur to be alert to opportunities is, in itself, a resource, thus making the individual entrepreneur a valuable resource. The resources provided by the incubator require an entrepreneur who has the propensity and intuition to combine and organise these resources into productive outcomes.

The research objectives were designed to provide knowledge which is linked to the gaps in the literature discussed in previous chapters. First, it was found that, across business incubator studies and within technology entrepreneurship studies, there is a lack of in-depth study of the relationship between technology business incubators and technology entrepreneurship. Second, very few studies consider the perspective of the technology entrepreneur, as most studies are designed around the incubator facility and its management. Third, despite the recognition that technology incubators have a positive impact on the region in which they are embedded, through the creation of jobs, technical knowledge, new firms and economic development, a majority of the previous studies have focused on more advanced countries, with very few studies on developing countries and even fewer in sub-Saharan African countries.

Finally, very few studies attempt to explain how the impact of technology business incubators influences the technology entrepreneurship process. Furthermore, in reviewing the literature on technology entrepreneurship and technology incubator studies in Nigeria, the following issues emerged; First, most of the studies, aside from Adegbite (2001), are conceptual and descriptive in nature. Second, all the authors have focused only on government-sponsored incubators. Third, none of the research included a proper investigation of the entrepreneurs and their ventures. Fourth, all of the studies were carried out in small, concentrated areas,

ignoring the well-established business hub of the nation or the capital state, Lagos and Abuja respectively. Finally, none of the studies makes any reference to how the technology incubators influence the development of technology entrepreneurship in the region.

In view of this study's stated objectives (stated in chapter four), the research set out to answer the following questions – i) What are the qualities and experiences of entrepreneurs in technology incubators and how do these qualities affect their ability to start and grow a new venture in the context of the incubator? ii) What resources are provided by Nigerian incubators and how do these resources help nurture and develop technology ventures in the region? iii) What are the resource implications for technology entrepreneurs and their ventures in the context of resource-based view theory?

Having described and explained the field study and qualitative methodology utilised to approach the empirical analysis in the previous chapter, the chapters that follow present the findings with analysis and discussion of the data that emanated from the field work. The chapters are structured and arranged to broadly highlight and present findings and analyses concerning the entrepreneur and the technology incubator, in accordance with the research questions stated above. On examining the findings, significant categories emerge via initial data examination. Following further analyses and pattern recognition, these categories are thematically arranged under each element of study, with exemplary narratives to accentuate them.

This chapter begins with understanding the Nigerian technology entrepreneur by discussing findings on their educational background, business/work experience, and personal attributes and motivation.

The table below is an overview representation of the twenty-one entrepreneurs, representing twenty-one business ventures that were interviewed.

Table 12: An overview of the entrepreneurs interviewed.

Unit	Gender	Incubator Affiliation	Time frame in Incubator	Education	Type of venture	Venture Location	Previous business experience	Previous professional experience	Stage in T.E Process
<b>Entrepreneur 1</b>	Male	IDEA Hub	In second year (Over one year)	1 <sup>st</sup> Degree (local)	Education	Yaba	Novice	Technical	Launched
<b>Entrepreneur 2</b>	Male	IDEA Hub	In second year	1 <sup>st</sup> Degree (local)	Transport	Yaba	Unsettled entrepreneur	Management	Product development
<b>Entrepreneur 3</b>	Male	IDEA Hub	10 months	1 <sup>st</sup> Degree (local)	Education	Yaba	Unsettled entrepreneur	Management	Launch
<b>Entrepreneur 4</b>	Male	IDEA Hub	6 months	1 <sup>st</sup> Degree (local)	Entertainment	Yaba	Unsettled entrepreneur	Technical	Launched
<b>Entrepreneur 5</b>	Male	Enspire Incubator	9 months	1 <sup>st</sup> Degree (local)	Food	Abuja	Novice	Management	Product development
<b>Entrepreneur 6</b>	Female	Enspire Incubator	2 months	2 <sup>nd</sup> Degree (International)	Education	Abuja	Habitual	Management	Launched
<b>Entrepreneur 7</b>	Male	Enspire Incubator	2 months	1 <sup>st</sup> Degree (local)	Business service	Abuja	Unsettled entrepreneur	None	Product development
<b>Entrepreneur 8</b>	Female	Co-Creation Hub	1 year and 6 months	2 <sup>nd</sup> Degree (International)	Maternal care/education	Yaba	Novice	Management	Launched
<b>Entrepreneur 9</b>	Female	Co-Creation Hub	1 year	2 <sup>nd</sup> Degree (International)	Transportation	Yaba	Unsettled entrepreneur	Technical	Launched
<b>Entrepreneur 10</b>	Male	IDEA Hub	1 year	2 <sup>nd</sup> Degree (International)	Telecommunication	Yaba	Unsettled entrepreneur	Technical	Launched

<b>Entrepreneur 11</b>	Male	IDEA Hub	1 year	1 <sup>st</sup> Degree (local)	Real estate	Yaba	Novice	None	Launched
<b>Entrepreneur 12</b>	Male	Co-Creation Hub	1 year	1 <sup>st</sup> Degree (local)	Transportation	Yaba	Unsettled entrepreneur	Technical	Launched
<b>Entrepreneur 13</b>	Male	Co-Creation Hub	3 years	1 <sup>st</sup> Degree (local)	Gaming and animation	Yaba	Unsettled entrepreneur	None	Launched
<b>Entrepreneur 14</b>	Male	IDEA Hub	3 months	1 <sup>st</sup> Degree (local)	Tourism	Yaba	Novice	None	Opportunity Discovery
<b>Entrepreneur 15</b>	Male	Co-Creation Hub	3 years	1 <sup>st</sup> Degree (local)	Data analytics	Yaba	Habitual	Management	Launched
<b>Entrepreneur 16</b>	Female	Enspire Incubator	1 year	1 <sup>st</sup> Degree (local)	Food	Abuja	Novice	Technical	Launched
<b>Entrepreneur 17</b>	Male	Co-Creation Hub	6 months	1 <sup>st</sup> Degree (local)	employment/internship/students	Victoria Island	Unsettled entrepreneur	None	Launched
<b>Entrepreneur 18</b>	Male	Y-Cumbinator	3 months	1 <sup>st</sup> Degree (local)	Financial / payment services	Ikeja	Habitual	None	Launched
<b>Entrepreneur 19</b>	Male	Y-Cumbinator	3 months	2 <sup>nd</sup> Degree (International)	Logistics		Novice	Technical	Launched
<b>Entrepreneur 20</b>	Male	Co-Creation Hub	2 years	1 <sup>st</sup> Degree (local)	Advertising	Yaba	Unsettled entrepreneur	Technical	Launched
<b>Entrepreneur 21</b>	Male	Lagos State Incubation Centre	10 years	1 <sup>st</sup> Degree (local)	Engineering / manufacturing	Ijaiye	Novice	None	Launched

## 5.2 Who is the Nigerian Technology Entrepreneur?

As mentioned in previous chapters and subsequently illustrated in the TE-TI schematic diagram, the technology entrepreneur is central to the management, survival and success of their venture. Their leadership style, strategic decisions and knowledge of the business all affect the entrepreneurial lifecycle of their venture. Additionally, investors and stakeholders gauge a firm's potential and growth by assessing the attributes of its founders. Essentially, the characteristics of the entrepreneur and their firm's performance are strongly linked (Schumpeter, 1934; Gartner, 1988; Shane and Venkataraman, 2000a; Newton and Gary Shreeve, 2002).

Thus, to understand how the development of technology entrepreneurship in Nigeria is leveraging technology incubators, the researcher sought to first understand what characteristics, traits, and experiences make up the Nigerian technology entrepreneur tenanted in technology incubators. This will answer the first research question of the thesis - *What are the qualities and experiences of entrepreneurs in technology incubators and how do these qualities affect their ability to start and grow a new venture in the context of the incubator?*

Three important factors predominantly associated with entrepreneur characteristics are likely to influence their firm's growth: human capital, past experience and the motivation of the entrepreneur (Baum and Locke, 2004; Solomon and Lind, 2016). An entrepreneur's human capital is often assessed by their level of education (Gasse and D'armours, 2000, cited in Hichri, M'Chirgui and Lamine, 2016), which is often considered to be higher than that of the general population, particularly in technology entrepreneurship. Experience includes any previous professional and entrepreneurial experience, while motivation relates to the attributes that influence the entrepreneur's behaviour. Once the researcher analysed these constructs, that is, level of education, experience and motivation, against the entrepreneurs, it was discovered that the Nigerian technology entrepreneur can be summarised by the acronym M.A.D that is they are *malcontented* with their education, possess *amateurish* entrepreneurial experience, being novice and unsettled entrepreneurs, and finally they have a strong *determination* through their resilience and passion for technological solutions, to build ventures that will provide some sort of social impact. These findings are discussed in more detail below:

### 5.3 Education

Most of the entrepreneurs, who were predominantly male (90%), were graduates of science, technology, engineering, or maths (STEM) degree courses and had completed post-graduate courses or degrees. The term 'post graduate degree' is used to refer to any additional university degree or professional certification acquired by the entrepreneurs. Most (68%) of the entrepreneurs acquired their first undergraduate degrees from universities based in Nigeria. However, it is worth noting that the quality of Nigerian graduate degrees, particularly degrees from government operated universities, can hardly be compared to degrees from developed countries. This is because Nigerian education is plagued by many issues that hamper its delivery of quality graduate degrees (Odia and Omofonmwan, 2007). These issues include the carrying capacity of the universities, infrastructure/facility challenge, inadequate public financing, and academic staff inadequacies (Aluede, Idogho and Imonikhe, 2012). Adegbesan (2011) asserts that the Nigerian education system is in total shambles because inadequacies are the order of the day in terms of human and material resources. The researcher who happens to be of Nigerian descent, have been privy to some of the challenges that beset the Nigerian education system. There are tendencies for university programs to take longer than expected, due to strikes and other environmental or security issues and there are instances where students are offered different courses from their course of choice. This leads to the student stopping half-way to switch to their course of choice, thereby leading to an overall delay in the graduation time. For example, entrepreneur (3), who founded a venture that provides training to programming enthusiasts or inexperienced programmers who want to acquire professional programming skills and work ethics, noted:

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*I studied electronic engineering; that was when I dropped out almost at my fourth year In University of Nigeria, I decided to switch to computer science, and finally finished from computer science*

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Consequently, the researcher presumed that the incubators would be predominantly filled with graduates from foreign universities, because of their better understanding and exposure to the concept of technology entrepreneurship from more advanced countries. Additionally, a growing trend among the majority of executives of well-known technology ventures in Nigeria is that they have been educated in more advanced countries, like the United Kingdom and the United States. For instance, Jason Njoku of Irokotv, an online platform for watching movie and



tv series online, just like Netflix, is a graduate from the University of Manchester in England. Mark Essien of Hotels.ng, an online platform for enabling efficient booking and reservation of hotel rooms, is a graduate with extensive experience from Germany. Tunde Kehinde is the Managing director at Africa Courier Express (ACE), which is a new logistics company and was also cofounder of Jumia Nigeria, an ecommerce platform similar to Amazon.com: Tunde acquired his bachelor's degree from Howard University and an MBA degree from Harvard Business school. Thus, it was interesting to find that most of the entrepreneurs in the incubators were graduates of local universities.

More than half of the entrepreneurs (60%) had completed some form of post graduate degree after acquiring their first degree. They include MBAs, MScs or professional advanced certifications in project management, robotics and other certifications in their field of interest. For instance, entrepreneur 8 completed an M.Sc. from London School of Economics in England. In the case of entrepreneur 3, after completing his undergraduate degree, he acquired an advanced diploma in Robotics and Automation, as well other certifications in project management. It is worth noting, however, that there was no entrepreneur with a doctorate degree in any of the incubators. Only a few of the entrepreneurs were able to further their education in foreign universities, mostly in the United Kingdom. Generally, most Nigerian students wish to further their education, regardless of their area of focus. For the reasons explained above, education in Nigeria is viewed by most as unsatisfactory and requires topping up, and technology entrepreneurs are no different, as entrepreneur 2, founder of a venture that uses GPS technology to help road users navigate the traffic congestion of Lagos city explains:

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*I went to Yaba College of Technology studying civil engineering... with my passion, I will try to actually further (my education) not in Nigeria, I actually want to be able to impact the 21st century because what I learnt (in university) was more like about the 18th, 17th and 16th century*

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Generally, the entrepreneurs did not take away much from their university education in Nigeria. the researcher observed an overall dissatisfaction with the education system. Many of the entrepreneurs were allocated degree programmes they did not apply for. In other cases, they became unhappy with the subject area and decided to switch to a degree they hoped would equip them with more skills, just like entrepreneur 7, creator of an online software application that supports small businesses, below:

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*I studied chemical engineering and then switched to computer engineering. To be honest education in Nigeria is not the best. Even the computer engineering degree did not necessarily teach me how to become a good computer engineer.*

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Prior studies have noted the importance of advanced education for technology entrepreneurs. Technology entrepreneurs are considered to be highly educated and skilled individuals because of their involvement in ventures that require specialised knowledge and skills. These findings correlate with Barringer, Jones et al.'s (2005) discovery of the level of education of technology entrepreneurs; that is, possession of some level of advanced degree, mostly in engineering and science. Generally, graduate entrepreneurs are expected to exhibit a greater ability to access knowledge and a variety of resources (Busenitz et al., 2003, Voisey et al., 2006). However, findings from technology entrepreneurs in incubators in Lagos does not completely agree with Colombo and Grilli's (2005), who discovered that founders of new technology ventures located in technology incubators had a considerably rich educational background. This is because, as indicated by the above description of the education system in Nigeria, the entrepreneurs who graduated from such a system cannot be described as individuals with a rich educational background.

It is important to note that, contrary to previous work on the importance of advanced education in firm growth, the level of education of the entrepreneurs in the incubator did not directly reflect on the stage of the entrepreneur's venture in the entrepreneurship process. There were entrepreneurs, such as entrepreneur 10, with advanced degrees, who were still at the phase of developing their products, while there were entrepreneurs who had no advanced degree but had already launched their venture, such as entrepreneurs 11 and 13. As much as an entrepreneur's level of education can serve as a proxy for entrepreneurial skills, particularly in knowledge-intensive fields such as information and communication technology, it is not sufficient to influence growth in a young technology venture. This result concurs with Hichri, M'chirgui and Lamine (2016), whose work with Tunisian incubators and technology ventures found that a high level of education does not promote firm growth. Spending many years studying for grand degrees is not a guarantee of venture growth.

According to the resource-based view of entrepreneurship, the individual entrepreneur is, in itself, a resource because of their ability to stay 'alert' to opportunities. One of the ways an entrepreneur develops entrepreneurial alertness is through education (Alvarez and Busenitz, 2001). Education is important because it forms the basis of understanding, through which an entrepreneur is able to apply and combine knowledge and information to create products and

services. Solesvik (2013) suggests that the quality of entrepreneurs can be increased if their external environment is manipulated to encourage more people to gain access to education and training that foster an entrepreneurial mindset.

### 5.3.1 Myopic Education

After reviewing the education background of the entrepreneurs, the researcher found that the average Nigerian technology entrepreneur is a graduate of a myopic education system and thus malcontented with the quality of their education. They are essentially dissatisfied with the quality of education they have received and are in constant pursuit to improve their quality of education and acquisition of skills. This feeling was more noticeable among graduates of public universities in Nigeria. This is because the education system in Nigeria can best be described as myopic, as it is only concerned with churning out individuals with degrees, without regard to how applicable the degrees are in the workplace, as well as the practical skills acquired by the students. This accords with other, earlier observations which showed that Nigerian university education, which was previously recognised globally as respectable and acceptable, is fast losing its high esteem in the eyes of the labour market and members of the community, because the currently certified Nigerian graduates lack an acceptable level of competence in their areas of specialisation (Omoregie, 2008).

Aside from teaching, Nigerian universities are not engaged in research, commercialisation or technology transfer activities. This finding reflects that of Okafor and Dike (2010) who analysed the research activities of about 300 academic scholars in Federal Universities in the south western zone of Nigeria. The research found that, in a nine-year period, only 30% of the scholars published up to 4 journal articles; that only 2.7% of them published 30 or more journal articles during the period; and that as many as 42.1% did not have any article in overseas journals.

Nigerian scholars also do not have a great profile when it comes to commercialising technology research. There are very few research centres actively involved in technological research or the commercialisation of high-technology ideas and there are no evidential results to show for their existence (Owolabi et al., 2012). Some scholars suggest there are several reasons for this, such as readiness of the market, funding and nature of the technology (Salicrup and Fedorková, 2006; Govindaraju, 2010). Commercialisation failures could arise from weakness of R&D institutions, managerial capabilities, poor marketing plan, and lack of incentives from government to drive industry to utilise local technology. Lagos is widely known as the entrepreneurial hub of the country, and sometimes the continent, because of its highly motivated citizens and thriving business environment (Forbes Africa, 2016).

There are two notable educational institutions at the heart of Lagos – University of Lagos and Yaba College of Technology. However, it cannot be said that these institutions have played any significant role in developing the entrepreneurial mindset of Lagosians. Universities contribute to entrepreneurship directly through commercialising research and being the seedbed for new ventures, and indirectly by educating candidates to take the path of entrepreneurship (Rasmussen and Sørheim, 2006). Nigerian universities, however, are neither producing nor commercialising research that could become new ventures. They are also not in the frame to train and encourage students to take entrepreneurship as a career path. From several onsite visits and observations of the entrepreneurship department of Yaba College of Technology, the researcher noticed that the building was shut and non-functional. It was mid-day in a weekday but there was nobody in the vicinity to speak to about the department. This was rather surprising, considering that this University makes up one of the two universities where there is a large concentration of new technology ventures in the state of Lagos. Moreover, in more developed countries, studies have shown that education institutions such as universities and research institutions contribute directly and indirectly to the development of new technology ventures in a region (Westhead and Storey, 1995; Huffman and Quigley, 2002; Díez-Vial and Montoro-Sánchez, 2016).

The Nigerian education system has a narrow perspective on education, without concern for broader applications of the knowledge that is acquired. Possible explanations for this decline in quality have been extensively reviewed in the literature and they include inconsistent government policies, lack of funding and investment in facilities, unfavourable working conditions and lack of financial motivation for lecturers and teachers (Adegbesan, 2011). It can also be a result of the extant focus on theoretical knowledge rather than practical skills training, as suggested by this entrepreneurship lecturer and scholar from Yaba College of Technology:

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*our education in Nigeria, at all the three levels of education is purely theoretical. It is not skill oriented... A workable model should be what we academics term down relations. Those in the industry, we allow them to come around and talk to our students especially in engineering, science students and so on and so forth. How the world of industry works, and we can take them to the factory to see things for themselves. That will deep drive their motivation and their creative ability. When they are now creating things, they will create things that are original, something that the industries require*

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The myopic nature of the education system in Nigeria is the reason that graduates, particularly of public universities at undergraduate level, appear competent on paper but lack the skills and sometimes knowledge to succeed in the workplace. This extends to potential entrepreneurs, who are also products of the same system. As a result, the consensus outcome is a dissatisfaction and disgruntled feeling towards the system by employers, potential entrepreneurs, and incubators. It can thus be inferred that one of the characteristics of the Nigerian technology entrepreneur is education malcontentedness.

Having discussed the entrepreneur's education level, the next section presents and discusses findings on past business and professional experience of the technology entrepreneurs.

#### **5.4 Experience Level**

An entrepreneur's previous experience is an important determinant of the success of their business (Wiklund and Shepherd, (2001) and considered to be one of the most reliable factors used in determining entrepreneurial performance. Managerial and entrepreneurial knowledge acquired from previous work experience largely explains success in business. This is even more probable if the previous experience is relevant to the business activities of the current venture (Cooper, Gimeno-Gascón and Woo, 1997). To gain a full understanding of the experiences of the technology entrepreneurs in the incubator, the researcher cross-examined the entrepreneurs about their previous professional and entrepreneurial experience.

In the literature, two distinct types of entrepreneurs are identified – Novice and Habitual entrepreneurs. Novice entrepreneurs are first-time entrepreneurs, since they have no prior business experience, while Habitual entrepreneurs engage in repeated entrepreneurial behaviour (Westhead, Ucbasaran and Wright, 2005; Politis, 2008; Rerup, 2005). Habitual entrepreneurs are more experienced entrepreneurs who have learnt efficient ways to overcome the stumbling blocks in their first entrepreneurial efforts. However, the study revealed there is a middle ground between these two distinct classifications of entrepreneurs. They are the unsettled entrepreneurs.

Essentially, there were two classifications of technology entrepreneurs in the incubators based on their previous experience - Novice and Unsettled entrepreneurs. This typology is discussed further below:

### ***Novice Entrepreneur***

This type of entrepreneur does not have any previous business experience (Ucbasaran, Westhead and Wright, 2001; Read et al., 2003). They might have professional experience but have never taken part in any entrepreneurial activity. There were 8 entrepreneurs across the incubators who had no previous business experience. Although this group of entrepreneurs were without business experience, they had some form of professional experience; only one of this group of entrepreneurs was a fresh graduate from university. Their professional work experience was perceived to be a compensation for their lack of business experience. A common view among the entrepreneurs was that their work experience gave them the opportunity to express their skills, either through learning new skills or applying them in a real business environment. Work experience was an opportunity for some entrepreneurs to learn new skills, while for some others, it was an opportunity to apply skills they already had in a real work environment. As entrepreneur 4, founder of a venture that builds mobile platforms and devices to bridge the digital divide in emerging markets, explains:

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*Yes I started right after school I had a full time employment so I was a lead developer in a consulting company, desktop, enterprise and technology experience with that I learnt most of my skills through self-learning but that gave the opportunity to practice them so I was able to build solutions that government and thousands of people used so I guess that gave me the confidence that yes it is possible*

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However, not all of the novice entrepreneurs had technical skills to operate their technology ventures. Only three of the entrepreneurs had technical capabilities and had previous work experience in technical roles, such as software development. This observation is in contrast to the literature (Plehn-Dujowich, 2010) that suggests novice entrepreneurs are usually highly skilled individuals because of the returns in wage for their skills. Additionally, the researcher observed that this group of entrepreneurs had a positive attitude towards learning. They

recognised their deficiency in knowledge and were hungry to learn about the venture creation process. This comment by entrepreneur 14:

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*Personally, I am happy to learn as much as I can from the incubator manager. I make sure I have one on one encounters with the manager. He gives me personal assistance on how to scale as an entrepreneur. I had many one on one interaction between the head of incubator and myself. I am very sure many fresh entrepreneurs like myself would say the same.*

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This finding supports a study by Odorici and Presutti (2013), who found that Novice entrepreneurs have a strong learning orientation. What should be noted here is that this type of learning is not simply classroom learning; it is action-based learning.

In terms of the impact of the entrepreneurial experience of Novice entrepreneurs on the creation of their venture, there was not any clear differentiation from more experienced entrepreneurs. Most of the novice entrepreneurs had already launched their ventures and were at the phase of reiterating their products. Generally, the literature suggests that more experienced entrepreneurs are likely to be more successful than novice entrepreneurs because they are more attractive to investors; however, this is yet to be seen among entrepreneurs in Nigerian incubators. From the analysis and observations, previous business experience did not necessarily transform to success in their current venture. What appears to be more significant is the determination of the entrepreneur and ability to demand more dynamic resources from the incubator, just as this Incubator manager 1 explains:

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*... I tell every single person here, your success is up to you. If you don't push me, you wont get anything beyond the basics I provide. It is when you push me, you will then get over and beyond. I am forced to think deeper to find that person you need and that resource specifically for you. I won't be able to do that for ten founders except I have the team*

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### **Unsettled Entrepreneurs**

Unsettled entrepreneurs do not have as much experience as habitual entrepreneurs, but they are not novice entrepreneurs. This type of entrepreneur has started two or more ventures in the past that have not been wholly successful. Although they are picking learning experiences

from their failed ventures, they still do not have the learning experience of a successful venture. That is, they might know what to do to avoid failure in their next venture but might not know what to do to become successful at that next venture. Their previous venture might or might not be related to their current venture; in the case of Nigerian technology entrepreneurs, it is usually unrelated. This classification of entrepreneurs happens to be the predominant class of entrepreneurs in Nigerian technology incubators. The researcher observed that these types of entrepreneurs are hungry for success and are more specific about the kind of resources they require to enable them to achieve their success. They are more knowledgeable than novice entrepreneurs because they have learnt entrepreneurial lessons in the real marketplace.

One example of an unsettled entrepreneur was entrepreneur 10, who, prior to founding his current venture, operated a small business venture that facilitates other entrepreneurs to get online through website and corporate branding; started another venture that enabled university students to have social interactions through an exclusive social network during his masters program in the United Kingdom; and finally was involved in a restaurant business as well. Another example is entrepreneur 13, who was first based in Abuja, the capital city, where he operated an internet café business, as well as a web design agency. In the case of entrepreneur 9, she started an online fashion brand with a friend but closed it down, as the business did not do as well as expected.

'Hustlers' is the street name of this type of entrepreneur (Adepoju, 2015). They believe that one of their ventures will be their success story and there is no place for them in the corporate world. That hunger for success drives them and every previous venture failure is viewed as a learning process and a step closer to eventual success. Speaking on this, entrepreneur 2 commented:

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*Someone said that in order to succeed you must fail, that beautiful houses are built from dirt because you have to mix sand, cement and add water in order to build them.*

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Although they haven't created successful ventures, unsettled entrepreneurs learn a lot from their failed ventures. The researcher asked some of the unsettled entrepreneurs about their learning experience and, in the case of entrepreneur 10, it helps him to be more particular about validating his idea with the market:



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*... I think it helped me looking forward to being firmly particular about really validating what is called product market fit before even wasting time that is having the product ready and in front of potential customers as basic as it is – MVP*

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In the case of entrepreneur 13, who is the founder of a venture that develops mobile gaming applications, he learnt the value of building a strong network of relationships:

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*My previous experience taught me that relationship are key which is a key one. One thing I learnt is Credibility says a lot, plays a huge role. Because I remember when we were in business it wasn't that we had so many clients, we just had a few of them who were, it cost to recommend us to other people after that what I learnt from that was that we are in the market where there isn't so much, value can seem like a big deal so it helped us in terms of we are just being honest guys and credible guys, it helped us accept and that's what still playing out I guess today.*

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Entrepreneur 2 learnt the importance of continuous innovation and seeking collaboration with bigger partners:

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*.. I learnt from that business. I learnt that I should keep on innovating and I learned that I should keep on collaborating*

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Most of the unsettled entrepreneurs had professional work experience, in addition to their entrepreneurial experience. However, both their work and business experiences were unrelated to their current venture. For instance, entrepreneur 2 had a previous business in the telecommunication sector and worked professionally for a private software company as a personal assistant to the chief executive officer of the company. In the case of entrepreneur

9, her previous business experience was in the fashion industry and she worked professionally as a market researcher and test analyst but her current venture is in the transport industry.

Whilst there are transferrable skills from their previous experiences, they fail to seize the opportunity to build domain knowledge and expertise from their previous experiences. Previous experience constitutes a means of acquiring knowledge in the sector in which an entrepreneur wants to start their business (Hichri, M'chirgui and Lamine (2016). Domain knowledge is the extent of in-depth knowledge about a specific industry possessed by an entrepreneur. Technology entrepreneurs with domain knowledge are able to understand the underlying structural features of a problem, have superior pattern recognition skills, and, combining this with technology knowledge, develop more robust solutions to the problems (Bingham and Eisenhardt, 2011).

This is because new technology ventures require deep domain expertise to undertake deep-dives and to assemble and develop a wide scope of knowledge (Kamuriwo, Baden-Fuller and Zhang, 2017). The issue of domain expertise might not be a big deal in a more advanced country, where information and human capital on any industry is widely available. However, in a developing country like Nigeria, where information on anything is difficult to obtain, it is advantageous that the founder or someone in the founding team has some sort of specific domain expertise. Although not a panacea for venture success, having someone on the team with depth in a specific industry can provide a competitive advantage for the venture (Joubert, 2013; Birch, 2017). Relevant work experience is important to technology venture founders as it builds domain expertise, which is useful when thinking of technological solutions for a problem in a particular industry (Roure and Keeley, 1990).

Following the above findings and analysis, it can be inferred that another characteristic of the Nigerian technology entrepreneur is amateur experience level.

#### 5.4.1 Amateur Experience

Essentially, the experience level of the Nigerian technology entrepreneur is amateurish. This is because the majority of the entrepreneurs (80%) in the incubator were either novice or unsettled entrepreneurs. Additionally, the researcher observed that, although most of the entrepreneurs had gained some type of work experience, they were mostly from small private companies with no more than twenty employees and were not in sectors directly related to their current venture. While this finding from the study is consistent with previous studies that emphasise the importance of previous professional experience, it also discloses an area less spoken about, particularly in the context of developing countries; that is, relevance of previous

experience. An experience becomes more valuable if it corresponds to the current business activities of the venture created (Ozgen and Baron, 2007; Quan, 2012). Professional experience in the sector where an entrepreneur wants to their start their business constitutes a means to acquire specific domain knowledge. It reduces risk to the entrepreneur and becomes a way of building distinct advantage for the venture. Entrepreneurs in Nigerian incubators, despite having acquired professional experience, did not have experience related to the venture they were currently on. It is possible that this is one of the reasons why entrepreneurs were stalled in the technology incubator.

Business techniques are at the heart of the process of starting and building a venture. This is why Cooper and Park (2008) emphasise business experience which helps understand the reality and workings of the market. Some of the Nigerian entrepreneurs in the incubator were complete novices, with no previous business experience, while some others had some form of amateurish business experience; amateur in the sense that it was previous business experience gained from either assisting parents in petty trading business, or attempting to start a venture in a conventional area like running a restaurant. Very few were habitual entrepreneurs with extensive entrepreneurial experience. Taken together, it can be suggested that the majority of the current Nigerian technology entrepreneurs possess amateur entrepreneurial experience.

During the field work study, an online discussion ensued in the technology entrepreneurship community. It was motivated by an interesting online opinion shared by Tavio Oviolu, a founder of a well-funded and successful technology venture in Nigeria. According to Tavio, the current wave of technology entrepreneurs lacked the relevant experience to operate successful technology ventures (Ndiomewese, 2016). This opinion led to a debate about whether entrepreneurs interested in technology ventures should first seek relevant previous experience or dive straight into founding a technology venture. This debate motivated me to question participants on the amateurish experience of Nigerian technology entrepreneurs; entrepreneur 12 exclaimed:

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*fresh graduates and inexperienced entrepreneurs contribute to the high failure rate in Nigeria... experienced entrepreneurs with valuable work experience and network have a better chance at technology entrepreneurship success!*

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The general perception is that more experienced entrepreneurs are more likely to be successful. However, the lack of employment in Nigeria means entrepreneurship is like a lifeline to an improved standard of living. As discussed in the literature review chapter (see chapter 2), emerging economies such as Nigeria are prone to necessity entrepreneurship because of unfavourable working and living conditions. Only Entrepreneur 8 understood the place of experience in founding a technology venture. Prior to starting her venture, she quit her job as a management consultant from one of the reputable accounting firms and decided to intern with a successful technology enterprise before founding her venture. Speaking about her professional experience, she explained:

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*...for me there was a disconnect and I couldn't continue seeing myself as a management consultant. I quickly moved to DealDey because I knew the tech space was new and I was very curious and also because I had an idea to do what I am doing now. So I just wanted to learn the ropes and see how I can start myself moved to tech space out of curiosity and to learn the ropes of running a tech venture*

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In response to the debate on the experience level of Nigerian technology entrepreneurs, incubator manager 1 argued that while it is advisable for technology entrepreneurs to first seek relevant professional experience, for some others, it is good to dive into implementing their ideas; that is, launch their venture and learn through the hurdles, regardless of what the outcome might be. He explained:

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*...There is no hard and fast rule, though I don't belong to any of the schools of thought, I believe that circumstances and situations determine where you go. Am I better off having 10years experience before coming into this? Of course definitely but does anybody need 10 years of experience before getting into this? Of course not. If you can't that experience because of the situation in Nigeria, why not just learn by doing? Which is what we encourage*

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Essentially, the consensus permeating the technology entrepreneur community in Nigeria is that the average technology entrepreneur possesses amateur experience. The entrepreneurs'

amateurish experience could be a hindrance to the progress of their venture. One of the responsibilities of the incubator is to help the entrepreneur bridge this experience gap by providing coaching and education (see section 6.4.2).

Although literature emphasises the importance of previous experience and the entrepreneurs insist that there are lessons to be learnt from their amateurish experience, the researcher would argue the relevancy of their experience particularly in their ability to develop market knowledge. Market knowledge refers to awareness and understanding of a business' customers and competitors (Li and Calantone, 1998). Where a technology entrepreneur possesses deep market knowledge, they can be alert to existing and future opportunities. This view point is shared by Kirzner (2015), who suggests that entrepreneurs recognise an opportunity by being 'alert' and aware of the current situation that a market presents. This finding, while preliminary, helps us to understand a couple of things. i) considering that most of the entrepreneurs in the incubators are novice and unsettled entrepreneurs, their level of experience is generally amateurish; and ii) the reason they are in the incubator is the hope that the incubator can help them gain relevant experience and leverage the incubator's network of relationships.

As discussed in the literature review, one of the duties of the incubators is to provide the freedom for potential entrepreneurs to try out their ideas. This also doubles as an opportunity for the entrepreneurs to build up relevant experience. The failure rate associated with technology ventures, however, means there is the possibility that the idea does not work out as intended. This happened in one of the incubators the researcher interviewed, where a venture that provided a solution for taxi drivers did not get further due to inability to raise sufficient funds for the business and viability of the idea. The entrepreneur and some of their team were assimilated into another venture in the incubator. As incubator manager 1 explained:

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*... it is possible that the first idea from a particular entrepreneur does not become successful, but the invaluable skills and experience gotten can be transferred into other ventures or full-time work experience that might exist within the incubator.*

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Although that particular venture was not successful, the entrepreneur and other team members gained valuable experience which can then become useful learning points for their next venture. Particularly as it was within the incubator, the management of the incubator can also find use for the skills of the entrepreneurs in other ventures.

Finally, as entrepreneurship RBV suggests, the ability of an entrepreneur to be alert to opportunities hinges on their ability and propensity to notice and be sensitive to information about objects, incidents, and patterns of behaviour in the environment. Beyond education, an entrepreneur's previous experience is important in determining entrepreneurial awareness. However, in a situation where the previous experiences are in matching entrepreneurial sectors and areas, they build domain expertise and give the entrepreneur an 'alertness' advantage. It can, therefore, be assumed that an entrepreneur with generic experience can be deemed resourceful, but an entrepreneur with domain expertise in a particular area can be even more valuable and inimitable.

Previous experience, whether business or professional, broadens the knowledge and general leadership aptitudes of the entrepreneur (Ozgen and Baron, 2007). Many scholars have shown that there is a correlation between previous experience and business performance (Ozgen and Baron, 2007; Cooper, Gimeno-Gascón and Woo, 1997; Hichri, M'chirgui and Lamine, 2016). Thus, an entrepreneur with amateur experience would negatively affect the growth venture, which might explain the slow pace of growth experienced in technology ventures in incubators in Nigeria.

## **5.5 Personal Attributes and Motivation**

An entrepreneur's personal attributes and motivation are among the primary factors associated with entrepreneur characteristics that are likely to influence venture growth (Gartner, 1985). One application to entrepreneurship of resource-based view theory is its illustration of how an entrepreneur's unique awareness or entrepreneurial recognition enables the entrepreneur to be alert to opportunities and cultivate opportunity-seeking behaviours, which is itself a resource. An entrepreneur's personal traits and motivation contribute to the ability of the entrepreneur to develop entrepreneurial recognition abilities (Shane and Venkataraman, 2003).

In this study, personal attributes refer to personality traits that are essential for founding and operating a technology venture in Nigeria, while motivation refers to the internal and external factors that stimulate the desire and energy of the entrepreneur (Bullough and Renko, 2013).

The entrepreneurs interviewed reported several peculiar attributes that were important to founding and operating a technology venture in Nigeria. They include perseverance, resilience, patience, commitment, passion, love for technology, the ability to network, and

ability to learn quickly. Overall, it was found that the overarching attributes that every Nigerian technology entrepreneur possesses are the ability to be resilient and a passion for technology and its application to solving problems.

### 5.5.1 Entrepreneurial Resilience

Entrepreneurial Resilience is the human ability of an entrepreneur to adapt and stay the course, in spite of personal, business or environmental catastrophe, disturbance and other challenges (Bullough and Renko, 2013). All of the entrepreneurs agreed that entrepreneurial resilience is an absolute skill to develop to successfully found and operate a technology venture in Nigeria. According to entrepreneur 3:

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*In this country you have to be resilient and be stubborn to achieve success in business particularly in technology businesses.*

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Another entrepreneur (Entrepreneur 11), founder of an online platform for buying and selling real estate properties explains:

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*You need doggedness, patience and commitment because of the slow adoption level when it comes to technology businesses in Nigeria*

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The general impression gathered from the research findings suggests the ability to be resilient is one of the most important personal attributes any entrepreneur in Nigeria can possess. The ability of an entrepreneur to be resilient is a direct result of the interaction between the entrepreneur and their environment (Ayala and Manzano, 2014). This is understandably the case in Nigeria, because the Nigerian environment poses many challenges that disrupt entrepreneurial success. Nonetheless, to continue to survive as a technology venture, entrepreneurs must be able to evolve, acquire knowledge, abilities and skills that will help them withstand the uncertain terrain of operating a technology venture in Nigeria. More importantly, they must face these uncertainties with a positive attitude, creativity and optimism, as reflected by Entrepreneur 2:

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*you have to be resilient and be dogged. I'm this kind of person that If I say I want that chair and somebody says you can't have that chair, I will say why? If you can't prove to me why I can't have that chair, then I'm going to go for that chair.*

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Studies, such as that of Ayala and Manzano (2014), confirm that entrepreneurial resilience is indeed important for business success. Findings from the research further illustrate that entrepreneurs ought to possess entrepreneurial resilience to excel in a challenging terrain like Lagos. For instance, Entrepreneur 10 and entrepreneur 4, both unsettled entrepreneurs who have started a few, not so successful, ventures in the past, attribute some of those failures to the tough terrain of doing business in Nigeria. Some of the challenges that they face include the logistical difficulty of transporting goods and services to customers, lack of mature and trustworthy local talents, power instability which leads to high cost of maintaining a standby generator, high cost of having and maintaining an office, and general lack of support from government to small entrepreneurs.

These challenges were mostly echoed by other entrepreneurs in different respects. For instance, a particular entrepreneur in the incubator who was constantly not available because they were out trying to make deals happen concerning their venture. The venture (blood bank) is essentially an online service that enables coordination of blood transportation from a donor to a patient. The researcher expected that such a venture would have no problem growing in prominence. However, the opposite was the case. At the time of the interview, the researcher was told by incubator manager 1 that this particular venture was struggling because the bureaucratic nature of the hospitals was simply difficult to work with and they were not buying into the idea. Although this venture showed very promising value to the health sector in Nigeria, it struggled simply from the hostile environment. The incubator manager explained further:



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*...take Blood Bank for example, they help blood to be transported from the person donating the blood to the person who needs the blood. A simple but very effective idea that is working in the western world and should work here. But here is what is happening; the hospitals are meant to update their portal to alert the guys when they are short or urgently in need, but they just don't. Also when there is need of the blood, think of how the guys navigates traffic just to get to the where the blood is needed. It's just so many things that makes such a business difficult here in Nigeria.*

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It can thus be suggested that it is paramount that aspiring entrepreneurs develop some level of resilience, even before beginning their entrepreneurial journey, because it is almost certain that challenges will arise that will disrupt the entrepreneurial process. Using the concept of (Jackson and Timothy, 2016), while in more developed regions in the world, resilience might be a reactive quality to circumstances, in a country like Nigeria, it should be a proactive quality, developed even before the entrepreneur encounters any disturbance.

#### 5.5.2 Passion for Technology Application

The second overarching attribute of importance to operating a technology venture is a passion for the application of technology to problem solving. Although it sounds obvious, it was a common view held by most entrepreneurs interviewed. Having a passion for technology equates to having an obsessive relationship with the technology venture and the problem that is tackled. This finding suggests that technology entrepreneurs should be obsessed with the solutions they are providing and the process of building a technology venture; they should be ready to do everything necessary to make their venture survive and thrive. This is because the process of launching a technology venture and making it successful could be a very long, tedious process that requires continuous action from the entrepreneur. Surprisingly, there are very few studies on the role of entrepreneurial passion in founding and growing a venture. The entrepreneur's passion is what keeps the entrepreneur interested and focused on the purpose and mission of the venture, thus increasing the resilience of the entrepreneur. It can therefore be assumed that the entrepreneur's passion for technology contributes to one of the factors that help to build resilience. These findings are in line with previous studies, which list perseverance and passion as part of the ingredient of entrepreneurship and the entrepreneurial process (McGrath and MacMillan, 2000; Ma and Tan, 2006). From personal observations, it was noticed that these entrepreneurs were very interested in the solutions that technology can help them build. The researcher could feel the excitement as they spoke about

their ventures and the problems they solve. One entrepreneur (entrepreneur 2) explained how he has been able to use technology to build a platform that can somewhat predict and inform users about traffic congestion in Lagos. He went further to explain how his team are testing out drone technology to help provide visual traffic information for users. He explained:

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*...Technology has made a lot of things possible. Through technology, the Lagos traffic can now be known and avoided. Users log into our platform to see where the traffic is building up and we also create alternative routes for them to take. We have been testing drones to capture and report the traffic life. All these won't be possible if not for technology*

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Essentially, entrepreneurs with strong passion and great resilience in Nigeria are more focused and committed to their entrepreneurial pursuit and find innovative ways to navigate difficult entrepreneurial environment and challenges. This conforms with a statement by Ma and Tan (2006), who emphasise that successful entrepreneurs are passionate believers in what they do and are determined to realise their entrepreneurial dreams and achieve success against all odds.

These findings suggest that, in Nigeria, the most important personal traits any technology entrepreneur can possess alongside other skills are resilience and a passion for the application of technology to solve problems. Entrepreneurs who possess these traits can be deemed a resource to their venture, compared to other entrepreneurs without these traits. This finding should, however, be interpreted with caution. This is because this study does not show to what extent resilience and passion for technology impact the success of the technology venture and for how long an entrepreneur needs to possess these traits during the technology process before calling it quits. Nonetheless, these personal traits are important, because, while education and experience are resources that can be substituted, resilience and passion are inherent abilities that are specific to an individual and are non-substitutable.

### 5.5.3 Motivation to Solve Problems

Considering the motivation of Nigerian technology entrepreneurs in incubators, the study revealed that the entrepreneurs are motivated to solve problems. The researcher's observation of the environment and types of ventures confirmed Nigerian entrepreneurs are truly motivated to solve problems that exist in their surroundings. Most of the ventures were a direct response to a problem that exists in Nigerian society. For instance, entrepreneur 2 is

solving the problem of traffic jams by creating a reporting application/map. Entrepreneur 3 is solving the issue of communication that exists in schools with their online management portal. Entrepreneur 5 is solving the problem of figuring out the best restaurant to have a meal by building a platform that aggregates the restaurants in an area and provides reviews from other users. Entrepreneur 6 is using her venture to encourage and train women to possess technical skills. Entrepreneur 11 solves the problem of finding real estate properties to purchase. The Majority (80%) of the entrepreneurs were operating ventures that were directly solving a personal problem or one that they had observed in society. Entrepreneur 1 explained:

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*...I had a friend whose mum had a school . I was invited to do some IT work for them and I noticed how rowdy and difficult the school handled communication within themselves and also with external stakeholders of the school. I was immediately motivated to create a solution for this communication problem.*

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#### 5.5.4 Motivation to create value

It was discovered that about 70% of the entrepreneurs were motivated to create value by providing, through their venture, some sort of social impact in the form of employment opportunities, knowledge contribution and transfer, or improving existing products and services. The researcher observed a general dissatisfaction with the state of affairs in the nation and a feeling of responsibility from the entrepreneurs. These entrepreneurs believe the success of their venture can help the situation of employment and economic development in one way or another. An entrepreneur (entrepreneur 14) commented:

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*I would like to improve the tourism sector with my business because that has been abandoned by the government. Maybe I can do something there and make people want to visit some of the tourist places in Nigeria and improve economic conditions.*

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There are two explanations for entrepreneurial motivations – Push and pull. The push factors of entrepreneurship explain that individuals are pushed into entrepreneurship by negative forces, such as job dissatisfaction, unemployment, insufficient salary or unfavourable work schedules. On the other hand, the pull factors of entrepreneurship are such that individuals are attracted to entrepreneurial activities to seek self-fulfilment, wealth, and other desirable outcomes (Keeble, Bryson and Wood, 1992; Orhan and Scott, 2001). The findings point to a pull motivation by entrepreneurs in Nigerian incubators. However, a note of caution is due

here, as it was difficult for me to distinctly pinpoint the distinction between pull and push factors as entrepreneurial motivations amongst entrepreneurs in the incubator. There is the possibility that the entrepreneurs were biased or unclear in their own minds about their answers about their motivations.

Nonetheless, the entrepreneurs the researcher spoke to report their motivation is fuelled by a need to create value through social impact, which is a pull factor. These entrepreneurs see the bigger picture of their venture beyond building technology products or services. The general conception that every technology entrepreneur carry is one described by entrepreneur 2:

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*...we are not trying to build a product; we are trying to solve a problem or create a solution to solve a problem.*

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It was observed that only a few of the entrepreneurs spoke about financial gains as their motivation to be technology entrepreneurs. This confirms Cooper and Bruno's (2000) study, which recognises technology entrepreneurs to be only moderately motivated by high financial rewards and highly motivated to apply their creative and technical skills to solving real issues. Overall, the high unemployment rate among young graduates in Nigeria, mediocre products and services, and other indigenous challenges are what motivate technology entrepreneurs to create solutions which are then converted into business opportunities. Again, a note of caution is due here, since the positive and patriotic response could also be biased. Every entrepreneur likes to believe their venture is contributing to social good in one way or the other and might be reluctant to disclose their actual motivation.

## **5.6 Summary**

In summary, this chapter has presented findings and analyses on the Nigerian technology entrepreneur. It is important to know these characteristics because they inform the research on how these characteristics and experiences affect the creation of a new technology venture in an incubator. Individuals identify and engage with opportunities differently, and a number of factors are responsible for this, such as their educational background, information and knowledge, past experiences, and motivation.

The characteristics of the average Nigerian entrepreneur can be summarised with the acronym M.A.D. This acronym was made up, not to demean Nigerian entrepreneurs, but simply to capture their unique features and characteristics. It was found that most of the entrepreneurs in the incubator are home-grown and locally trained; thus, they are graduates of a myopic education system. They attained their first degrees in STEM subject areas; that is, science, technology, electronics, and mathematics. Most of the entrepreneurs had or were considering acquiring some form of advanced degree. There was a general dissatisfaction with the quality of entrepreneurship education in educational institutions in the country; hence, many entrepreneurs felt that they needed 'topping up'. In contrast to the subjects of their first degree, many entrepreneurs consider completing an MSc or MBA, as opposed to specialising in a technical area.

Also, the incubators were not well supplied with returnees or entrepreneurs who trained in foreign universities. As mentioned in the discussion chapter, perhaps incubators in Nigeria are not resource-rich enough for returnees, who are already fortified with a set of overseas networks and can afford some basic amenities. Educational level does not necessarily affect the process of creating a new technology venture; however, having exposure to study in a developed country increases the capability of the entrepreneur to attract more resources and be taken more seriously. It also enhances the chance of the entrepreneur to understand and extend the application of the resources they are provided. The implication for this to the incubator is that they ought to be more mindful of the class of entrepreneurs they attract and how the resources they provide suit them.

An entrepreneur's past experience, whether work or business-related, plays an important role in how they operate their venture, especially when the experience is in a relevant field (Hichri, M'chirgui and Lamine, 2016).

The entrepreneurs found in the incubators do have some form of previous experience, but many are not in a relevant field; that is, not the same area as the venture they are currently developing. As a result, aside from their amateurish experience, the majority of the entrepreneurs lack domain expertise in the area in which they are developing their venture. The study uncovered that the entrepreneurs in the incubator were mostly entrepreneurs with little to no experience - *novice* entrepreneurs and *unsettled* entrepreneurs, who are entrepreneurs with experience but very little to no success. Previous research has dealt well with novice and habitual entrepreneurs (Read et al., 2003, Westhead et al., 2005) but this research study found that there are entrepreneurs who are not necessarily novice entrepreneurs but, at the same time, are not habitual entrepreneurs. They are unsettled entrepreneurs, who have tried several businesses but have not been successful yet, mostly

due to environmental circumstances or general lack of resources. These entrepreneurs feel more comfortable in an incubator, because they can use the resources which were previously scarce to them to their advantage. Previous literature, such as Gimmon and Levie (2010) and Hichri, M'chirgui and Lamine (2016), suggests that previous experience is essential for venture growth and entrepreneurship in Nigeria is not an exception. However, there isn't enough data to show how effective previous experience has helped Nigerian entrepreneurs. That said, most of the leading and well-known technology entrepreneurs in Nigeria possess vast professional experience and advanced education in more developed countries.

An entrepreneur's personal attributes are likely to influence venture growth (Gartner, 1985). Entrepreneurial resilience and a passion for applying technology to solve problems were the two distinct characteristics reported as essential personal attributes for a technology entrepreneur in Nigeria. Building a technology venture can be a daunting task, particularly in a challenging environment like Nigeria. It is no surprise, therefore, that participants unanimously recommended resilience as the number one attribute to possess. Passion for technology thus becomes the fuel and driving force for entrepreneurial resilience. Nigerian technology entrepreneurs are motivated by pull factors; that is, the need to create some form of a social impact, through employment, improved economic conditions, or improving existing products and services.

Technology incubators are responsible for providing valuable resources that can enable the technology ventures to survive and thrive. That said, the technology entrepreneur who happens to be in the driving seat is responsible for utilising these resources appropriately. Consequently, it is important that the technology entrepreneurs possess the right knowledge, understanding, and motivation to maximise the resources made available to them by the technology incubators. Experience is not a major issue, because part of the role of the incubator is to encourage entrepreneurial activities and experimentation. However, incubators have the task of rising to the demands of teaching and educating enthusiastic entrepreneurs on the nuances of technology entrepreneurship, particularly in Nigeria, where there are gaps in the knowledge of technology entrepreneurship activities. Furthermore, the idea that incubators are only for growing new technology ventures is incomplete. Other activities that happen within the incubators can lead to other outcomes, such as collaboration for job opportunities or acquisition of skills, particularly in a developing region such as Nigeria. Many home-grown entrepreneurs, who happen to be the ones that appreciate the value of the incubators, could gain valuable experience from working with other ventures or learning about technology entrepreneurship. The table below is a summary of the findings from this chapter:

Table 13: Table summary of findings on the characteristics of the Nigerian technology entrepreneur

Who is the Nigerian tech Entrepreneur?	Findings	M. A. D Elements
<b>Education</b>	<ul style="list-style-type: none"> <li>• Undergraduate from a local university</li> <li>• Dissatisfied with quality of education</li> <li>• Seeks further knowledge and education in areas of interests.</li> <li>• Quest for further education through advanced degree, e.g., M.Sc. or professional certifications</li> </ul>	Graduate of a <b>Myopic</b> Education system
<b>Background Experience</b>	<ul style="list-style-type: none"> <li>• Novice: first time business experience</li> <li>• Unsettled/hustlers: have tried a few unsuccessful businesses</li> <li>• Experience is unrelated to current venture</li> </ul>	<b>Amateurish</b> Experience
<b>Personal Attribute / Motivation</b>	<ul style="list-style-type: none"> <li>• Resilience</li> <li>• Passion for application of technology</li> <li>• Motivated to create value</li> <li>• Motivated to solve problems</li> </ul>	Strong <b>Determination</b> regardless of background experiences and environmental challenges

Having discussed the characteristics of the technology entrepreneurs in the incubator, the next section discusses the incubators and the resources they provide the entrepreneurs.

## CHAPTER 6: Understanding Nigerian Technology Incubators

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### 6.1 Introduction

Having discussed the findings on the entrepreneur's characteristics, this chapter deliberates on the technology incubators, their objectives, selection processes, and resources they provide. Technology incubators exist themselves as ventures with objectives, processes and goals to target. Generally, they are support organisations with sole responsibility to help new technology ventures to survive and thrive. A resource-based perspective of technology incubators contends that the resources provided by the incubators will enable tenant ventures to gain a competitive advantage in the marketplace. The TE-TI schematic diagram illustrates from previous studies how these resources are grouped into human capital, organisational, technological, and financial resources (see section 2.8).

One of the key elements of the resource-based view theory is the capability of the resources to have VRIN properties (valuable, rare, inimitable and non-substitutable), to achieve sustainable competitive advantage. In technology entrepreneurship, this means that the technology ventures are provided with a resource-base by the technology incubator, which can give them a competitive advantage over non-incubated ventures which do not have access to these resources. Fundamentally, If the resources provided to the technology ventures by the incubators are valuable, rare, inimitable and non-substitutable (VRIN), the resulting competitive advantage will improve their chance of survival, growth and eventual success (Mian, 1996).

This chapter begins with a description of technology incubators to help in understanding the confusion that exists in literature concerning incubators in Nigeria. This is followed by findings on the selection process employed by the incubators, after which findings are presented on the resources the incubators provide to the entrepreneurs and their ventures.

As discussed in the literature review chapter, the concept of incubation in Nigeria is in a phase of rejuvenation, as previous attempts at incubation by the government have not met expectations. Thus, at the time of conducting this study, the incubators were only working on their second set of entrepreneurs. The table below is an overview of the incubators the researcher interviewed



Table 14: An overview of the incubators visited by the researcher

<b>Incubator</b>	<b>Name</b>	<b>Location</b>	<b>Focus</b>	<b>Sponsorship and Affiliation</b>	<b>Mode of Operation</b>	<b>Founded</b>	<b>No of Graduates</b>
<b>Incubator A</b>	Co-Creation Hub (CCHub)	Lagos	Information and communication	Privately sponsored	Autonomous	2010	6
<b>Incubator B</b>	IDEA Hub	Lagos	Information and communication	Government sponsored	Autonomous	2010	5
<b>Incubator C</b>	Enspire	Abuja	Information and communication	Government sponsored	Autonomous	Unknown	None
<b>Incubator D</b>	Lagos Technology Incubation Centre	Lagos	Industrial	Government sponsored	Non-Autonomous	Unknown	1

## 6.2 The Nature of Technology Incubators in Nigeria

The general concept of incubation in Nigeria is not new. However, incubation in its proper sense is relatively recent. Prior to the field work, the researcher reviewed a study that identified twenty-one (21) incubators in Nigeria (Bubou and Okrigwe, 2011) and another study claimed there were thirty-seven incubators in Nigeria; one incubator in every state in the country (Akhuemonkhan et al., 2014). The researcher is a Nigerian who spent a large part of his formative years in Nigeria, with a keen interest in technology activities, the researcher struggled with the report of the studies as the incubators they mention are rarely spoken about, heard or seen. Thus, it is important to first provide a descriptive overview of the concept of incubation in the country. Moreover, this tackles the objective of assessing the current development of technology incubators in Nigeria.

Essentially, there are three categories of incubators in Nigeria. *Government-sponsored and Non-autonomous incubators, government-sponsored and autonomous incubators and privately sponsored incubators.* The main difference between these incubators is how they are sponsored and operated. Incubators can either be publicly-sponsored, non-profit sponsored, university-sponsored, or privately sponsored (Hackett and Dilts, 2004). The classification of Nigerian incubators by sponsorship is distinctly classified into publicly (government)-sponsored and privately sponsored incubators. Furthermore, the mode of operation of government sponsored incubators in Nigeria also differs; they are either dependent and operated by the government themselves – Non-autonomous - or independent and operated by private individuals – Autonomous. The descriptions of these incubators are the result of the researcher's personal observation during the field work, interviews with stakeholders, and the incubators' websites and other online web sources. Below are descriptions of the types of incubators in Nigeria.

### 6.2.1 Government Sponsored and Non-Autonomous Incubators

This type of incubator was the earliest type of incubator that existed in Nigeria. There are very few studies on them, and the studies are mostly conceptual. Onsite visit and observation of one incubator of this type of revealed that these incubators are actually science parks, which are confused with the term 'incubator'. Fundamentally, the term 'incubator' has been misused by the Nigerian government. The National Board for Technology Incubation (NBTI) in Nigeria is the agency responsible for setting up these venues for small business development. The term 'science park', which is used interchangeably with Research Park, Technology Park, Business Park, Innovation Centre, and Technology Innovation Centre, is widely used to refer

to an agglomeration of science and technological activities which have a spiral effect on the firms located around the park (Westhead, Batstone and Martin, 2000).



*Figure 5: Technology incubator centre Lagos*

The image above is the incubation centre researcher visited in Lagos. Most of its spaces were empty, with lots of non-functioning machinery. As discussed in chapter 2, science parks, which are different from incubators, are organisations with a mandate to:

- Provide formal and operational links between high education institutions, such as universities or research laboratory centres, companies, and technicians
- Encourage the formation and growth of knowledge-based businesses and other organisations, through a spin-off mechanism normally located on its site,
- Provide a managerial function which is actively involved in the transfer of technology and business skills to organisations on its site, and
- To work in partnership with other innovative research companies, centres and science parks to facilitate the global standard of the firms located on their site

The above practical definition contrasted with the onsite observation; the Nigerian government has only been able to provide science parks, rather than incubation centres, to selected regions. Not surprisingly, the science parks have been very ineffective in providing any support for tenant firms. Entrepreneur 20, a tenant in this supposed incubator, who also happens to be the Lagos chairman of the National Association of Technology Incubator Entrepreneurs (NATIE), explains and laments:

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*The government has failed at even implementing science parks because they are located far away from universities, so there is no knowledge development or transfer; Entrepreneurs grossly overstay their place in the park for as much as 10 years; and there are no real value added to the tenant ventures in regard to resources, advice and basic support.*

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The next two incubators are the more recent form of incubator, which is the main focus of this study as it has rarely been studied in literature.

### 6.2.2 Government-Sponsored Autonomous Incubators

This type of incubator is financially sponsored by the government (Nigerian Information Technology Development Agency) but allowed to operate autonomously. At the time of this study, there were two incubators of this type in Nigeria; IDEA Hub in Lagos and Enspire in Abuja, the capital city. IDEA Hub, established in March 2013 by the then Minister of communications and technology, Omobola Johnson, is located in the Yaba area of Lagos and occupies a four-story complex. IDEA Hub was founded as a technology incubator for technology entrepreneurs and their ventures. The incubator was set up in partnership with the government to empower them in different aspects. Since its inception, IDEA has incubated 50 start-up ventures and raised \$800,000 in funds for these startups, as well as accommodated over 1,500 potential entrepreneurs for seminars, workshops and training programmes.

Enspire is the other government-sponsored autonomous incubator. Enspire is based in Abuja, the capital city, and was set up as part of the initiative of Abuja Technology Village Free Zone company (ATV). On its website, it states that “*it seeks to stimulate economic growth and sustainable job creation in Nigeria through innovation, entrepreneurship, enterprise development and technology commercialization by providing training, mentoring, networking opportunities, infrastructure and access to finance among others*” (ATV, 2015). The researcher visited the Enspire incubator and interviewed the incubator manager, who explained to me that Enspire is the first and the only incubator of its type in the city of Abuja.

However, it was observed that, although Enspire is located in Abuja, it lacked the pace and buzz of its counterpart in Lagos. This is because Lagos is widely considered the business hub of the country, while Abuja is perceived as slow paced and relaxed because of its dependence on the federal government's support.



*Figure 6: IDEA Hub Lagos*

### 6.2.3 Privately Sponsored Autonomous Incubators

This type of incubator is privately sponsored and operates autonomously. They are essentially private incubators, with no links to the government. There are more of this kind of incubator coming up in Nigeria; at the time of this study, there were about four such incubators in Lagos

and one just about to start up in Abuja, with a few in other states. This type of incubator tends to be more serious with its operations, because they do not have the financial cushion compared to the government-backed autonomous incubators. That said, the majority of these incubators still struggle because of the financial burdens of their operation. Co-Creation Hub (CCHub), established in 2010, was the first incubator of this type to arrive in Nigeria. It is located in Yaba, Lagos, right next to IDEA Hub. Together, both incubators have contributed a great deal to the development of technology entrepreneurship in Lagos, as will be discussed in the sections below

CCHub describes itself as a place where creative social technology ventures are born and claims to have supported over 90 technology ideas and companies. They mainly focus on technology ideas that are solutions to problems of everyday Nigerians. The researcher's observation of this incubator revealed that the incubator was very active, with many entrepreneurs busy iterating on their product or service. They have successfully graduated several entrepreneurs who were included in the study. They raise their funds from private institutions and collaborations with international bodies. CCHub gained exposure recently when the CEO of Facebook, Mark Zuckerberg, made a surprise visit to the centre in acknowledgement of the impact it has made thus far on the technology ecosystem in Lagos (see figure 7 below) (Shapshak, 2016).



*Figure 7: Co-creation hub, Lagos*

The table below highlights the similarities and differences between the classes of incubators in Nigeria:

Table 15: A table showing the typology of incubator in Nigeria

<b>Government-Sponsored, and Non-Autonomous Incubators</b>	<b>Government-Sponsored Autonomous Incubators</b>	<b>Privately Sponsored Incubators</b>
<b>Focused on heavy machinery and manufacturing type of business</b>	Focused on information, technology, and media ventures	Focused on information, technology, and media ventures
<b>Provides tenants with space only</b>	Provides with space, power, and internet	Provides with space, power, and internet
<b>Entrepreneurs are left to be independent</b>	Entrepreneurs are guided and assisted	Entrepreneurs are guided and assisted
<b>No structured business assistance or help</b>	More structured assistance	More structured assistance
<b>No provision of mentors, internet or stable power</b>	Provision of education and coaching	Provision of education and coaching
<b>Not located within vicinity of any educational institution</b>	Strategically located	Strategically located
<b>Heavily reliant on government for any type of resources</b>	Reliant on government for financial resources but has autonomy to charge for other services	Non-reliant on government. Depends on private individuals and institutions for resources
<b>Staff not professionally trained or experienced</b>	Qualified staff	Qualified staff
<b>Unstructured tenancy period</b>	More structured but not strict	More structured and stricter
<b>Unfavourable working conditions</b>	Favourable working conditions with designated spaces for collaboration	Favourable working conditions with designated spaces for collaboration
<b>Nepotism in recruiting entrepreneurs</b>	Recruits entrepreneurs through formal and informal selection, and by contest	Recruits entrepreneurs through formal and informal selection, and by contest

Having described the types of incubators in Nigeria, the next section will discuss and present findings on the selection process used by the incubators to admit entrepreneurs into their space.

The table below is an overview representation of the four incubator managers that were interviewed.



Table 16: An overview of the interviewed incubator managers

Incubator Manager	Position in the Incubator	Incubator Affiliation	Type of Incubator
<b>Incubator Manager 1</b>	Managing Partner	Co-creation hub	Private Incubator
<b>Incubator Manager 2</b>	Director	IDEA Hub	Government-sponsored Autonomous
<b>Incubator Manager 3</b>	Operations Manager		
<b>Incubator Manager 4</b>	Head of Incubation	Enspire	Government-sponsored Autonomous

### 6.3 Selection Process

As the TE-TI schematic diagram illustrates, technology incubators are characterised by their selection process and the support they provide to the tenant ventures in the form of technical and business assistance. The study revealed three broad themes pertaining the selection process used by the technology incubators. They are formal selection, informal selection, selection by contest. These themes are discussed further below

#### **Formal Selection Process**

Eight of the entrepreneurs interviewed went through a formal selection process. The formal selection process begins with an online application by potential tenants. The actors from the incubator management, led by the incubator manager, go through the applications and invite a selected few for an interview in the form of a presentation exercise. This activity is known as 'pitching' in entrepreneurship, and it gives selected entrepreneurs the opportunity to present themselves, their venture and the problem they are solving. Discussion is then held among the incubator management and decisions are made on which ventures will be incubated. The statement by entrepreneur 3 below illustrates the general outline of a formal selection process:

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*There was an application phase, applied online, then the selection phase. After selection phase, there was interviews. Interviews, pitch, explain vie for the proposition and all that. After that there will be final selection stage in into the perceived category.*

---

The panel responsible for making the final decision included the incubator management and external actors, such as experienced business individuals. The entrepreneurs who went through this process agreed that there was a board of different individuals involved in the process. This comment by entrepreneur 2 illustrates this:

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*There was a formal application. After that they shortlisted us for a meeting with the board after which we were selected*

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The incubator management have a set of criteria which they use to assess the entrepreneur. However, the researcher found that these criteria were fuzzy and changed over time to accommodate the entrepreneurs. In most cases, the entrepreneurs were unsure about the criteria by which they were selected. For instance, entrepreneur 4 commented:

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*... I don't know because they did not quite share the criteria with us. I am guessing they sent out broad categories to startups for fintech, oil and gas, media so I guess that's the category*

---

It can, therefore, be assumed that the incubators are employing different strategies to attract and admit new ventures into the incubator and the incubatees are not aware of these strategies.

However, the incubator managers insist that they have a set of criteria with which they admit the entrepreneurs to the incubation process and adhere to them. According to incubator manager 2:

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*We do have set criteria. We look at the viability of the idea, we also look at the entrepreneur and if they have the ability to make it work by assessing their skills level. While we sometimes say come with an idea, most times we expect that the idea is formed in your head and even better if you have begun implementing some things.*

---

Generally, the eligibility criteria used by the incubators include

- A functional product (mobile or web)
- Clear understanding of the venture's revenue model
- Venture should be in operation and have some customers
- A team of at least 2, of which one must have a technical background
- A potential to scale

The time from application to acceptance is uncertain, as different entrepreneurs reported different times. A particular entrepreneur remarked that it took about four weeks to get a response from the selection committee, while another claimed it was about six weeks. On average, the formal selection process takes eight weeks from application to acceptance.

Formal application, with proper evaluation techniques and criteria for vetting the entrepreneurs and their ventures, is the standard way incubators in more advanced countries recruit tenant ventures. This is because the incubator is able to screen the entrepreneurs based on the objectives of their venture. It also helps the incubators to determine the entrepreneurs that are best fit for the incubation process. This process increases the rate of success of the both the incubator and the ventures they admit (Lee and Osteryoung, 2004). Thus, several scholars prescribe that incubators adopt a formal process that is rational, well communicated, and appropriate to the mission and objectives of the incubator (Wiggins and Gibson, 2003; Lee and Osteryoung, 2004; Aerts, Matthysens, and Vandenbempt, 2007).

### ***Selection by Informal Relationship***

Interestingly, selection by informal relationship is the most popular form of selection process conducted in Nigerian incubators. This is a situation where entrepreneurs are accepted into the incubation process through the privilege of previously knowing a person in the incubation management or being acquainted with the incubator manager and, thus, having direct access to him or her. As a result of this type of friendly, informal relationship, the entrepreneurs are invited to be a part of the incubation process and, in some cases, invited to participate in the

resources offered by the incubators without actually going through the formal selection process. In a particular instance, an incubator manager merged his incubator with another incubator and, as a result, also combined tenant ventures from the previous incubator with those of the current incubator. Entrepreneur 2 explains:

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*Initially we started Passion incubator. I think we came to IDEA Nigeria in October last year so I think about a year. So while coming over here to IDEA we already had a proven concept so it was not very difficult for idea to take us in, all we needed was to inform the management that we would like to join and with the aid of [Incubator Manager 2] and other selection committee we were accepted*

---

It was observed that the Informal selection process was predominantly practiced in the government-sponsored incubators. There was a more relaxed attitude noticed among the government sponsored incubators compared to the private incubators and this permeated to the selection process. Entrepreneur 6, tenanted in one of the government-sponsored autonomous incubators, explains how she got access to the incubator:

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*I think it was a bit informal maybe because [Incubator Manager 3] is a really good friend of mine and I have known him now for over 8 years. So were we incubated per se, yes and no. He would always ask me how can we help you. For instance, our website was built by another incubatee, another group in the space (incubator) organised our workshops and another group in the space (incubator) has just arranged to take some of our women as interns. So for me the incubation was introducing to a community of people who was ready to help us with anything*

---

### **Selection by Contest**

Selection by contest is the third way the incubators used to select their entrepreneurs. It is the process through which entrepreneurs and their ventures are selected to be incubated after winning a competition. Most times, the competition is a pitching contest but, sometimes, the competitions are unrelated to technology entrepreneurship and are not organised by the incubator. Nonetheless, the incubator partners with the competition organiser and offers incubation as their contribution. Although this was the least common form of selection process

operated in Nigerian incubators, it still accounted for almost 25% of the entrepreneurs interviewed. As entrepreneur 3 explains:

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*I didn't go through the normal incubation (selection) process... because it was a national competition USPF idea and our team won... Part of the competition terms was that I was liable to get a free three months from them so I took that opportunity*

---

This type of selection process was noticed more in the private incubators. It could be because they want to attract the best talent to their incubator.

### 6.3.1 Weak Selection Process

There were more ventures in the incubators who got access through informal selection process than by formal selection. This result is in accord with a recent study by Solomon and Lind (2016) indicating that incubatees in a South African incubator were not sure of the criteria used to admit them into the incubator, thus signifying different strategies employed in managing the incubator space.

Additionally, these results show that, although the incubators have a formal process of application in place, as confirmed by the incubator managers, most entrepreneurs gained access to the incubators through informal processes, such as relationships with the incubator manager or through contests. Even though some entrepreneurs still went through the formal application process, findings from this study imply a weak selection process operated in Nigerian incubators. A weak selection process could lead to a mismatch between the entrepreneurs and the incubator, which results in uncertainty on the path to progress, ending up in long periods of tenancy in the incubator. This was confirmed by one of the incubator managers who, when asked what he would do differently if he had the opportunity, mentioned he would put a more rigid and thorough selection process in place. These results provide further support for the hypothesis on characteristics that make up a successful incubator, as reported by Akçomak (2009), discussed in the literature review (chapter 3).

The selection process is an opportunity, not just for the incubator to select potential ventures, but also for the entrepreneurs to choose the right incubator for their venture. Even though Nigerian entrepreneurs do not have many choices, they still have the choice to select which of the few incubators is best for their venture. What was noticed however, is that the selection process is lopsided to the incubators. The entrepreneurs did not recognise the selection

process as an opportunity for them to align their goals with the incubator of their choice. This miscommunication at the selection process could be because the entrepreneurs lack the fundamental understanding of the incubation process.

To assess the entrepreneur's level of understanding of incubators, they were asked questions about their prior knowledge of incubators and what they now expect from the incubator. Surprisingly, a vast majority of the respondents had little to no prior knowledge of the concept of incubation. As a result, they had no expectation whatsoever. Only a small number of participants had a little knowledge about incubators; they had either come across the concept online or accidentally found a well-known incubator while looking for some entrepreneurial support. Talking about this issue, Entrepreneur 1 remarked:

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*when I started up I never knew about incubators. I somehow stumbled on it when I needed some help and the first incubator I heard of was CCHub.*

---

The concept of incubation, which gained popularity since the early 1980s in OECD countries is still a very new concept in developing countries. Incubators became popular as a result of the collapse of traditional industries and a lack of support for small companies (Al-Mubarak and Busler, 2010). Even though Nigeria, through the National Information Technology Development Agency (NITDA), proposed to implement its policies by establishing IT parks as incubating centres for the development of software applications at national, state and local levels, it was found that the entrepreneurs were mostly naive about the existence of incubators or any other business support institution. They either accidentally discovered the incubator or were directed to it by colleagues or associates. In many ways, the researcher observed the entrepreneurs were at the mercy of the incubators and, as a result, lacked the confidence to communicate what they intended to achieve from the incubator at the selection process. However, once the entrepreneurs had spent some time in the incubator and gained some knowledge, they demanded more from it. For instance, this comment by entrepreneur 1 after spending 14 months in the process illustrates this:

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*I did not know about incubators before I came here so I took anything I was given. At the time, it was what I needed. Now, I have gotten to the point where I need more specific resources. Things like specific mentors and strategic partnerships in my industry*

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Another possible explanation for the weak/multiple selection process is that, as technology entrepreneurship in Nigeria is still in its early days, incubators are having to compromise on their selection process just to stimulate more interest in technology entrepreneurship. This could be the reason why incubators are employing different strategies to accommodate ventures into their incubators. Also, it can be linked to the knowledge capabilities of the region, as mentioned above. Perhaps the gaps in the knowledge on technology entrepreneurship in Nigeria has led incubators to employ these different strategies. As incubator manager 2 suggests:

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*Everything boils down to knowledge. If you don't know what we technology ventures do, you would abuse what we do. And it is the biggest challenge I think. That is why we use these different avenues to let people in to make them understand exactly what we do*

---

This relaxed attitude to the selection process can be counterproductive and become a potential problem. It is almost becoming apparent that, although technology incubators in Nigeria are creating enabling environments for technology entrepreneurship activities to thrive, there are no major success stories to be reported from the incubators. The selection process is an opportunity for both the incubator and the entrepreneurs to align their goals and objectives to ensure they achieve success at the end of the incubation period. Once there is that understanding between both parties, it becomes possible to allocate resources more effectively.

Having discussed the selection process employed by the technology incubators, the next section presents and discusses findings on the type of resources provided by incubators to the technology ventures.

## **6.4 Incubators as Resource Hubs**

The fundamental function of incubators is to support young technology ventures by providing the necessary resources, both tangible and intangible, to help them grow and survive. As illustrated in the theoretical framework (see section 2.8), technology incubators from a resource-based view could create a resource environment that could potentially be a major

determinant of survival and success of the technology ventures. Previous studies classified these resources into human resources, financial resource, technological resources and organisational resources. However, when the researcher asked questions about the types of resources provided by Nigerian incubators, the participants were unanimous in the view that incubators provide three main resources: basic infrastructure, education and coaching, and access to networks, which could be considered to fall under the headings of organisational and technological resources.

The application of the RBV theory in this thesis is as a theory of sustainable competitive advantage, rather than the more conventional firm approach. This is because RBV as a theory of the firm is imprecise. A theory of the firm usually means a theory of existence, structure and scope of firms (Kraaijenbrink, Spender and Groen, 2010). New technology ventures are not structured and, therefore, do not operate in the same way as structured firms. Technology ventures are dynamic and operate in fast-paced, unpredictable circumstances (Agarwal, Audretsch and Sarkar, 2010). As a theory of sustainable competitive advantage, the VRIN attributes enable researchers to test for the competitive capability of resources. The competitive capability of resources provided by incubators should ultimately provide the ventures with sustainable competitive advantage, as suggested by the RBV theory (Solomon and Lind, 2016). Consequently, the researcher assesses the competitive capability of the resources provided by the incubators to the entrepreneurs and their venture. The researcher's assessment essentially asks the following questions

*Valuable: Is the resource valuable to the entrepreneur and their venture?*

*Rare: Is the resource only available to incubated entrepreneurs and their ventures?*

*In-imitable: How easily is the resource replicable?*

*Non-substitutable: Can the resource be replaced by a cheaper option?*

What follows are the resources provided by Nigerian incubators to their entrepreneurs. Furthermore, the findings are discussed and analysed against the VRIN attributes prescribed by the resource-based view theory.

#### 6.4.1 Basic Infrastructure

It was found that the main activity of Nigerian incubators is the provision of very basic infrastructure to their tenant ventures. Basic infrastructure for the ventures in this context includes a physical office space, reliable internet connection and stable electricity. The researcher considers them to be basic, because they are the fundamental resource an incubator must provide in a region like Nigeria, plagued with infrastructural challenges. These



resources are essential for new technology ventures for the following reasons. First, rents in the metropolitan city of Lagos are very high, and new ventures can barely afford them. This is coupled with the expenses and pandemonium of having to self-source for stable electricity and reliable internet connection. After all of these are obtained, they require constant maintenance and checks because electricity is a problem across the whole of Nigeria, such that a backup generator is always needed to keep the power on. Internet connections are still below class and can be unpredictable but, at the same time, expensive.

All these are tiresome issues for a new entrepreneur to tackle at the early stages of building their venture. The incubators absorb the responsibility of providing the ventures with these basic amenities as well as maintaining them. This gives the entrepreneur allowance to focus on building their venture and not worry about an epileptic power supply or interrupted internet connection. These basic amenities are mostly provided at no cost to ventures currently in incubation and provided at an affordable cost to entrepreneurs who are not currently in incubation. The statement below by entrepreneur 4 is supported by all of the entrepreneurs, who agree that provision of basic infrastructure is a fundamental resource provided to them by the incubator:

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*I will say right now we are doing the basics actually. Which is provision of physical office space, and constant power and good internet connection*

---

This finding is interesting because previous research establishes that, although one of the functions of incubators is to provide a physical workspace, it is, however, the minimum resource they provide. Beyond providing physical working space, incubators have been reported to be more about commercialising new technologies, seed funding, creating linkages and relationships with research labs and universities, market knowledge and networking with off-incubator ventures (Wynarczyk and Raine, 2005; Chen, 2009; Rubin, Aas and Stead, 2015). In Nigeria however, it was observed that basic infrastructure is still a very important resource to the ventures. Incubators have gone through a phase where any physical working space passed for an incubator because they are able to provide basic amenities to technology ventures. This puts Nigerian incubation many years behind Europe, America and some emerging countries, where incubators have become instruments for supporting innovation; facilitating technology transfer; and encouraging entrepreneurship to develop local economies (Wynarczyk and Raine, 2005). This is not to put down physical working space as a useful resource for entrepreneurs; as described above, there can be a lot of struggle and expenses to have those basic amenities set up. This result may be explained by the fact that Nigeria, as

a nation, has failed to repair and improve its basic infrastructure. Thus, incubators have had to take up and focus on the role of providing basic infrastructure, which comes at a high cost, so that entrepreneurship can thrive in the region.

In the context of RBV and the VRIN attributes, provision of basic infrastructure, particularly for Nigerian technology entrepreneurs is a valuable resource. The incubators create an environment where the entrepreneurs can be focused on their venture, rather than chasing power and internet suppliers or worrying about paying expensive real estate rent. However, this type of resource is not rare. Non-incubated entrepreneurs can join a co-working space or find other entrepreneurs to share the cost of renting a space. As a result, provision of basic infrastructure can be easily replicated but cannot be substituted with a cheaper option, considering the ventures do not have to pay any rent to use the incubator space.

#### 6.4.2 Education and Coaching

The second very important resource that Nigerian incubators provide to their tenant ventures is education and coaching. Education is in the form of tutoring and training entrepreneurs on important topics relating to building a technology venture. Coaching on the other hand is in the form of mentoring and pairing entrepreneurs with more experienced and successful entrepreneurs outside of the incubator. This comment by Entrepreneur 11 explains this further:

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*They brought experts to educate us on how to build a technology business. They also provided training on how to pitch our ideas and general presentation skills.*

---

In a particular instance, the researcher observed the entrepreneurs taking part in a training event organised by the incubator. It was on legal issues and business development and was facilitated by a professional lawyer and a business development expert, respectively.

This particular resource is important, because it can be linked to one of the characteristics of the Nigerian entrepreneurs in the incubators discussed in the previous chapter. It was discovered that most of the entrepreneurs were local graduates of the myopic education system in Nigeria. As a result, many of the entrepreneurs lack fundamental knowledge and skills on the activities of technology entrepreneurship. The incubator, recognising this knowledge deficiency, spends time organising events to train and educate the entrepreneurs on the nuances of building a technology venture. The topics they cover include presentation,

financing, relationship building, and organisational structure. At a more advance level, the entrepreneurs are paired with external mentors to coach them on more specific areas.

Although technology incubators have always been linked to higher education and research labs, it was discovered that Nigerian incubators' relationship with local educational institutions is almost non-existent. Past research suggests that the most obvious type of relationship between incubators and educational institutions is one where the incubator is the beneficiary. A study by Ratinho and Henriques (2010) suggested that the determinant of incubator success lies in their university links; that is, access to university facilities and research labs. Other scholars suggested that one of the main roles of incubators is commercialising technology from higher education (Löfsten and Lindelöf, 2005; Rothaermel and Thursby, 2005).

Interestingly, findings from this research do not support reports from the previous studies. The current findings suggest that, in Nigeria, the dynamics of the relationship between incubators and higher education is different. More specifically, Nigerian incubators do not commercialise new technology, because there are no affiliations or links with any research or educational institution. Incubator manager 1 illustrated this in these remarks:

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*The reality is that those things are tough to combine. Ideally we keep telling people that CCHUB should be in a UNILAG ( University of Lagos) lab somewhere, it shouldn't be a private effort outside of the university. Because that is the environment for knowledge transfer and acquisition. Unfortunately, we don't have an educational system that can support that. The system is geared towards 'pass and get out'. So that fertile ground for those kinds of knowledge to happen isn't really there.*

---

This finding was somewhat surprising, considering the incubators are in proximity to higher educational establishments in the Yaba area of Lagos. These educational institutions include the prestigious University of Lagos and Yaba College of Technology. Despite their vicinity, the study revealed a huge gap between higher education institutions and technology ventures and incubators. In other developed societies, there is an extant understanding between educational establishments and incubators. For instance, Universities can provide knowledge through research and students' capabilities (Lumpkin and Ireland, 1988). They can also be financial supporters to the incubators, thus reducing some of the financial cost to the incubators. Research laboratories have the ability to produce cutting-edge technologies which are, in turn, commercialised by the incubators. However, this was not the case in Nigeria.

Responding to the issue, an entrepreneurship scholar who has written journal articles on incubation in Yaba College of Technology explained:

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*...all the three levels of education is purely theoretical. It's not skills oriented and that's what informed federal government emphasis on entrepreneurship education... but there are some fundamental things that must be done. We have been teaching entrepreneurship but it's still been taught like a regular subject. You require facilities like PowerPoint, video multimedia, and industrial tours but all these are not there; we just teach like a general studies so it's not working.*

---

To further illustrate this point, the researcher visited the entrepreneurship department at Yaba College of Technology. It appeared locked, unused and lifeless, with no sign of any entrepreneurial activities taking place. Another observational study happened in the office of the academic participant, where several workbooks on entrepreneurship were displayed, as opposed to a presentation of entrepreneurial ideas or products. As a result of this void left by the Nigerian education system, technology incubators have risen to the challenge to fill the knowledge gap.

The sort of education and coaching provided by the technology incubators is not only a top-down approach and unidirectional mode of learning; the incubators have created an environment where collaborative learning can take place within and amongst entrepreneurs. Entrepreneurs learn, not only from the incubator management and other external experts, but also from their fellow entrepreneurs. It was observed that the incubator's seating arrangement was designed in such a way as to encourage collaborative learning. There were entrepreneurs dotted around in designated spaces, having discussions about their ventures. This comment by entrepreneur 9 illustrates this further:

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*The incubator gives the opportunity for internal collaboration with other individuals in the incubator. I also get encouraged just from having discussions with other entrepreneurs about their venture. I can learn one thing or two from them and they can also learn from my mistakes or success. That's the good thing about this place.*

---

According to this finding, we can infer that one of the major resources Nigerian incubators provide is educational support. One entrepreneur even compared the incubator function to

that of universities, because they educate entrepreneurs on the process of technology entrepreneurship. This finding is somewhat interesting, considering that there is not much deliberation in previous literature on education as a resource provided by incubators. Nigerian technology incubators encourage university students to come into their premises and learn from other entrepreneurs through volunteering and placement. One of the entrepreneurs interviewed for this research was a current student at the University of Lagos experimenting with his idea at the incubator. It can thus be suggested that incubators in Nigeria are an extension of educational institutions in the area of technology entrepreneurship. Perhaps they are viewed as a form of business school, where lessons are learnt from action entrepreneurs have actually taken themselves.

In the context of RBV and the VRIN attributes, it can be inferred that the provision of education and coaching by the incubators is a valuable resource to the entrepreneurs and their ventures. This is because the incubator is filling a knowledge gap, as well as providing practical entrepreneurial skills, a void left by formal education in Nigeria. However, it is not rare as entrepreneurs can acquire knowledge through other means. Entrepreneurs could gain experience by starting ventures, just like habitual and unsettled entrepreneurs or learn from colleagues and friends who are more experienced entrepreneurs. Additionally, entrepreneurs can read stories online about other successful and not so successful entrepreneurs. Many entrepreneurs openly write and blog about the challenges of operating a technology venture in Nigeria and offer learning points for upcoming entrepreneurs. Consequently, as it is not a rare resource, it can be easily imitated by other entrepreneurs who are not in incubators; other entrepreneurs currently not in incubators can attend business schools and gain similar business knowledge and skills, even though it is a more expensive option. As a result, incubators as education centres cannot be substituted with a cheaper option.

#### 6.4.3 Access to Network

The third resource provided by Nigerian incubators is exposure and access to a network of individuals and institutions. Most entrepreneurs revealed that one of the most useful resources provided by the incubator is the exposure and access to a network of stakeholders that could be valuable to their venture. Exposure and access to these networks of individuals and institutions are important to the entrepreneurs because they possibly will generate value in the form of business support from private organisations, funding from financial institutions, and mentorships. However, this resource will be more valuable to entrepreneurs who are in the post-launch phase of the venture creation process. At this stage, the entrepreneur is in search

of that key advice to move their venture forward. This comment by Entrepreneur 5 illustrates this:

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*So they provide us access to mentorship, access to meet already successful entrepreneurs in the ecosystem. We got to meet good guys like the founder of Jumia, hotels.ng and not just meeting them but they came to us, they sat down and talked to us.... These players in the industry chat with us, gives us access to mentors and that actually help us to advice us on how we can move forward.*

---

One way the incubators create this exposure and access to their network is by organising mentoring schemes where the entrepreneurs are mentored by other, experienced entrepreneurs and business individuals. Most respondents agree these schemes are useful because they are able to come in contact with high-net-worth individuals, business professionals, and other successful entrepreneurs who are otherwise scarce and difficult to gain access to, particularly in a society like Nigeria. Although, while most entrepreneurs agreed that the mentoring schemes set up by the incubator have been useful, a few complained about the proficiency of the mentors provided. Entrepreneur 15 remarked:

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*Some of the people running the incubator here might not have enough experience required for a particular specialisation so there is a limitation that they face to helping you realise your dream but I won't blame them completely. I'll say it is lack of availability of mentors... the incubator played a role by bringing people as facilitators for different meetups like google which was good but not sufficient. They brought in a lot of international guys but sometimes to believe it is possible within your locality, you need to see someone who have done it in your area so many guys were left with just dreams*

---

While most of the entrepreneurs were quite positive about the access to networks the incubator provides, entrepreneur 15 was quite cautious in his comment. Perhaps it is because entrepreneur 15 was speaking retrospectively and is also a habitual entrepreneur. Entrepreneur 15 was one of the first graduates and success stories of incubation in Nigeria. Their venture is a data analytics venture that tracks the budget allocation and expenditure of the Nigerian government. They found that, at the time of starting up their venture, the incubator provided generic mentors to them, but they would have preferred specific mentors in the sector of their venture. This comment by entrepreneur 11 appreciates the network the incubator

provides but is also critical of the depth and experience level of the types of mentors available through the incubator:

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*The knowledge the incubator managers provide originates from the corporate world and that is the same with the mentors they bring. Knowledge in experience is limited because of their corporate background. However, I will say the network they provide is good enough for now*

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This shortcoming in quality of mentors provided might be as a result of the age of technology entrepreneurship in Nigeria. Most ventures, including the incubators themselves, are still trying to figure out what works and what doesn't regarding operating technology ventures in Nigeria. There are only a handful of entrepreneurs who have successfully started technology ventures and scaled them. As a result, incubators are limited in the number of mentors they can provide. Thus, they are left with regular career professionals, such as bank executives and other professionals, as mentors for startups. As entrepreneur 11 points out:

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*Those incubator managers do not have real entrepreneurship experience. What they are giving us is book and theory knowledge. We are talking practical knowledge here and not knowledge books. I think at the moment, it is because everything technology entrepreneurship is still a new thing in Nigeria. Maybe with time, we will see more successful start-ups who will now become the mentors for the incubators.*

---

Nonetheless, access to networks was reported as one of the most important resources the incubators provide, even in a situation where basic amenities are met, and education is up to standard. One of the reasons for this is that many institutions, such as financial lenders and even government institutions and policy makers, do not completely trust the viability of young entrepreneurial ventures. In these instances, the incubators play the role of guarantors for the entrepreneurs and their ventures. The incubators vouch for the viability of the venture, as well as the character of the entrepreneurs. These institutions are more likely to trust the credibility of the incubators, because they are somewhat more established and have taken precautionary steps to vet the entrepreneurs and their ventures. This puts the incubators in an advantageous position, because they form an intermediary between entrepreneurs and other resources that can help them survive and thrive.

An example of this was explained to me by incubator manager 1 in Co-Creation Hub. CCHub was instrumental in convincing the Lagos government to provide fibre-optic internet connection to the Yaba area of Lagos, where they (CCHub) are located. As the incubator manager explained, it took lots of convincing and persuasion, which yielded results in the end. As a result of this, the entrepreneurs now have access to a fast and reliable internet connection. The incubator manager went further to inform me about an investment fund of \$350 million currently being set up to invest in the ventures. The fund is in collaboration with the Nigerian government and other private institutions but will be managed and allocated by the incubator.

Interestingly, the researcher observed that most of these lofty ambitions were achieved by the private incubator, rather than the government-sponsored incubators. It became obvious to me that the private incubators were more ruthless and eager to help their ventures than the government-sponsored incubators. The government-sponsored incubators had a more relaxed attitude to helping their technology ventures, perhaps because they had the backing of the government. In an online interview with the CEO of IDEA Hub, Helen Anatogu, she confirmed that a memorandum of understanding was signed with the Nigerian Information Technology Development Agency (NITDA) in 2013 to provide grant funding to the ventures. However, in the last three years, NITDA has only provided 30% of the agreed funds. In Nigeria, the government's complacent and inefficiency towards matters of this nature is legendary and not surprising.

That said, the majority of the participants suggested that another benefit of the access to network the incubators provide is that it can potentially result in collaboration and partnerships. The incubators not only provide access to external network; they have also created an environment internally where networking opportunities can take place naturally and thrive. Participants were certain that incubators were very successful at assembling individuals who are skilful in various fields, including technology and marketing. Technology business incubators encourage the development, implementation and growth of new technology ventures. As such, the incubator can attract an alliance of individuals who are skilful and enthusiastic about building new technology ventures. Entrepreneurs are then able to benefit from these individuals, as well as form relationships with other entrepreneurs in the incubator



through sharing knowledge, leveraging skills and collaboration. This comment by entrepreneur 6 illustrates this:

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*There is a community of technology knowhow and experiences in the incubator pace. It is a great place to find talents and skills, technical skills. I am exposed to people through programs and events. This exposure can lead to potential partners or employees*

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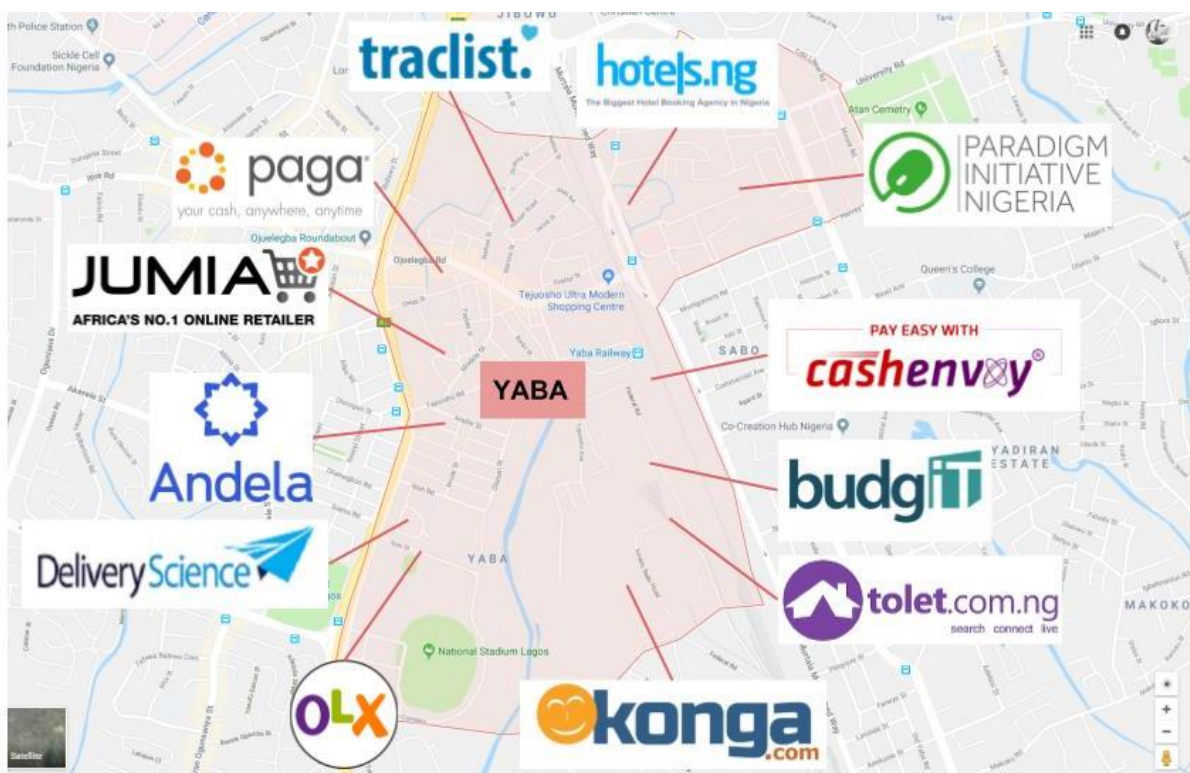
The convergence of talents and professionals to create a community interested in technology entrepreneurship led me to ask a particular question: “Is there a growing cluster in the Yaba region of Lagos”? This question lingers across the technology entrepreneurship community in Nigeria, because most of the incubators are in the Yaba region of Lagos, which has created a convergence and increase in technology entrepreneurship activities in the local area. In observational studies, it was noticed that this assumption is somewhat inconsistent. The elements that aid the creation and growth of a strong cluster environment, as identified in the literature, include a strong bunch of technological companies around a geo-location, skills and human resources, finance and risk capital, science and technology knowledge and transfer, research and development, favourable policy instruments and regulations, and incubation and mentoring (Saxenian, 1994; Potworowski, 2002). Even though the Nigerian technology scene still lacks most of these elements, there is still a presence of a growing technology community around the Yaba area of Lagos. As the diagram below illustrates, there appears to be a clustering of technology companies in the Yaba region of Lagos, which happens to be the location of most of the functioning incubators in Lagos. Yaba is home to over thirty (30) technology companies, two (2) reputable universities, three (3) incubators, and lots of coworking spaces and other private businesses. Asked if this was intentional, most of the respondents attested that they have intentionally located their ventures within the Yaba axis to be in proximity to the incubators. Entrepreneur 11 and 20 chose to relocate their ventures from the incubator to their private offices within the Yaba area to remain in the region arguably

perceived to be the technology hub of Nigeria. An executive of a technology skills and training agency within Yaba explains below:

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*We were not in Yaba before, we came to Yaba because I understand there is a future for this. There are people who have focused their entire career on this and that is why I believe this will be here for a long time... Paga and co will not leave Yaba anytime soon because they understand the connection between mainland and island that Yaba provides. Don't forget Yaba has political history that people don't realise. Yaba was the centre of Nigeria from the time of Hubert Macauley who was one of our colonial masters*

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The above image shows some of the well-known technology ventures based in Yaba. Jumia, one of Nigeria's leading e-commerce ventures, opened a massive office in Yaba in 2015. This move contributes to Yaba's growing popularity as one of Africa's most viable technology hubs. Jumia is backed by three global experts in e-commerce and African markets; Millicom, MTN Group, and Rocket Internet, and is committed to driving entrepreneurship in Africa through building tight links and securing strategic partnerships to grow the ecosystem (Adeyina, 2015). Traclist and Budgit are successful graduates of Co-creation hub, which is one of the incubators in this study. Paradigm Initiative Nigeria educates young individuals on technological

solutions, as well as campaigning for better policies for technology ventures in Nigeria. These communities have become a point of access to the Nigerian technology entrepreneurship scene, as entrepreneur 7 remarks:

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*So it is very important that the incubators are there and the major access points for not investing this time around, they are the access points for the other bigger tech influence to the country, like Facebook, Google. Google will not come to your office but they will prefer to partner with incubators to push new ideas and products.*

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These data need, however, to be interpreted with caution. Although there is a growing technology community present around the Yaba area of Lagos, it is still lacking any education and research environment, science and technology transfer, funding and enabling government policies. A technology journalist who has been covering the technology entrepreneurship scenes in Nigeria had this to say about Nigeria's supposed growing cluster around Yaba:

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*As we are now, there isn't really a – well yes there is a community and like I said, it's more of a follow-follow mentality... interesting yes; but in the real sense of what an ecosystem is, is there an ecosystem? NO! when you think of yabacon, do you think of UNILAG or yabatech? Are there tech entrepreneurs lecturing in universities? Are there lecturers consulting for technology ventures?... Why are we deceiving ourselves, there is no ecosystem, like I said everything is just a follow-follow thing but there is potential but right now with the way it is going, it might end up not been Yaba...*

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While there is seemingly a growing, noticeable cluster brewing in the Yaba area of Lagos state, caution should be observed as the convergence of technology ventures, and other enthusiasts might be just associated with a perceived cluster effect generated by the incubators in the region.

In general, access to networks is the most prominent resource the entrepreneurs appreciate, both in the form of external networks, such as financial lenders and private businesses, and the internal network, in the form of the convergence of professionals and enthusiasts. Access to networks is a prominent resource because, perhaps, while infrastructure, coaching and education are important, most entrepreneurs believe that having access to the right networks could be what takes their ventures to the next level.

In the context of RBV and the VRIN attributes, it can be inferred that the provision of access to a network of professionals, institutions, and funders is definitely a valuable resource to the entrepreneurs and their venture. Technology entrepreneurs require these resources at every stage of the venture process to move their ventures forward. Incubators are limited in how much resource they can provide themselves, so they function as resource banks which acquire resources from their array of networks and make them available to their tenant entrepreneurs. They also facilitate connections between their entrepreneurs and these external networks. It is rare to find this type of opportunity and access through any other means. Decision makers in industry, government and academics are not the easiest people to get hold of, particularly in Nigeria. The researcher experienced this first-hand during a field study, when it was extremely difficult to meet with some decision-makers, e.g. a venture capitalist. The incubator, having developed relationships with these decision makers, makes them easily available to the entrepreneurs.

Consequently, these resources are difficult to imitate because it takes years and expertise to develop such relationships with decision makers. These relationships are not one-way relationships; they are beneficial to both sides and require also the possession of resources the decision-makers are interesting in. Finally, access to networks is a resource that can significantly alter the direction of a venture; thus, it is non-substitutable with a cheaper option.

#### 6.4.4 Funding

Funding is a resource that entrepreneurs greatly seek to gain from incubators. Technology ventures require capital to be sustained and grown. One of the roles of incubators is to provide access to the initial capital required by a venture to explore an idea and launch a minimum viable product or service. Most incubators in more advanced countries provide funding for their tenant ventures. However, when asked about funding received from the incubator, there were mixed responses from the entrepreneurs. While some entrepreneurs reported that early funding was promised and partly provided, such as Entrepreneur 4, who received only 20% of the funds he was promised, others, such as Entrepreneur 5, reported not having received any funds from the incubator. It was observed that privately-operated incubators were more forthcoming in providing funding for their entrepreneurs than government-funded incubators. Ventures that were not funded by the private incubators were deemed not ready for funding. The table below illustrates the funding differences amongst the incubators.

*Table 17: Table showing the funding discrepancies between the incubators*

Entrepreneur	Venture Type	Stage of T.E process	Incubator	Funding by incubator
Entrepreneur 1	Education	Launched	Incubator B	Not funded

Entrepreneur 2	Transport	Product development	Incubator B	Not funded
Entrepreneur 3	Education	Launch	Incubator B	Not funded
Entrepreneur 4	Entertainment	Launched	Incubator B	Partly funded
Entrepreneur 5	Food	Product development	Incubator C	Not funded
Entrepreneur 6	Education	Launched	Incubator C	Not funded
Entrepreneur 7	Business services	Product development	Incubator C	Not funded
Entrepreneur 8	Maternal care	Launched	Incubator A	Funded
Entrepreneur 9	Transportation	Launched	Incubator A	Funded
Entrepreneur 10	Telecommunication	Launched	Incubator B	Partly Funded
Entrepreneur 11	Real estate	Launched	Incubator B	Partly Funded
Entrepreneur 12	Transportation	Launched	Incubator A	-
Entrepreneur 13	Gaming and animation	Launched	Incubator A	Funded
Entrepreneur 14	Tourism	Opportunity Discovery	Incubator B	Not Funded
Entrepreneur 15	Data analytics	Launched	Incubator A	Funded
Entrepreneur 16	Food	Launched	Incubator C	Not funded
Entrepreneur 17	Job/internship/students	Launched	Incubator A	Funded
Entrepreneur 18		Launched		Funded
Entrepreneur 19	Logistics	Launched		Funded
Entrepreneur 20	Advertising	Launched	Incubator A	Funded
Entrepreneur 21	Engineering	Launched	Incubator D	Not funded

Although incubator managers insist that their incubators make funds available for their entrepreneurs, most of the entrepreneurs did not completely agree. The general response from the entrepreneurs is that even the funds promised by the incubators are not sufficient. For instance, according to entrepreneur 11, some funds were promised by incubator B but were yet to be remunerated at the time of this study. Entrepreneur 4 is also still expecting promised funds from incubator B. Co-Creation Hub, incubator A, provides \$5000 for new ventures and \$10,000 for already established ventures, while incubator B, IDEA Hub, claimed to provide funds up to \$50,000 to their ventures. The incubators, in return, ask for stakes in the ventures between 10% - 15%.

When compared to incubators in Europe and America, it can be assumed that funding for venture growth is not sufficient. For instance, Ycumbinator in Silicon Valley gives \$150,000 to its incubated ventures, another incubator, 500Startups, invests \$50,000 in its companies. In Europe, Emerge Education, an incubator focused on grooming technology ventures in the

education space, invests between £40k and £100k in exchange for 3-8% equity. Talking about this issue, Entrepreneur 15 remarked:

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*My opinion is this, the reason why it doesn't work is this, unlike some of the countries in the west, in Nigeria, the first need of an entrepreneur is the fact that they are hungry, yes they don't have accommodation and other basic necessities...*

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According to Entrepreneur 15, the incubator's funding model is barely enough to cover the basic needs of the entrepreneur, such as accommodation, transportation and subsistence. As a result, the entrepreneur is forced to depend on the funds provided for their venture to survive. He advised that incubators ought to introduce different funding strategies that look after the entrepreneur and address the peculiarity of operating a technology venture in a region such as Nigeria. Nonetheless, entrepreneurs generally agree that funding is one of the resources they hope to obtain from participating in the incubation process. This finding is consistent with previous research that emphasizes funding as one of the major resources provided by incubators.

Access to financial support is essential to the success of new technology ventures. Availability of and easy access to venture capital firms within a region play a critical role in the early stages of a new technology venture, both in raising funds and helping to organise and advise the venture (Colombo and Grilli, 2010). Generally, most interviewees acknowledge the lack of investors for technology ventures, particularly locally. The study revealed there was very little or no financial support available to new technology ventures in Nigeria outside of the technology incubator. This happens to be the case from both government and private institutions. The lack of local funders and financial institutions for technology ventures was a recurring topic during the field work. As a result, it was intriguing to know why there are no local investors in a country known to be the centre of business for West Africa and famous for industrious businessmen. It was gathered from various responses that there are four main issues with technology venture funding in Nigeria, and these four issues can be subdivided into the funder's side and the recipient's side.

The funder's side are the individuals and institutions responsible for giving out the funds. They include venture capital firms, angel investors, private banks and other financial support organisations for small businesses. From the funder's perspective, as reported by entrepreneurs and incubator managers, the main issue with funding local technology ventures, is i) the lack of education and risk averse nature of wealthy individuals, and ii) lack of incentive

or motivation, while, on the recipient's side, the issues were iii) venture maturity, and iv) trust and validation. These issues are discussed below.

### ***Lack of Education and Risk Averse Nature of Wealthy Individuals***

Because of lack of education, a common view held amongst interviewees was that, although there are local wealthy individuals in Nigeria, they are oblivious and clueless about the opportunities that prevail within technology entrepreneurship. While some participants felt that wealthy individuals in Nigeria would rather risk their funds in traditional methods of investing, such as real estate and other safe investment vehicles, others felt that some local investors are willing to invest but lack basic education about technology entrepreneurship. They expect a quick return on investment, rather than the long-term interval required for technology ventures to turn profits. Essentially, as discussed above, one of the resources provided by incubators through networking is to prepare and help their tenant ventures secure funding from investors. However, in Nigeria, incubator managers have somewhat limited options because there are no investors. As incubator manager 2 explains:

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*We are connected with Venture Capital in a weird way. The Lagos Angel Network which just kicked off, we know them but we do not have a formal relationship and other people are playing in their own space, funding and all that. But as an environment or space, there is no angel investor or venture capital or that kind of thing here because to a certain level we are all pioneers*

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### ***Lack of Incentive or Motivation***

The second issue reported by respondents from the funder side is the issue of stimulation. Both incubator managers and entrepreneurs accept there is a lacklustre attitude towards investing in technology ventures in Nigeria. The majority of participants suggest the reason for this is the absence of stimulation for investors, most especially local investors. Essentially, the investors are not stimulated by technology ventures because, thus far, there are no big

success stories from any of the ventures in the incubator. This comment from Entrepreneur 15 illustrates this:

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*Why are there no local investors in the startups? My answer is– we have not had any rich successful person that has made money from technology in Nigeria per se. In Silicon Valley, go and check all the investors. They are either the guys who founded PayPal, or Microsoft co-founder*

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As Nigeria is a young player in technology entrepreneurship activities, there are few or no success stories from technology incubators. Moreover, the question of success in technology entrepreneurship is not well defined in literature. Regardless of how success is defined in technology entrepreneurship, some well-developed countries have been able to create success stories out of their technology entrepreneurship activities. These have led to more investments in the industry in the form of capital and human resources from both local and international investors. For instance, in the United Kingdom, the government has created organisations and departments specifically to grow the technology innovation and entrepreneurship clusters. This has happened through favourable tax incentives, media publicity, educational support and government backing (INNOVATE UK, 2015). In Nigeria, there is no stimulation for investors to look in the direction of technology entrepreneurship. Most entrepreneurs complain of the lack of government backing and unfavourable tax conditions to new technology ventures. Considering technology entrepreneurship is high-risk, some form of motivation and stimulation is needed for local investors to consider investing in technology ventures. This could be the reason why most local investors prefer to stick to their traditional style of investing because it is what they understand. The comment below by incubator manager 2 illustrates this:

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*It's the same thing with our investors, they're used to buying and selling , oil and gas, real estate and so if your mind is used to something, it takes a whole different orientation to change it to something else. It's the fact*

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On the recipient's side, the reported issues were around i) venture maturity and ii) trust. The recipient's side means the receivers of the funds; that is, the entrepreneurs and their technology ventures.



### ***Venture Maturity***

When asked about raising funds, a few entrepreneurs were not interested and felt they were not keen on raising funds for their ventures. The study revealed that entrepreneurs who were still in the process of creating a prototype, otherwise known as minimum viable product or service, were more reluctant to accepting external funds, compared to ventures that have already launched. One incubator manager argued that some ventures are not mature enough to raise venture capital funds. Funds are only needed when a venture is seen to be ready to scale its operation and services. One of the incubator's objectives is to help their tenant ventures get to this stage. However, speaking to some entrepreneurs, they felt either disinterested in the idea of raising funds or that their venture was not at the stage of raising funds.

### ***Trust and validation***

Finally, the issue of validation is one where financial body do not have enough trust in these technology ventures to provide funds for them. This issue is linked to the issue of education, because most investors in the local region lack basic knowledge about technology entrepreneurship. As a result, they stay away from such ventures. Essentially, local funders are reluctant to risk their funds on something they do not understand. Also, trust is required when finance comes into play, because investors want to ensure that their funds are not going to waste and yield no return. As an incubator manager puts it:

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*Basically, nobody is willing to invest in something that has a high risk of failure, like technology venture. That is why the incubator is here. You can put the fund in my hands and hold me, the incubator, responsible and get your return on investment in a separate way*

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Literature suggests that venture capital tends to converge towards areas booming with technology innovation and act as both catalyst and capitalist to business ventures (Florida and Kenney, 1988, Colombo and Grilli, 2010). However, in Nigeria, this research shows that this is not yet the case for the issues mentioned above. This is where incubators can step in and act as guarantors for the ventures, ensuring that they educate local investors and act as the intermediary between investors and ventures. They can also provide platforms for investors to safely invest their money by doing due diligence on the ventures before presenting them to investors. This way, the issue of validity and education would be taken care of. Incubators also need to be able to showcase and tell their success story to the population. This will educate

the local region on the value of technology ventures and increase interests from potential investors.

Having presented and discussed findings on resources provided by technology incubators, the next section discusses unintended outcomes as a result of the resources provided.

## **6.5 Summary**

This chapter was concerned with presenting findings on the incubators, their selection process and the resources they provide. The concept of incubation has been well dealt with in more advanced countries but not so much in developing countries, particularly in Nigeria where empirical data on technology incubators is over fifteen years old. This study uncovered some rather interesting findings of the operations of incubators in Nigeria, their selection process, the resources they provide and the unintended outcomes of the resources.

As discussed above, an essential component of incubation is the selection process, which is the point where new technology ventures are selected for incubation. It is important, because most incubators tend to take care to admit ventures with a higher chance of success, using special criteria and standards (Lumpkin and Ireland, 1988; Bergek and Norrman, 2008). However, what is not clear in literature is if incubators use other ways to admit ventures into their membership.

Findings from this study uncovered that Nigerian incubators selected entrepreneurs and their ventures using three main means; selection by formal application, selection through informal relationship and selection by contest. There were dissimilarities in views surrounding the selection process and criteria between the incubation managers and the entrepreneurs. While the incubator managers maintained they had strict selection criteria and processes in place, some of the entrepreneurs were not even sure why they were selected. Most of the entrepreneurs gained access to the incubator through a combination of either personal relationship with the incubator manager or as a prize for winning a contest. A few others went through the formal process of applying online, sitting through an interview and defending their ventures to a selection team.

These findings suggest that, in general, incubators in Nigeria have relaxed selection criteria and employ different strategies to admit entrepreneurs and ventures into their space at the expense of the quality of the idea or solution the venture is solving. A possible explanation,

given through further analysis and discussions, revealed that some of these compromises were made just to create awareness of the existence of the concept of incubation.

Central to this study are the resources the incubator provides and how they are utilised by the entrepreneurs to enable the technology entrepreneurship process. According to the resource-based view theory, these resources are what will help the ventures in the incubator to gain competitive advantage.

Previous literature often states that, beyond a physical working space, incubators provide links to industry and educational institutions, new technology commercialisation, mentorship advice, and finance. However, this study revealed that, in Nigeria, the situation is slightly different. Nigerian incubators do not provide any links to educational institutions; neither do they commercialise any new technology from any research lab. Rather, they provide three fundamental resources, which are basic infrastructure, education and coaching, and access to networks. The infrastructural challenges that plague the region, such as unstable electricity, internet connection and very expensive real estate space, make infrastructure resources a valuable commodity to entrepreneurs and their ventures. They provide coaching and education through their mentors and management team, because the majority of the entrepreneurs are malcontented about their education. Most of the entrepreneurs are appreciative of the mentors the incubator provides, but still raise concern over the quality of experience they possess. They expect mentors to have entrepreneurial experience that, preferably, matches the domain in which the venture operates. The most valuable resource to the entrepreneurs and their ventures is the access to network available through the incubator.

When put in the context of the resource-based view theory, it can be inferred that these resources are valuable, in that they either help the entrepreneurs save on cost or provide comfort for the entrepreneur to focus on the core of their venture. They are rare because only ventures who are incubators have access to these resources and they are unique to each venture. They are inimitable because they can be difficult to acquire outside of the incubator, and non-substitutable because some of the resources are not widely available or easily accessible in a developing country.

However, it is important to note here that incubators in themselves are limited in the amount of these resources they can provide. As discussed above, the resources provided by Nigerian incubators are still elementary and might not be sufficient for a returnee who has the privilege of a richer network of resources at their disposal. In its current state, Nigerian incubators appear to attract more home-grown entrepreneurs than returnees.

While these resources are important at the starting-up phase of the venture to provide a competitive advantage, they are not enough to sustain the ventures for a long time. In such a

dynamic environment, things are constantly changing at a rapid pace. As a result, entrepreneurs are continually looking for resources that can help their venture to achieve a long-term sustainable advantage, within the incubator and outside of the incubator. At the same time, the incubator management are constantly seeking resources to help their tenant ventures.

Funding is the lifeblood of technology ventures. It can be argued that funding is a resource that could significantly propel a venture to attain sustainable competitive advantage. This study revealed that funding for technology ventures in Nigeria is still very much an issue. On the funder's side, there is a lack of knowledge about technology entrepreneurship activities and lack of motivation through incentives. Individuals and institutions with the capacity to provide funds for small technology ventures either do not understand the technology entrepreneurship landscape or have no incentives that motivate them to invest in the area.

On the receiver's side, there are issues of venture maturity and validation. Many ventures are either not ready for external funding, or not qualified enough to receive funding. This finding suggests a need for privately operated incubators to collaborate and educate private funders on the prospects of technology entrepreneurship in the region. More important is the need to celebrate the few successes that have emerged from the incubators and demonstrate how the incubators can be beneficial to the investors. The table is a summary of findings on this chapter.

*Table 18: Summary of findings on understanding Nigerian incubators*

<b>Technology incubators in Nigeria</b>	<b>Provisions</b>	<b>Summary of insights</b>	<b>Key strengths and weaknesses</b>
<b>Types of Incubators</b>	<ul style="list-style-type: none"> <li>• Government sponsored, Non-Autonomous</li> <li>• Government sponsored Autonomous</li> <li>• Privately sponsored</li> </ul>	Nigerian incubators are distinctly divided into government-sponsored and privately sponsored incubators. However, government incubators are subdivided into autonomous and non-autonomous incubators in their mode of operation.	Private incubators are slightly ahead in terms of achieving their objectives and goals for the entrepreneurs. Government-sponsored incubators are still faced with challenges that come with depending on an unreliable government

<b>Selection process</b>	<ul style="list-style-type: none"> <li>• Uses different strategies to admit entrepreneurs</li> <li>• Formal selection process</li> <li>• Informal selection process</li> <li>• Selection by contest</li> </ul>	<p>Most popular selection methods are informal selection means, i.e., Informal selection process and selection by contest. Could result in clash in expectations with incubator</p>	<p>Selection processes are put in place but are informal and not strictly upheld.</p>
<b>Resources provided</b>	<ul style="list-style-type: none"> <li>• Basic infrastructure</li> <li>• Education and coaching</li> <li>• Access to Network</li> <li>• Funding deficiency</li> </ul>	<p>Incubators provide these as they are specific to the landscape of technology entrepreneurship in Nigeria.</p>	<p>Technology entrepreneurship is gradually gaining popularity as a result of the resources provided by incubators. However, funding is still an issue and the incubators have not perfected adapting the resources to venture-specific needs.</p>

Having presented the findings on the incubators, their selection process and resources provided, the next chapter discusses the implications of these resources on the entrepreneurs and their venture.

# CHAPTER 7: Resource Implication on the Entrepreneurs and the Venture Creation Process

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## 7.1 Introduction

As the primary concern of this thesis is to understand the technology entrepreneurship process in the context of technology incubators, it is important to understand the implication of the resources provided by the incubators to the venture creation process as well as the entrepreneurs. The fundamental argument of the resource-based view theory is that a firm's resources can provide a sustainable competitive advantage if they fulfil the VRIN criteria (Valuable, Rare, Inimitable and Non-substitutable). While there are studies that use the resource-based view theory to examine incubators and the resources they provide, most of the studies do not examine the resources against the VRIN attributes as suggested by RBV. In this thesis, this theoretical precept of the resource-based view is used to examine the technology entrepreneurship process within the incubators. This will answer the last research question on this thesis: *What are the resource implications for the technology entrepreneurs and their ventures in the context of resource-based view theory?*

Many developed and emerging countries are adopting incubation mechanisms as a way of dedicating support to young businesses. Most of these incubators in advanced countries are established and associated with educational institutions, such as universities, and have connections with industry and government. They are generally aimed at promoting technology diffusion into the local economy, as well as commercialising these technologies to improve the economic development of the region they are embedded in (Gertner, 2013). However, the findings from this study have revealed some contrary evidence regarding how incubators influence entrepreneurs and their ventures from the perspective of an emerging country in sub-Saharan Africa.

This chapter present these findings and analysis. The chapter is divided into three sections. The first section deals with the resource implications on the entrepreneurs while the second section deals with the resource implications for the venture creation process. The third section deals with unintended outcomes of resources for both the entrepreneurs and their ventures.

## 7.2 Resource Implications for the Entrepreneurs

In chapter 5, it was found that a typical Nigerian entrepreneur in the incubator is a graduate of a myopic education system and is dissatisfied with their educational level. They possess amateurish experience and are determined to solve problems and create value through their passion for technology and resilience. Considering these are the characteristics of the technology entrepreneurs, this section covers how the resources provided by the incubator influence these entrepreneurs.

The general response to the influence of the resources provided by the incubator was positive (over 95%); however, they differ from what previous research has reported about the impact of technology incubators in more developed countries. Following the analyses of the entrepreneurs' responses from all the incubators on resource implications, three themes emerged – Further education, collaborative learning, and safe house/support mechanism. The themes are individually discussed below

### 7.2.1 Further Education

One of the implications of the resources provided by the incubator to the individual entrepreneurs is the opportunity to get further education on technology entrepreneurship activities. The incubators are essentially advanced education centres focused on training entrepreneurs. The incubators are assuming the task of educating the entrepreneurs, investors, private institutions, and the wider public on the nuances of technology entrepreneurship. The incubators fill the information gap left behind by an ailing education system in Nigeria, by providing vital information on activities and opportunities in technology entrepreneurship in the region. While learning in the incubator is partly the traditional, theoretical approach, it is mostly the 'learning-by-doing' approach as suggested by Rasmussen and Sørheim (2006). For instance, aside from several training sessions organised by the incubator, the researcher observed incubator A had a different floor in its building dedicated to entrepreneurs who are still learning and developing their ideas. Incubator C was solely focused on training and educating entrepreneurs on operating a technology venture. They invited experts in various fields, such as law, accounting and business development to help the entrepreneurs. Consequently, almost all the entrepreneurs agree with this statement by entrepreneur 7, essentially recommending incubators as education centres for entrepreneurs, which should be formalized as a requirement for school leavers:

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*Incubators play the most important role in developing technology entrepreneurship. Beyond that, in educating people. I think that schools should be replaced with incubators. I think that anybody that has finished their secondary school break should resume in an incubator. While they are learning their formal things to get them literate, they should be plugging themselves into the economy and it's the incubator that'll do that.*

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Although most of the respondents acknowledge this finding, one of the entrepreneurs was not convinced that the incubators have enough knowledge to teach entrepreneurship. His concern was that the incubators themselves are new ventures who are still learning how to operate. Incubator manager 2 agrees, but insists learning is not just one-directional. His comment below illustrates this point:

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*When you look at us, we've been only operating for a few years and there are still a lot to be learnt. The good thing is everyone is about at the same stage in the ecosystem. We are all learning from each other. So learning here is not only done by the start-ups. We, the incubators, are also learning from the start-ups' successes and failures.*

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Additionally, most entrepreneurs and other stakeholders in their responses made reference to the fact that the growth of technology entrepreneurship in the Lagos region of Nigeria was a result of the effort of the incubators. This is so because the incubators have spent time educating, training and exposing potential entrepreneurs to various entrepreneurial activities and opportunities.

As education centres, the incubators expose the entrepreneurs to a plethora of topics relating to entrepreneurship, such as presentations, social responsibility, finance, marketing, communication, technology. These topics are delivered through workshops or seminars by guests who are experts in their fields. This statement by entrepreneur 5 illustrates this point:

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*The incubators are always organising one workshop or training to help us sharpen our entrepreneurial skill. Sometimes it is in management and other times it is in using the right and latest technologies. I think this is important for us, the entrepreneurs*

---



Surprisingly, this finding is not well reflected in previous research. Generally, it is assumed that entrepreneurs in technology incubators are well educated and vastly experienced in technology entrepreneurship. This is seen in this study conducted by Colombo and Delmastro (2002) on the impact of technology incubators. The studies revealed that, on average, “founders of on-incubator firms have a richer educational background, especially as regards scientific and technical studies, than their off-incubator counterparts” Other studies conducted in more advanced countries focus on the ability of the incubators to commercialise advanced technology universities and research labs. They fail to notice that, in less developed countries, such as Nigeria, incubators do not take part in commercialising new technology. Rather, they bridge the gap in knowledge of technology entrepreneurship left by their education systems. Incubators are more active in providing fundamental practical training on technology entrepreneurship, particularly where technology entrepreneurship education is lacking in higher institutions. This statement by Entrepreneur 1 illustrates this point:

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*I think incubators are ideal for not the high-income start-ups but the grass-roots entrepreneurs that still need much knowledge*

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In the context of RBV and the VRIN attributes, it can be inferred that incubators as education centres are a valuable resource to the entrepreneurs, because they are gaining practical skills as well as knowledge that was not given to them in formal education. However, the researcher would argue that it is not rare as entrepreneurs can acquire knowledge through other means. Entrepreneurs could be experienced from starting previous ventures or have colleagues and friends who are more experienced. Also, entrepreneurs can read stories online about other successful and not so successful entrepreneurs. Many entrepreneurs openly write and blog about the challenges of operating a technology venture in Nigeria and offer learning points for upcoming entrepreneurs. Consequently, it is not a rare resource and can be easily imitated by other entrepreneurs who are not in incubators. Other entrepreneurs, currently not in incubators, can attend business schools and gain similar business knowledge and skills. However, it is a more expensive option; as a result, incubators as education centres cannot be substituted with a cheaper option.

### 7.2.2 Collaborative Learning

One of the implications of the resources provided by the incubator is the collaborative learning opportunities and atmosphere it facilitates. This can be related to the provision of education and basic infrastructure, such as co-working space. The co-working spaces are created to encourage collaborative learning among the entrepreneurs in the incubator. The comment by entrepreneur 8 illustrates this point:

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*The space provided by the incubator encourages us to learn from each other*

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Incubators design their space to encourage social interactions and discussions. In a visit to the incubators, it was observed that the spaces were designed to be open-plan and without wall barriers. Aside from actual working tables and chairs for the entrepreneurs, there were dedicated spaces with comfortable cushions for lounging and social interactions. It was not unusual to find tenants in the incubator sitting and chatting in these designated spaces.

Fundamentally, the way incubators are set up inspires collaborative learning. This is because the entrepreneurs are sharing many of the resources, including learning and education. The alternative for an entrepreneur would have been to privately hire an office. However, in a private office, the entrepreneur is isolated and would not benefit from sharing knowledge with fellow entrepreneurs. What is more interesting is that the incubator space is not restricted to just tenanted entrepreneurs. An important avenue for making additional revenue for the incubator is making their spaces available to other entrepreneurs who are not in the incubation program. These entrepreneurs are not necessarily technology entrepreneurs. For instance, in incubator B, there was an entrepreneur in the space who managed a charity organisation and just wanted a physical space to work from. In incubator C, there were entrepreneurs who were not part of the incubation program but used some of the physical resources in the incubator, such as the internet and stable electricity supply. These entrepreneurs interact with incubated entrepreneurs and knowledge is shared both ways. Entrepreneur 6 illustrates this in the comment below:

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*There are times when other external people will come in here and use the incubator facilities. What that means is that we can share knowledge because they might know things I don't know and I might know things they don't know. There is no problem as long as knowledge is shared.*

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Comparison of this finding with those of other studies confirms that knowledge sharing is one of the implications of resources provided by technology incubators. According to Tötterman and Sten (2005), incubated firms pool their tangible resources and complement each other in order to overcome the liabilities of newness and weak competitiveness. It basically stretches the learning basis of the entrepreneurs. They are not only learning from the incubator management, but also from fellow entrepreneurs and other experts in the incubator. Collaborative learning also extends to the management team. They are able to learn from the entrepreneurs' experiences as they go along the incubation process. With every batch of entrepreneurs, the incubator passes out, the incubator management team gain new knowledge and insight on building technology ventures. This comment by incubator manager 1 illustrates this point:

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*I mean, we are not where we were 5 years ago when we just started. We are not also perfect but we have definitely learnt a great deal with each start-up we work with. I have personally learnt from the entrepreneurs and, as a team, we have learnt from process.*

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Another example is entrepreneur 8. Through collaborative learning, she gained knowledge and motivation from fellow entrepreneurs in the incubator. According to entrepreneur 8:

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*Seeing what other ventures within the incubator was doing boosts motivation rather than brew rivalry.*

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Collaborative learning is important in technology entrepreneurship because it is a knowledge-intensive field. Technology ventures are dynamic in how they are created and operated and often functions in dynamic markets where there are many uncertainties (Agarwal, Audretsch and Sarkar, 2007). Thus, they require the combined knowledge of experts in various fields to successfully launch a product or service. Entrepreneur 8, for instance who operates an online venture that provides information products and resources to pregnant women and young families, requires the expertise of a web expert to design her website. Not only that, but she also requires the expertise of a digital marketer to help her website constantly rank high in search engines like Google and Bing. Entrepreneurs do not work in isolation; it is a social role, embedded in a social context. According to Jelinek (1996 p.799), technology entrepreneurship is a “quintessentially social activity that requires joint efforts”.

In the context of RBV and the VRIN attributes, it can be inferred that the opportunity for an entrepreneur to participate in an environment that encourages and facilitates the sharing of knowledge is definitely valuable. This is because, as a technology entrepreneur, there is value in tapping into the knowledge of another entrepreneur who is an expert in another field. Although non-incubated entrepreneurs can join a co-working space and find other entrepreneurs, it is rare to find a co-working space that facilitates knowledge sharing as incubators do. This is even more apparent in Nigeria, as the researcher observed co-working spaces with private offices and partitioned wall barriers. Aside from co-working space, which comes the closest, there is no organisation or network that facilitates collaborative learning like incubators. Collaboration can take place in universities but, as mentioned in chapter 5, Nigerian universities do not have the capacity to create or facilitate knowledge sharing; they are geared towards graduating students, as opposed to sharing knowledge about launching new ventures. It is imitable because the incubator model of facilitating knowledge sharing and collaborative learning can be replicated in a university setting as a small business society, or in a more intentional co-working space. However, it is non-substitutable because technology entrepreneurs are constantly learning and improving themselves to be able to improve their products and services. The incubator facility makes this learning easier and faster because of the opportunity of collaborative learning.

### 7.2.3 Experimental Freedom

Lastly, freedom to experiment is another implication of the resources provided by the incubators to the entrepreneurs. It is a rather underexplored resource implication of incubators to technology entrepreneurs. In order for technology entrepreneurship to thrive in a region, there need to be numerous entrepreneurs willing to start new technology ventures. However, the high failure rate of new ventures means entrepreneurs need to be resilient in their endeavours to start new businesses. They also need to be given support and freedom to start more ventures. As entrepreneur 17 suggests:

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*it is also a numbers game because the more new technology ventures started, the more chance of success there might be*

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Technology incubators are more supportive and generally encourage entrepreneurs to try out their ideas. They understand the risk involved in starting new technology ventures and provide basic resources which aim to increase the survival chance of the new ventures. As a result, the incubators are regarded as safe houses because of their willingness to give entrepreneurs the opportunity to develop their ideas and transform them into successful ventures. Incubator manager 2 in his comment below, describes it as a 'hand holding' attitude of the incubators to the entrepreneurs:

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*I tell you what, the hand holding attitude of the incubator has led to more entrepreneurs willing to take risks and try and fail*

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This is even more apparent in Nigeria, where resources are generally scarce and appetite to take risks on technology ventures is generally low. As a Nigerian the researcher understands the cultural stigma that comes with failure. For instance, parents place high expectations on their children, expecting them to acquire high-quality education and get employment in a government job that provides long-term security. Entrepreneurship is generally viewed as a risk that could potentially lead to colossal disappointment and eventual poor economic conditions. As a result, most Nigerians aspire to have a safe comfortable government job and dabble in entrepreneurial ventures, which are generally referred to as 'side hustle'.

This observation is in accordance with Cardon, Stevens and Potter's (2011) paper, which examined cultural views of venture failure. The data, which analysed 389 accounts of entrepreneurial failures from 1999 to 2001 in the US, suggested that cultural sense-making of failure varies by geographical area. The study found that failure had a large impact on the stigmatization of an entrepreneur within a local area, as well as on the individual entrepreneur's view of themselves following failure. That said, the technology entrepreneurs interviewed do not have other jobs. They have left their previous jobs and are pursuing entrepreneurship as a full time career path. Also, considering the majority of the entrepreneurs in Nigerian incubators are first time entrepreneurs and unsettled entrepreneurs, the incubator's provision of an environment that supports entrepreneurs' freedom to experiment and develop their ideas is momentous. This comment from entrepreneur 5 illustrates this:

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*They give you a platform to make your mistakes without it costing you too much which is not a thing in our culture. You have the opportunity to make your mistakes; you have the privilege to be among a community of people who either bumbling about in the dark or they've found their way and so everyone is holding everyone's hand and moving.*

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There were, however, concerns about the quality of new ventures started by the incubators. Some private incubators in Nigeria have begun with promising new ventures but are currently not in operation. According to Entrepreneur 17, incubators are useful in starting new ventures, but do not increase the number of new ventures that are successful:

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*Incubators are useful but not as significant as people think. It increases the number of tech startups that gets started but doesn't increase the number of startups that succeed.*

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This view is echoed in other studies in literature, such as that by Ratinho and Henriques (2010), who described the impact of business incubators as “modest” in their contribution to creating jobs and creating economic growth in Portugal. In agreement with this view, Hichri, M'chirgui and Lamine (2016) asserted that estimates show that incubators play a very modest role in business growth in Tunisia. These arguments of the significance of technology incubators, however, is countered by this statement by incubator manager 1:

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*incubators give more potential entrepreneurs an opportunity to try. They have access to technical talent, finance and other resources. Incubators if anything acts as safe house for people to try and fail and that in itself is massive value*

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He argued further that incubators are not for everybody. The idea of growing a new technology venture outside of an incubator is certainly possible but requires a lot of hard work, a large pool of network and some strokes of luck. These uncertainties and labour are not for everyone; some entrepreneurs prefer the relative, structured ease of being groomed in an incubator and given the required resources for their venture to survive.

The freedom of experiment and safe house environment provided by incubators to their entrepreneurs reflect those of Löfsten and Lindelöf (2005), who also found that technology business incubators could be viewed as breeding grounds for new and innovative companies to minimise their risk of failure.

### **7.3 Resource Implications for the Venture Creation Process**

While the previous section discussed the resource implications for the entrepreneurs, this section discusses the resource implications for the ventures. As discussed in the literature review chapter, previous scholars described the entrepreneurial process in phases - recognition of an opportunity; assembling the essential resources; launching a new venture; managing growth and building success; and harvesting rewards (Baron and Shane, 2007). The technology entrepreneurship process embodies the conventional entrepreneurship process, with a biased focus on innovative technology ideas and opportunities, wherein the entrepreneurship process involves recognising opportunities, building products or services, raising capital, and launching new ventures. Unsurprisingly, the general consensus gathered from respondents suggest that the process of technology entrepreneurship is not quite a linear structured procedure in phases. Rather, it is a dynamic, endless circle of constant improvement and mini launches. As shown in the TE-TI schematic diagram, the process of technology entrepreneurship begins with opportunity recognition. According to Nigerian technology entrepreneurs, opportunity usually stems from a motivation to solve problems or add value (see section 5.4.4). The opportunity recognition phase is also where the idea is formed. Following opportunity recognition is the product development phase, where a prototype product or service is created. In technology entrepreneurship, this is popularly referred to as 'minimum viable product'. Entrepreneur 2 explains further below:

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*...in between this idea and prototype documentation there should be what is called MVP, the minimum viable product. A minimum viable product is a product that we use the minimal resources at your disposal for you to test the market, to get the feedback from your perspective users and leads fast for you to create a perfect product*

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The idea is to get the minimum viable product into the hands of early adopters as quickly as possible to get valuable feedback. This leads to the next activity in the process; that is, the launch. At this phase, the product/service is introduced to the marketplace for testing and

validation of the business idea. As earlier mentioned, the venture creation process in technology entrepreneurship is dynamic and unending. Thus, the venture is continually in a post-launch phase of reiterating and improving their product/service, as per feedback from the users. Thus, this section presents findings on how the resources provided by the incubators influence the ventures as they go through these processes.

Following the analyses of the responses from entrepreneurs, incubator managers and other stakeholders on resource implications, three themes emerged – Corporate partnerships and collaborations, clustering effect, and guarantor/advocation. The themes are individually discussed below.

### 7.3.1 Corporate partnerships and Collaborations

This research study revealed that one of the most important influences incubators have on the technology entrepreneurship process is that they facilitate corporate partnerships and collaborations. This is directly linked to the access to networks made available to the entrepreneurs. The majority of the entrepreneurs acknowledged that the networking opportunities provided by the incubators could lead to a partnership with a corporate organisation for their venture. An example is Entrepreneur 14, who testified that, through the network provided by the incubator, he was able to secure a collaboration deal with the Portuguese and Spanish embassy to create translation apps. He explained:

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*One of the things that has worked for me has been in terms of their networks. I've had first hand experiences where they have been and seen potential values that will help my business. They've connected me with those sources and facilitated those kind of things to happen. A very practical reference is the Portuguese and Spanish translation for the Yoruba app. They facilitated my trip to Brazil so it by virtue of them being there and seeing the value and how appreciative those people were of the product they then started the process that led to me experiencing things for myself so I don't need any other motivation...*

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Another entrepreneur (Entrepreneur 8) was able to secure sponsorship opportunities from one of the big telecommunication organisations in Nigeria. The collaboration led to significant monetary and infrastructure support. Although not yet popular in the Nigerian technology entrepreneurship landscape, previous studies have also shown direct links between a venture's prominence in its network and its likelihood to get acquired. Mazzola, Perrone and



Kamuriwo (2016) argue that a firm's direct ties and prominence enhance the firm's visibility and signal, thus increasing its chances of getting acquired. Thus, as an extension, collaboration and partnership opportunities can be in the form of acquisition.

Partnerships and collaboration are not only possible with external organisations. They can be internal with other ventures in the incubator or with the incubator itself. For instance, a digital distribution venture operated by Entrepreneur 4 was able to partner with the incubator to launch its services into the marketplace. The incubator created channels through which the venture could reach a wider audience, by leveraging their credibility. Another example of this is Entrepreneur 9, who is privileged to have some executives of the incubator actively involved in the development of a transportation venture. As a result, the incubator management were able to bring in a significant investment through their relationships with some angel investors to hire staff and invest in marketing campaigns for the venture.

Although it is acknowledged that one implication of the resources provided by the incubator is facilitation of corporate partnerships and collaborations, there was little evidence to this effect. Collaboration between ventures is a source for growth and competitiveness among entrepreneurial firms in most western countries (Lechner and Dowling, 2003), but from observational studies and discussion with respondents, it was gathered that not much partnership and collaboration takes place in the Nigerian tech scene. Very few entrepreneurs could testify of the partnerships and collaborations facilitated by the incubators. As Entrepreneur 16 said:

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*In our startup industry, we don't have a culture of convergence. If we are doing or almost doing the same things we're competing. If you're going to be dying and can't continue, why don't we come together and do something. Maybe re-evaluate the model and create a better startup. We don't have that culture. Everybody dies and you have the big one getting bigger*

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The comment above by Entrepreneur 16 is describing a lack of synergy in the Nigerian technology ecosystem. It was also found that private organisations do not cooperate with new technology ventures. When entrepreneurs were asked if they had worked with any private organisation in achieving their goal, the majority of response was negative, aside from Entrepreneurs 8 and 14 mentioned above. What was striking is that some large private organisations compete in similar spaces with new technology ventures for their customers and solutions. For instance, most Nigerian banks have developed their own payment solutions to directly compete with new technology ventures like Simple Pay and Vogue pay, which are ventures also offering payment solutions to small businesses. Another example is an

ecommerce website -smartmarkethub.com established by GTBank to help small businesses and individuals sell online. This solution directly competes with Jumia.com and Konga.com, which are huge ecommerce websites for businesses and individuals to sell online. Entrepreneur 2 expressed his frustration in this comment:

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*Almost everything constrains if you're working in a technology venture in Nigeria. When you start thinking of no power, no internet, lack of government capital and government support and a lot of things. To the point where the government is even clamping on a lot of tech innovations and we've also seen bigger competitors like banks competing with start-ups on payment solutions.*

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Development of technology entrepreneurship thrives where there is cooperation and collaboration between key stakeholders in the process to achieve a common goal. However, in Nigeria, corporate partnerships and collaborations between incubators and private organisations or between technology ventures and private organisations are still tenuous. This comment by incubator manager 1 illustrates this:

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*Here is the problem, all these private organisations don't get it. Why will you outsource your technology to another country when you can simply hire us, the incubator, to work on it? I have tried many times to explain this thing to them that we can consultants on projects. But they will much prefer to hire more expensive organisations than us.*

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Similarly, the Nigerian government has been sluggish in supporting new technology ventures. The researcher perceived a general dissatisfaction from respondents on the government's approach to technology entrepreneurship. Although the current government is restating a renewed commitment to technology entrepreneurship, in the form of promises of establishment of new technology incubators across the country (Matuluko, 2015), the researcher sensed a lack of confidence among the respondents on any promises made by the government. As a matter of fact, most interviewees were certain that the government is simply paying lip service to technology entrepreneurship because of the perceived success of privately-operated technology incubators and the fear of missing out from the new global phenomenon of commercialising knowledge and creation of new technology firms. The government's attempts to establish technology incubators have been unsuccessful in the past. As a result, almost all of the interview respondents' reaction to the current government's

proposal to build new technology incubators has scepticism written all over it. The general consensus is that the government is taking a wrong approach. Some respondents suggested that, rather than set up new incubators, government should revisit existing government incubators and try to improve their services or simply create enabling environments for technology ventures to thrive. Other respondents suggested that the government should form partnerships with existing private incubators and collaborate on creating new incubators. Speaking on this issue, a seasoned entrepreneur exclaimed:

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*They have hubs that they haven't even funded. Most times they don't have internet there... If Buhari (The President) does that, by the time the next guy comes, they might not recognize that. So they keep increasing their overhead which they cannot sustain. There is what we call Abuja Technology Village in Abuja but it's not running! A lot of it is simply waste of time... The guy we don't even know him, he just came and became minister of Science and Technology and he now came to say he wants to duplicate what! For who?!... Let me tell you, what is driving Nigeria (technology landscape) is the people like me who haven't given up*

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This finding further supports the idea of the importance of collaboration and partnerships in technology entrepreneurship. The process of technology entrepreneurship has to do with collaborative production based on a shared vision of future changes in technology (Bailetti, 2012). It also corroborates the ideas of Williams and Tsiteladze (2016), who indicated that one of the attractions of incubators is their collaborative opportunities. Technology entrepreneurship transcends single individuals and enterprises; it is much more a mix of relational and institutional configurations, linked and affected by the context in which it is deployed. The context here refers to sets of local conditions, such as favourable environmental conditions, to foster the development of technology entrepreneurship. It can thus be suggested that the fundamental issue in Nigerian technology entrepreneurship is the scarcity and unwillingness of both government and private institutions, which are an essential unit of the technology ecosystem, to understand the intricate process of technology entrepreneurship and collaborate in its development.

Although most participants agree incubators are attractive venues for collaboration to take place and they are the point of access for technology entrepreneurs, investors and other enthusiasts, it is unclear why there are so few active partnerships and collaboration between ventures within the incubator and with ventures outside the incubator. A possible explanation for this might relate to the syndrome of first-time and inexperienced entrepreneurs that are chosen by the incubator, as discussed in section 6.3. This type of entrepreneur is still in the

early stages of the entrepreneurial journey and might not see the value of collaborating with another venture just yet. It could be that entrepreneurs in the incubator view other ventures within and outside the incubators as rivals, rather than partners. Also, it could be a cultural attitude towards collaborating on projects, as most Nigerians tend to be independent and stubborn about achieving independent success. A few entrepreneurs complained about this attitude. Nonetheless, as an incubator manager emphasised, although situations and environment may be different, with the ability to spot opportunities such as collaboration opportunities, it is entirely up to the entrepreneur to push the incubator management to make such opportunities available.

### 7.3.2 Clustering Effect

Another implication of the resources provided by incubators for the ventures is the clustering effect it generates. A majority of the participants acknowledged that the incubator served as a place of assembly of both entrepreneurial and professional enthusiasts who have common interests in technology entrepreneurship. As most respondents asserted, technology incubators attract and serve as the converging place for talents, investors, entrepreneurs and other stakeholders. For instance, investors can meet with entrepreneurs in the incubator space, and entrepreneurs can employ talented individuals that come around the incubator space. Entrepreneurs can also use the incubator facilities to demonstrate and present their products and services to the wider public. Also, government officials can visit the incubator space to leverage the skills, knowledge and experience of the incubator management.

In observational studies, it was discovered that the incubators were always welcoming some form of visitors; some prestigious government official on some days and regular enthusiasts on other days. It was unsurprising to discover that, just a month after concluding this study, the CEO of Facebook, Mark Zuckerberg, visited Nigeria to learn about technology entrepreneurship activities happening in the region, and visited one of the incubators that were used in this research, CoCreation Hub to be precise (Busari, 2016). Entrepreneur 7 illustrates the usefulness of incubators as points of access in the comment below:

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*It is very important that the incubators are there as the major access points for not investing this time around, they are the access points for the other bigger tech influence to the country, like Facebook, Google. Google will not come to your office but they will prefer to partner with incubators to push new ideas and products.*

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As mentioned in chapter 6, the Yaba area of Lagos is popular with technology ventures and technology entrepreneurship activities. However, there are debates around the strength of Yaba as a technology cluster. This is because the elements that make up strong clusters, such as funding, education and research centres, are not yet very visible and active. Nonetheless, while Yaba as a technology cluster is being debated, the influence of the incubators in facilitating this perceived cluster effect cannot be dismissed. According to Bosin Tijani, founder of CoCreation Hub, the choice to locate the incubator in Yaba was deliberate. He asserted that “the driver of the vision was simply the fact that the new and emerging technology industry requires a strong root to allow it to attract resources and build strength. This was to be a long and intentional exercise with multiple players independently and collectively driving the growth of the industry” (Tijani, 2017).

The impact of incubators on the growth of the Yaba cluster can show how intentionally the incubators create an atmosphere for technology ventures to thrive. For instance, CoCreation Hub has a program called i-HQ that focuses on supporting the current government’s regeneration effort in converting Yaba into a hotspot for creative ventures. It aims to create a collaborative environment where key stakeholders (academic, industry and government) can find adequate infrastructure and resources. The Yaba cluster is arguably the most successful cluster in Nigeria and that is because, over the years, with the help of incubators such as CCHub and IDEA, Yaba has attracted interest and resources and commanded respect for technology and start-ups in Nigeria. That said, Yaba as a technology cluster still has a way to go. As discussed in the previous section, there is still an obvious lack of synergy between academy, industry and government.

This clustering effect further highlights the social aspects of entrepreneurship, which is very much present in technology entrepreneurship. Technology clusters exist when there is a geographic concentration of a critical mass of interconnected companies and institutions in a particular field. Clusters of technology ventures have, over the years, become a source of economic development in advanced countries and a central focus of technology policies in both advanced and developing countries.

Several studies of technology clusters yield a compelling explanation that centres around social networks and labour market mobility (Casper, 2007). Technology ventures have a tendency to gravitate towards each other and form clusters, because firms in a cluster tend to gain many performance advantages, due to the external economies of scale; easy access to information; proximity to specialised suppliers and customers; and reduced transaction costs among others (Porter, 1998; Delgado, Porter and Stern, 2010). Furthermore, firms in a cluster

have free and speedy access to local information and networks, simply because of their physical proximity (Özcan, 1995; Engel and del-Palacio, 2009; Ozcan and Islam, 2014)

The emergence of Silicon Valley and other clusters has been attributed to several factors, such as alignment of incentives and goals, rapid creation of new companies as a mechanism to commercialise new technology and innovation, testing new business models, developing new markets. and early strategic perspective. However, most significant is the mobility and rapid repurposing of resources; that is, people, money, and technology, within and among highly entrepreneurial firms and individuals.

The clustering of technology ventures within a geographical region leads to the formation of dense network structures, both formal and informal (Saxenian, 2007). Through these networks, learning, knowledge, information and other resources are rapidly exchanged. This creates a strong justification for the approach underlining the social embeddedness of technology entrepreneurship. It also explains why technology companies embedded within regions with a dispersed culture of high mobility of resources and diffusion of knowledge tend to gain “regional advantage” over companies that are not (Casper, 2007; Klepper, 2010; Engel and del-Palacio, 2011; Ozcan and Islam, 2014).

### 7.3.3 Advocation

Analysis of the data revealed that one of the influences of technology incubators on the development of technology ventures in Nigeria is the advocacy services they render for the ventures. The incubators assume an intermediary position and function as a surety for the ventures in their cohort. This comment by incubator manager 3 illustrates this:

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*One of my roles here is to present this startups to my bosses or other interested parties as viable guys. They trust that we have done our due diligence which we have, and we know how good they are.*

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In addition to being a place of convergence, they are also connectors, because of their unique positioning. The incubators essentially represent their ventures and present them as trustworthy to external stakeholders, such as banks, venture capital, government, private businesses and so on. This is not surprising, considering the primary objective of incubators is to help their tenant ventures to survive and be successful. This they do by interceding on behalf of the entrepreneurs with relevant resources and tools that will be useful to their ventures. On one of the visits to CoCreation Hub, the researcher observed incubator manager

1 was preparing for a meeting with potential venture capital investors. When the researcher inquired about this, the incubator manager admitted that the incubator was in the process of establishing a \$350 million social innovation fund with other financiers, aimed at early-stage technology ventures. Essentially, the incubators are the voice of the entrepreneurs because they are reputable, and institutions would rather engage with the incubators as guarantors than with individual entrepreneurs. The comment below is the experience of Entrepreneur 8:

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*You know for the kind of business I run, I need a lot of sponsorships and through their contact, we had a lot of meetings with high profile companies that we work with now and it was through the incubator connection... Also, a lot of the partners we work with, we met them through the incubator*

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This can be related to the networking activities of the incubator. The management of the incubator are constantly advocating for more resources from external stakeholders on behalf of their ventures. This finding was also reported by Soetanto and Geenhuizen (2005) who discovered that technology business incubators are 'intermediary agents' between firms and non-cooperate institutions. More interestingly, it reinforces arguments by Apa, Grandinetti and Sedita (2017) that community-based relationships and intermediation by incubator management are crucial for supporting tenants in product and business development activities.

External stakeholders are more likely to trust a venture that has been through incubation than off-incubated firms (Modena and Shefer, 1998; Rothschild and Darr, 2005). However, observing the landscape of technology entrepreneurship in Nigeria, incubators are yet to be trusted to produce high-flying ventures. For instance, most of the top technology ventures in Nigeria, such as Irokotv.com, Jumia.com, Hotels.ng, and wakanow.com are not incubated ventures. Incubator manager 1 had this to say regarding this:

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*What we do cannot be discounted. I know people say all these things about incubators not yet producing any successful startups. When you compare, you will discover these other startups have a large network and have been able to raise significant amount of cash. Therefore, they are willing to take bigger risks. We have limited resources yet, we have done ok with mamalette, and Budgit and others*

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As suggested by Incubator manager 1 above, perhaps the reason why Nigerian incubators are yet to produce successful technology ventures on the scale of top non-incubated ventures is the resources they have available to them. It is also possible that it is a result of the classification of entrepreneurs present in the incubators. Although resilient and passionate about technology solutions, Nigerian entrepreneurs in incubators still require further entrepreneurship education and some practical experience in operating a technology venture.

Having discussed implications of resources for entrepreneurs in incubators, the next section presents findings and analyses on unintended implications of resources for entrepreneurs and their ventures.

#### **7.4 Resource Curse**

The existence of unintended outcomes of resources provided by the incubators was an interesting finding of this study. Incubators are known for their ability to provide many benefits to their ventures, from access to capital, to a pool of human resource talents, mentorship advice, and marketplace knowledge. In the case of Nigerian incubators, discussed in the previous section, these resources are summarised under basic infrastructure, education and coaching, and access to networks. Surprisingly, not much has been said about how these resources can sometimes become potential drawbacks to ventures operating within the incubator. The resource-based view from the perspective of the incubators only addresses how the resources provided by the incubator enable their tenanted ventures to survive and thrive. It does not explain how resources can sometimes lead to unintended outcomes. While the researcher quizzed about the benefits of incubators, the entrepreneurs were also interviewed on the potential drawbacks of the incubators. Generally, the response received was that incubators are beneficial to the current climate of technology entrepreneurship development in Nigeria. However, it was interesting to find out that the incubators can sometimes limit the entrepreneurs and their ventures.

Three themes emerged as unintended resource outcomes following the analyses of the entrepreneur's responses from all the incubators – entrepreneurial passivity, clashes, and distraction. The themes are individually discussed below:



#### 7.4.1 Entrepreneurial Passivity

It was revealed that the resources provided by incubators could lead to entrepreneurial passivity as an unintended outcome. Entrepreneurial passivity is a state in which the entrepreneurs take on a sluggish attitude to their entrepreneurial journey. Commenting on this issue, entrepreneur 2 stated:

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*Sometimes you just get relaxed because you have all the amenities given to you, you have your light, space, internet.*

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This finding was unanticipated and is rather ironic. This is because the main purpose of incubators is to spur entrepreneurs and their ventures to success by providing the necessary advice and support, they require. However, this study found that entrepreneurs can become over reliant on the 'limited' resources provided by the incubator, rather than rising to the challenge of seeking and managing scarce resources to make their venture successful – which, essentially, is the definition of an entrepreneur. As entrepreneur 8 noted:

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*too much comfort for tenant ventures makes them lazy to go out and fend for themselves (over reliance on incubator provision)*

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This passivity of some entrepreneurs who are incubated has raised questions about the significance and relevance of incubators. Some entrepreneurs argue that incubators produce ventures that are not able to survive the marketplace. According to Entrepreneur 11:

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*Incubators keep ventures thinking like a baby. Most ventures do not come out of incubators as matured ventures*

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Essentially, the success of a venture begins with the founder, as several researchers have shown (Schumpeter, 1934; Gartner, 1988; Shane and Venkataraman, 2000a; Newton and Gary Shreeve, 2002). Many entrepreneurs in the study recognise this and are conscious of entrepreneurial passivity that comes from getting overly dependent on the incubator. For instance, it was observed that a particular entrepreneur (21) decided to move their ventures

out of the incubator as they began to sense the symptoms of entrepreneurial passivity. Although this result has not been previously described in any study, there have been suggestions that the incubation period for ventures should be structured and tailored to the incubator (Centre for Strategy & Evaluation Services, 2002). In a situation where an incubator has an unstructured and open tenancy agreement, as was observed in Nigerian incubators, the entrepreneurs are highly likely to fall into the perils of entrepreneurial passivity.

#### 7.4.2 Clash of expectations

The second recurring theme of unintended outcomes of resources was clashes between the entrepreneurs and the incubator management. Generally, incubators require a time commitment and adherence to their schedule, which includes many training sessions, workshops and conferences. While these training sessions and workshops are useful to the entrepreneurs, they can sometimes clash with the entrepreneur's time for productivity. Some entrepreneurs complained about instances where the incubator's time and schedules conflicted with their time to get meaningful work done. Also, the opening times of the incubator could also be undesirable, particularly in a developing region like Nigeria, still faced with infrastructural problems. The entrepreneur's best time to be productive are the times they are in the incubator. When they lose that time, they are faced with challenges like unstable power supply, slow internet connection and uncondusive working locations. According to entrepreneur 3:

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*The cons I would say is timing. That's the only thing I would say time schedule. For example if I want to work all day and the incubator says there will be a training by 1pm and 2pm, then I have to explain to customer – sorry I won't be available. Although it is for our good, but it affects business sometimes. Second, the incubator can close by 6pm and everything will shut down meanwhile, that might be the time for my top gear at work*

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Additionally, a few entrepreneurs suggested that clashes can also be in goals and objectives. The incubator might expect very different outcomes for a venture compared to the expectation of the founder. This can be linked to the issue of lack of clear selection criteria and objectives as discussed above (see section 6.3). For instance, some entrepreneurs were nonchalant about accepting external capital to fund their business to grow. However, it seemed incubators were eager for their tenant ventures to grow, scale and raise more capital to be successful. Speaking on this issue, entrepreneur 13 explained:

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*There is my definition of success and there is their definition of success and sometimes that intersection ... I think on the one hand it can be there from the beginning but I think in terms of expectation it would then be how flexible is it for both parties. You know there is the expectation that this can become this and that is why we are supporting you then there is the reality check of its 3 years and hey I think I have done this much for myself and my context is making me rethink success so that alignment might not be there again*

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Considering the poor state of entrepreneurship education in Nigeria, coupled with the fact that technology entrepreneurship is a new concept in the region, it is understandable that incubators try as much as possible to educate the entrepreneurs on how to operate and be efficient at running technology ventures. However, this finding suggests the need for incubator managers to have structured timetables of upcoming events so entrepreneurs could plan their time around the timetables. That way, entrepreneurs can gain the education the incubator is providing as well as find the time to be productive at growing their venture. The structure is agreeably important in operating a successful incubator but could have an adverse effect when it clashes with the entrepreneur's productivity. Secondly, this finding reveals the increasing importance of aligning the selection criteria with the incubator objectives and goals and ensuring they are reflected in the selection process.

#### 7.4.3 Distraction

The final theme that emerged from the analyses is distraction. The entrepreneurs become distracted when they are constantly inundated with advice and know-how from different expertise and professionals who are part of the community the incubator attracts. This was a surprising finding as one of the major influences of incubators on technology entrepreneurship is in the form of advisory guidance. It is unintended that advice from knowledgeable individuals could lead to distraction for the entrepreneurs. While some entrepreneurs felt that co-locating with other ventures and learning of their progress breeds a form of peer pressure and could lead to unhealthy competitions, others felt that having many individuals giving different forms of advice and opinions could lead to confusion for the entrepreneur, such that the entrepreneur loses sight of the problem they are trying to solve. As entrepreneur 6 puts it:

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*...when there are many opinions and ideas left  
right and centre, it can become distracting*

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This finding intersects with a particular case described to me by incubator manager 1. He explained that, in the early days of the incubator's operations, the incubator was open to anyone interested in using the space. What then happened was that the incubator had an influx of individuals who were not necessarily interested in technology entrepreneurship but just wanted the comfortable surroundings and the free internet connection to download movies. On noticing this, the incubator bought a new space in the same building and moved individuals who were serious about technology entrepreneurship, while leaving the previous space open to the general public. In observational studies, the researcher noticed the new incubator space was much more quiet, secluded and focused. Nonetheless, this finding suggests that, while incubators have a real intention of matching entrepreneurs with mentors, facilitating community dialogues and collaborative efforts, it could lead to distraction for the entrepreneur such that the entrepreneur loses focus on the essential problem they are trying to tackle.

This finding conflicts with the entire purpose for an incubator's existence. Resources provided by the incubator are meant to provide competitive advantage and not drawbacks. It is possible that this finding is a result of poor selection of entrepreneurs and lack of experienced incubator management and mentors. It is a paradox that an entrepreneur becomes 'lazy' as a result of overdependence on resources provided to help them fast-track their survival and success. An incubator management with the experience of walking in the shoes of an entrepreneur would understand the best times to engage and allow time and space for productivity. A focused and experienced mentorship community could reduce distractions that might arise from conflicting opinions and advice. This combination of findings provides some support for the conceptual premise that the resources provided by incubators could lead to unintended outcomes. However, a note of caution is due here, since this study only investigates incubators in Nigeria.

## **7.5 Summary and synthesis of the Interaction between Venture Creation and Incubator**

In summary, this chapter presents findings and discusses the implication resources provided by technology incubators for, first, the entrepreneur, and then their ventures. It presents new insights into the influence of incubators on the technology entrepreneurship process, particularly in a developing country. Basically, technology incubators support technology ventures by providing the required resources they need to develop. This is more prevalent in Nigeria, where support for technology ventures is infrequent. The aim of the incubators is to increase the survival chances of new technology ventures through the resources they provide. This study uncovered that the resources provided by the incubators have implications for the entrepreneurs as individuals and then their ventures.

The implications of the resources provided to the entrepreneurs are opportunity to gain further knowledge and education, collaborative learning opportunity, and freedom to experiment. First and foremost, as the majority of the entrepreneurs in Nigerian incubators are graduates of a myopic education system, novice and unsettled, the incubators have assumed the role of providing practical experience and specialised knowledge on entrepreneurship and new venture development. This implication was linked to the education and coaching resource provided by the incubators to their tenant entrepreneurs. The incubator essentially fills the knowledge gaps of the entrepreneurs, as they relate to entrepreneurship and venture creation. Second, incubators, through the provision of a convenient working space and stimulating environment, have been able to inspire an atmosphere that promotes collaborative learning. Learning for the entrepreneurs is not just happening through a top-down approach from the incubator management. Entrepreneurs are learning from each other's' experiences in the venture creation process. Likewise, the incubator management is also learning from the experiences of the entrepreneurs. Such an environment increases knowledge transfer and inspires creativity for the entrepreneurs and the incubator management. Finally, one of the fundamental influences of the incubators on the entrepreneurs is the safe harbour it provides for entrepreneurs to try out their ideas. Incubators understand the challenges involved in creating new technology ventures and provide relevant resources to improve the chances of survival. However, they also understand that not all the ventures will be successful. Nonetheless, they create a welcoming and safe environment for more entrepreneurs to try out their ideas without the fear of condemnation.

The implications of the resources provided by the incubators to the ventures are corporate partnership and collaboration, clustering effect, and advocacy. First, the access to network resources provided by the incubators could lead to partnership and collaboration opportunities

with key stakeholders. Considering most of the ventures were in their launch phase, this was a significant implication of the resources they were provided. Unfortunately, in Nigeria there is still a visible lack of synergy between technology ventures and external stakeholders, such as academics, industry, or government. Nonetheless, it was discovered that this is one of the most significant of the resources provided by the incubators.

Secondly, the incubators, as a central place for education, collaborative learning, and safe harbour have become attractive for technology enthusiasts, private businesses, private and institutional investors, government and even media. Consequently, they have attracted a few actors and played an important part in developing what is still perceived as a growing cluster in the Yaba area of Lagos. Yaba as a cluster for technology entrepreneurship activities is not solidified as it still lacks some of the fundamental infrastructure and synergy that makes up an active cluster. Nonetheless, the activities of the incubator have attracted new technology ventures to locate their offices in the Yaba area. Clusters are instrumental for technology ventures to have free and speedy access to local information and networks, simply because of their physical proximity.

Finally, the incubators take on an intermediary position on behalf of the ventures. They advocate on behalf of the ventures to key stakeholders for resources. Ideally, investors are more likely to trust a venture vetted by an incubator than a venture that has not been through incubation. However, currently, Nigerian incubators have not yet gained that level of prominence in the technology landscape in Nigeria.

An unanticipated finding from the study was that the resources provided by the incubators could lead to unintended outcomes. It was discovered that participation in incubation could lead to entrepreneurial passivity, clashes, and distraction. Entrepreneurial passivity happens when an entrepreneur becomes over-dependent on the resources provided by the incubator, such that, when the incubator is not forthcoming, it leads to paralysis of the entrepreneur and their venture. Clashes occur when the incubator time and activities schedule interrupt the productivity time of the entrepreneur. It also includes situations where the incubator and the entrepreneur have a separate expectation for the venture. This can be linked to the weak selection process and poor communication and understanding from the beginning between the incubator management and entrepreneur. An entrepreneur experiences distraction when they become open to too many opinions, suggestions and advice that they lose focus of the core purpose of their venture. This result exposes a gap not covered by the resource-based view theory – the notion that resources do not always lead to a positive outcome. The resource-based view theory argues that resources, when valuable and rare, should lead to

acquisition of competitive advantage. It does not deal with situations where the resources themselves lead to unintended outcomes.

The table below is a summary of the findings of this chapter

Table 19: A summary of findings on resource implications for entrepreneurs

Resource implication for Entrepreneurs	Related resource	Key strengths and weaknesses of Nigerian Incubators
<b>Further Education</b>	Education and coaching	<ul style="list-style-type: none"> <li>- Occupy an important place in educating potential entrepreneurs on entrepreneurship.</li> <li>- Provide action-based learning experience for the entrepreneurs.</li> <li>- Provide space that inspires collaborative learning</li> <li>- Provide experimental freedom for entrepreneurs.</li> <li>- There are concerns, however, about the quality of ventures the incubators are admitting into the incubator. Can be linked to table 3 weak selection process.</li> </ul>
<b>Collaborative Learning</b>	Basic infrastructure and Access to network	
<b>Experimental Freedom</b>	Education and coaching	

Table 20: A summary of findings on resource implications for the ventures

Resource implication for Ventures	Related resource	Key strengths and weaknesses of Nigerian Incubators
<b>Corporate Partnership and Collaboration</b>	Access to network	<ul style="list-style-type: none"> <li>- Incubators encourage and facilitate collaboration with external key stakeholders</li> <li>- Incubators have been instrumental in attracting talents and resources to Yaba, Lagos</li> <li>- Advocates for tenant ventures but still in the process of winning trust of key stakeholders to provide much larger resources</li> </ul>
<b>Clustering Effect</b>	Basic infrastructure and access to network	
<b>Advocation</b>	Access to network	

Having analysed and discussed the data in chapters 5,6 and 7, it is now necessary to provide a synthesis of the discussion between the venture creation process and technology incubators. The analysis performed in the previous discussion chapters entailed the separation of the subject under study into sub-parts for individual study; this section's synthesis will, however, combine the separate elements and themes to form a coherent whole. The synthesis of the discussion will help to crystallise the understanding of how different entrepreneurs utilise and bundle different resources at different stages of the venture creation process.

The TE-TI schematic diagram presented in figure 8 below summarises how the venture creation process is influenced by the resources provided by the technology incubators. It outlines how the different components inter-relate and specifies the implication of resources provided by technology incubators for potential new venture creation or other outcomes, all within the context of the incubator. The model adopts an integrated approach, accounting for the incubated technology entrepreneurs and their characteristics, the unique resources provided by the incubators, and how these resources influence the individual entrepreneur and their venture. It also includes the inductively derived themes which stemmed from the empirical analysis, illustrating how they all work together in an integrated way during the venture creation process. This model is an update to the framework presented in section... as it provides a more comprehensive perspective on how venture creation interacts with technology incubators.



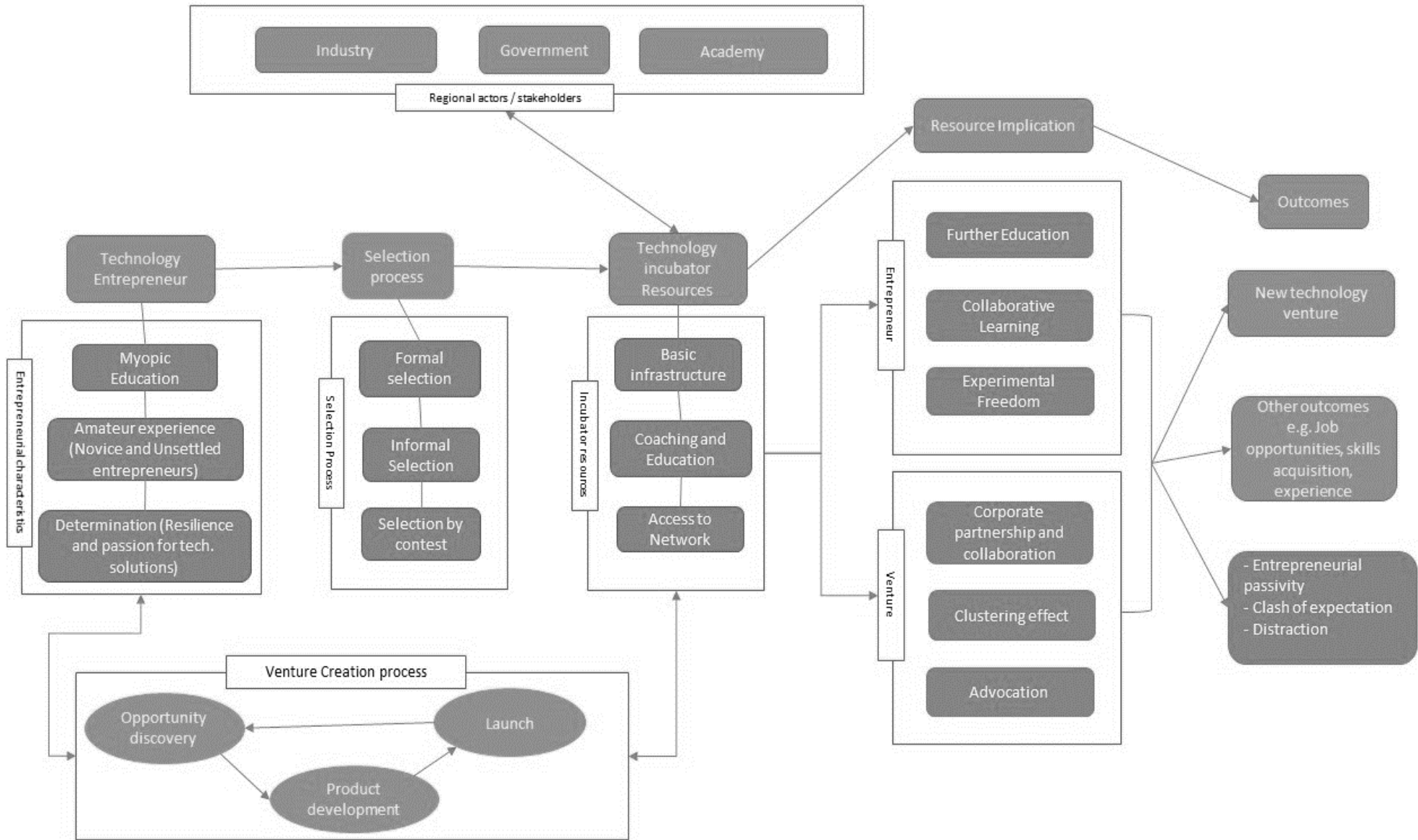


Figure 8: Updated TE-TI Schematic Diagram showing the interaction between the entrepreneurs, venture creation process and the resources provided by the incubator. Author's own.

Essentially, each technology venture is operated by one or more technology entrepreneurs with unique characteristics and experience. Also, the ventures are at different phases in the venture creation process and are exposed to a range of resources at every stage of the venture creation process. As such, the use and application of these resources differ from venture to venture. In this study, it was found that, while technology incubators do their best to provide their ventures resources to enable them to survive and thrive, it was essentially the responsibility of the entrepreneur to bundle and maximise the resources in the best way for their venture. Also, it was found that, within the technology incubator, the use and application of resources is in a shared and collaborative manner as opposed to an exclusive commodity that must be possessed by a single venture to achieve competitive advantage.

The 3 main phases of the venture creation process, as illustrated in figure 8 above are the opportunity discovery phase, product development, and launch phase.

Appendix III contains three venture-specific case vignettes, presented to create a narrative of how resources are bundled and put to use by individual technology ventures, developed by entrepreneurs at different stages of their careers. A holistic overview of these case vignettes highlights the dynamic nature of technology ventures and the different ways in which they interact with incubator resources. It is important to note that, while the general consensus of the resource-based view theory pitches resources as an exclusive commodity that must be possessed by a single venture to achieve competitive advantage, technology ventures achieve competitive advantage from the ways they bundle resources and share them among themselves.

The next chapter will conclude the thesis and provide an overview of the conceptual, methodological and policy contributions, limitations of the study, areas for future research, and personal learning points

## CHAPTER 8: Contribution and Conclusion

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This chapter is the conclusion to the study. It provides a summary of the research and its findings, contributions to the field of study, and future research directions suggested by the findings. It also highlights some areas of shortcomings and personal reflections of the entire research study.

### 8.1 Summary

The thesis has illustrated the role of technology incubators in stimulating the development of technology entrepreneurship in Nigeria's economic hub, Lagos. The empirical investigation assessed technology entrepreneurs, the process of new technology venture creation and how new technology ventures leverage resources provided by technology incubators.

The research identified the dynamic nature of technology ventures and the way in which the entrepreneurs' bundle and utilise resources during the venture creation process. Additionally, it provided an understanding of how the resources influence the individual technology entrepreneur and their ventures.

Chapter 1 introduced the thesis, the context, aim, and research questions. Chapters 2 and 3 discussed existing literature concerning entrepreneurship, technology entrepreneurship, technology incubators, and resource-based view literature. The review demonstrated that there are gaps in the literature on how resources provided by incubators influence the technology entrepreneurship process, particularly in developing countries. This thesis has responded to this gap, adopting a developing country in sub-Saharan Africa – Nigeria - to explain how the technology entrepreneurship process in the region leverages the resources provided by local technology incubators. Chapter 4 discussed the research methodology. It explained that a qualitative approach was undertaken because it is based on inductive theory generation which enables the thesis to generate empirically based knowledge to provide an in-depth understanding of the relationship between resources provided by technology incubators and the technology entrepreneurship process. The previous few studies have utilised document analyses or have been simply conceptual. This thesis takes a more appropriate methodological approach to capture understanding of an in-depth process. Additionally, most studies do not have a holistic view of the entire process. They either focus on the incubator managers or on superficial economic impacts of resources provided by incubators. This thesis takes a more holistic view of the entire process, with a focus on the entrepreneur's perspective. Chapters 5 and 6 presented the findings from the analysis of the semi-structured interviews and discussed them in relation to the literature from chapters 2 and

3. Chapter 7 followed on to discuss the findings, challenging and expanding boundaries of the theoretical knowledge that underpinned this thesis. This chapter concludes the thesis, explaining the contributions to the literature, the implications for incubator management, entrepreneurs, funders and regional policymakers. It will also discuss the development of the author of this PhD and address the limitations of the research with suggestions on how future research can further this thesis.

## **8.2 Resolution of Research Questions**

As highlighted at the end of chapter 3, within the technology entrepreneurship and incubation literature, there is a gap in fundamentally understanding how technology incubators influence the growth of technology entrepreneurship in developing countries (Soetanto and Jack, 2013; Hichri, M'chirgui and Lamine, 2016; Solomon and Lind, 2016). Based on this gap, an overarching question was developed (section 3.8) with three sub-questions to inspire this study: a) What are the qualities and experiences of entrepreneurs in technology incubators and how do these qualities affect their ability to start and grow a new venture in the context of the incubator? B) What resources are provided by Nigerian incubators and how do these resources help nurture and develop technology ventures in the region in the context of resource-based view theory? C) What are the resource implications for the technology entrepreneurs and their ventures? These questions are deeply explored through the analysis and conceptualisation of thematic empirical schema. In effect, the answers are provided through analysing the characteristics that defines entrepreneurs in incubators, the resources available to them and how the resources influence the venture creation process.

In reference to the first question 'What are the qualities and experiences of entrepreneurs in technology incubators and how do these qualities affect their ability to start and grow a new venture in the context of the incubator? – As discussed in chapter 5, it was discovered that the average Nigerian entrepreneur in a technology incubator was educated in local universities. However, their participation in incubators is not as a result of partnership between the incubator and their education institution. Rather it is mostly out of dissatisfaction with their quality of education and to increase their knowledge and gain some experience in technology entrepreneurship related activities. In experience, incubators were mostly occupied by novice and unsettled entrepreneurs. Most entrepreneurs did not have previous entrepreneurial or professional experience in fields related to their current venture. Although there is the potential that this crop of entrepreneurs would stunt growth of the venture as previous literature suggests that previous experience is essential for venture growth (Gimmon and Levie, ; Hichri, M'chirgui and Lamine, 2016). Nonetheless, experience is not a

major issue, because part of the role of the incubator is to encourage entrepreneurial activities and experimentation. Also, there isn't enough data to show how effective previous experience has helped Nigerian entrepreneurs. That said, most of the leading and well-known technology entrepreneurs in Nigeria possess vast professional experience and advanced education in more developed countries. Lastly, even though Nigerian entrepreneurs in incubators were dissatisfied with their education and lacked the experience to rapidly advance their venture, they possessed a strong will of resilience and determination. In a country faced with many challenges, resilience comes up an attribute that should be possessed by budding entrepreneurs. Passion for technology thus becomes the fuel and driving force for entrepreneurial resilience. The entrepreneurial resilience of the Nigerian entrepreneur originates from a passion for applying technological solutions to social problems they find around.

Chapter 6 extensively deliberates and resolves the second research question - What resources are provided by Nigerian incubators and how do these resources help nurture and develop technology ventures in the region in the context of resource-based view theory? It was discovered that Nigerian incubators provide three fundamental resources: Basic infrastructure, education and coaching, and access to network. In the context of RBV and VRIN attributes, all the resources provided by Nigerian incubators are valuable but not all the resources are rare, inimitable and non-substitutable. Access to network is the only resource that is valuable, rare, inimitable, and non-substitutable. Having access to the right network could substantively increase the chance of success of a new venture. Access to valuable ties through network relations could open doors and provide access to other resources such as funding and institutional partnerships and collaborations that would be otherwise difficult to access if not for the incubator. This is not a feat peculiar to developing countries alone. Hills, Lumpkin and Singh (1997) concluded that the quality of the contacts in the network can influence an entrepreneur's creativity and ability to maintain heightened entrepreneurial alertness. Elfring and Hulsink (2003) also found that, in the entrepreneurial process, the importance of an embedded network could be the link to finding crucial resources. Essentially an incubator and the entrepreneur are only as good as the network to which they have access.

The third research question - what are the resource implications for the technology entrepreneurs and their ventures? – is extensively deliberated in chapter 7. Resource implications essentially refers to how the resources provided by the technology incubators impacts the entrepreneurs and their ventures. The incubator's impact on the entrepreneurs were discovered to be provision of further education opportunities particularly in the area of entrepreneurship, collaborative learning and experimental freedom. The findings corroborate with the classification of entrepreneurs mostly found in the incubator such that an entrepreneur

with lacklustre education and novice experience can gain the knowledge, community support, and experimental freedom to build a successful venture. The poster cluster – Silicon Valley has these characteristics embedded in their community which to a large extent has amounted to the success of the region in regard to technology entrepreneurship activities (Engel and del-Palacio, 2009). The resources provided by the incubators also has implications on the venture creation process that is corporate partnerships and collaboration, a clustering effect, and advocacy. The literature on clusters and entrepreneurship, generally concludes that the proximity of entrepreneurs and their ventures within a locality enhances entrepreneurial start up opportunities within that area (Delgado, Porter and Stern, 2010). The research found that incubators in Nigeria has unintentionally forged a cluster in a particular area of Lagos, Nigeria which has vastly contributed to the development of technology entrepreneurship in the region. Corporate partnership and advocacy are the other resource implication for ventures provided by incubators. It can be linked to the outcomes of the resource embedded in having access to the incubator's network of mentors, partners and sponsors.

While the impact of technology incubators on the development of technology entrepreneurship has been felt through the provision of these resources and their implication on the entrepreneurs and their ventures, Nigerian incubators still have grounds to cover in terms developing viable ventures that has serious economic impact. It is fair to say the relationship between technology incubators and the development of technology entrepreneurship is at infancy stage. More needs to be done to maximise the resources provided by the incubator. Technology entrepreneurs need to be much aware of the resources available to them while the incubator ought to deepen the quality of the resources they provide to the entrepreneurs. Also, to further the development of technology entrepreneurship in the region, the incubators need to rise to the challenge by extending itself through partnerships and collaborations to the government. Knowledge sharing would be an important place to begin as not much is known about the activities of the ventures in the incubators.

### **8.3 Contributions**

This thesis has provided theoretical contributions to the scholarship of technology entrepreneurship and technology incubators. Its findings can inform policy making. These are elaborated further below:

#### **8.3.1 Theoretical/Conceptual Contribution**

The findings contribute to new knowledge on the study of technology entrepreneurship and technology incubators in a number of areas. First, technology entrepreneurship and technology incubators are not mutually exclusive. The process of creating a new venture may

occur within an incubator and the incubator participates in the process by providing the necessary resources needed for the venture to survive and thrive. Secondly, however, not all technology entrepreneurs are suited for incubation. This thesis found that there are three classifications of entrepreneurs based on experience to be found in incubators - novice, unsettled, and habitual entrepreneurs. Based on this classification, novice and unsettled entrepreneurs are more likely to be found in incubators than habitual entrepreneurs. Thirdly, it was discovered that incubators in Nigeria provide three essential resources for their incubated ventures - basic infrastructure, coaching and education, and access to networks. Fourthly, resources provided by incubators influence different entrepreneurs in diverse ways depending on their characteristics and phase of venture creation. Finally, although incubators function as resource banks for technology entrepreneurs, they are not the panacea of success for newly created ventures.

Moreover, this thesis sheds new and important theoretic insight on the interaction between the venture creation process and the resources provided by technology incubators. The Resource-Based View (RBV) theoretical framework provided the main theoretical lens to understand how incubators function as resource banks tasked with disseminating resources to incubated entrepreneurs and their ventures. While the RBV theory is competent in explaining the relationship between technology entrepreneurship and technology incubators, it is limited in capturing the dynamism of the technology entrepreneurship process and resource needs of entrepreneurs. It does not fully explain the social nature of technology ventures and resource dynamism, such as how entrepreneurs rely on the resources available within the region where they operate, and the incubator management continually acquire and collate resources from their network for their entrepreneurs. This is because the RBV framework is mainly presented as a theory of the firm, due to its focus on structure, conduct, and performance (Kraaijenbrink, Spender and Groen, 2010). Technology ventures are dynamic in how they are created and operated and often function in dynamic markets where there are many uncertainties (Agarwal, Audretsch and Sarkar, 2010). Additionally, this dynamic nature of technology ventures also explains how different ventures interact differently with the resources provided by the technology incubators at different phases of the venture creation process.

According to the RBV theory, resources are meant to always help a venture to attain competitive advantage. However, this study extends the theory by highlighting that resources are subjective and can sometimes be a curse to the ventures and lead to unintended outcomes. Hence, this exposes a deficient area in the RBV theory; that is, resources do not always lead to competitive advantage. Resources can sometimes have unintended outcomes and become a curse to the venture.

The researcher identified three unintended adverse outcomes of resources provided by the incubators. The first is entrepreneurial passivity, which occurs when entrepreneurs become over-dependent on the resources provided by the incubator, leading to resource laxity. As a result, the entrepreneurs become resistant to leaving the cushion of the incubator. The second is a clash of expectations which happens when the incubator imposes a schedule that interferes with the productive time of the entrepreneurs. It also includes clashes in goals and objectives, whereby the management and the entrepreneurs are not aligned to a common goal. Finally, distraction and confusion occur when entrepreneurs face multiple advice from diverse sources and find it difficult to develop their own priorities.

A number of gaps were identified in the literature. First, across technology entrepreneurship and incubator studies, there has been a lack of in-depth study of the relationship between technology incubators and technology entrepreneurship. Although there is research on technology incubators and technology entrepreneurship, they are generally presented as independent of each other. Second, most studies are designed around the incubator facility and its management while very few studies consider the perspective of the technology entrepreneur and venture creation process. Third, despite the recognition that technology incubators have a positive impact on the region in which they are embedded through creation of jobs, technical knowledge, new firms and economic development, the majority of the studies have focused on developed countries, repeating and debating over singular views on incubator effects. Finally, there are very few studies that attempted to explain the impact of technology business incubators and almost none explores their influence on the technology entrepreneurs and their ventures. The majority of the studies discuss the impact of technology incubators on a broader scale of job creation and economic development but ignore how it links to the process of technology entrepreneurship, particularly in developing countries.

In Nigeria, most of the studies, aside from Adegbite (2001), are conceptual and descriptive in nature. They based their analyses on secondary sources and offered no empirical data to back up their claims. All the authors have focused only on government-sponsored incubators, which have repeatedly produced the same poor implementation results. None of these studies actually conducted a proper investigation of the tenant firms, the entrepreneurs, and other stakeholders in the venture creation process. Moreover, these were carried out in small, concentrated areas, ignoring the well-known business centres, such as Lagos and Abuja, and made no reference to how the technology incubators influence Nigerian technology entrepreneurs and their ventures.

In order to provide a visual representation of the findings of this study, the research presents an updated TE-TI schematic diagram that illustrates the interaction between the venture



creation process and the resources provided by technology incubators (see figure 8). It presents a synthesis of how technology entrepreneurship and technology incubators interface in Nigeria. This includes the process of venture creation, including incubated entrepreneurs' characteristics, their education, experiences and personal motivation. It also accounts for the incubator selection process, incubator resources provided and the implications of the resources for the technology entrepreneur and their venture. This approach provides a more holistic perspective on the relationship between technology entrepreneurship and technology incubators as it attempts to conceptualise and discuss all of the components that contribute to the creation of a venture.

One of the significant discoveries of this research was the characteristics and attributes that characterise the average Nigerian entrepreneur. The characteristics of the average Nigerian entrepreneur can be summarised with the acronym M.A.D. This acronym was made up, not to demean Nigerian entrepreneurs, but to simply capture their unique features and characteristics. It was found that most of the entrepreneurs in the incubators are graduates of a *myopic* education system. Although the majority of the entrepreneurs were graduates from STEM subject areas, i.e., science, technology, electronics, and mathematics, most of the entrepreneurs had or were considering acquiring some form of advanced additional degree. The entrepreneurs felt there were gaps in their knowledge resulting in a general dissatisfaction with the quality of education they received. For this reason, many of the entrepreneurs felt a need to improve and further their education in the area of management or entrepreneurship.

This lack of foresight on how universities can increase the motivation and competence of their graduates to become key persons in innovative and entrepreneurial activity is the reason why the Nigerian education particularly in entrepreneurship was best described as myopic.

Next, it was found that the Nigerian technology entrepreneur has *amateur* experience. Although they have some form of experience, their experience is not in a relevant field; that is, not the same sector as the venture they are currently developing. This was ascribed to the major type of entrepreneur found in the incubator - novice and unsettled entrepreneurs.

Finally, it was found that the Nigerian entrepreneur had a *determination* to make their venture successful. This determination stems from their resilient personality and passion for applying technology to solve problems. The characteristics of the entrepreneurs, as well as the phase they are at in their venture creation process determines how they bundle and utilise the resources provided to them by the incubator.

Another significant finding of this research was the implication of resources provided by the incubators to the technology entrepreneurs and their ventures. The inductively derived themes elaborated how entrepreneurs and their ventures are influenced by resources they are

provided. The theme of further education, inductively derived from the empirical analysis, relates to the implications of resources for the individual entrepreneurs. It was found that, in developing countries, where entrepreneurs are not satisfied with the conventional educational system, particularly in the area of entrepreneurship, incubators provide the opportunity for the entrepreneurs to further and deepen their knowledge in technology entrepreneurship activities. While it is recognised in literature that incubators have great relationships with universities through commercialising new technology from research labs (Rothaermel and Thursby, 2005; Rubin, Aas and Stead, 2015; Scillitoe and Chakrabarti, 2010), this study found that, in Nigeria, incubators are another extension to education for aspiring technology entrepreneurs to gain real experience and learn by doing. The theme of Collaborative learning is not included in previous literature, aside from Tötterman and Sten's (2005) recognition of how incubated firms pool their tangible resources and complement each other in order to overcome liabilities of newness and weak competitiveness. Perhaps it is because incubators are considered to have all the knowledge of how to help new technology ventures survive (Rubin, Aas and Stead, 2015). This study, however, found that incubators recognise they are still undergoing a learning curve in Nigeria; thus, learning is a collaborative effort from all actors involved with the incubator. This includes the incubator managers, the incubated entrepreneurs, and key actors in industry, academic and government.

The theme of experimental freedom is also scarce in previous literature, even though it is recognised by Löfsten and Lindelöf (2005) that technology business incubators could be viewed as breeding grounds for new and innovative companies to minimise their risk of failure. Technology entrepreneurship thrives where there are entrepreneurs who are willing to take the risk to try new combinations, such as create new products or service, create new marketing/distribution channels, or create new business models. Consequently, incubators create the freedom for willing entrepreneurs to experiment with their ideas and moderate the risk of failure.

The theme of corporate partnerships and collaboration was also inductively derived from the empirical analysis in relation to the implication of resources on the ventures. It further supports the idea of the importance of collaboration and partnerships in technology entrepreneurship. The process of technology entrepreneurship has to do with collaborative production based on a shared vision of future changes in technology (Bailetti, 2012). It also corroborates the ideas of Williams and Tseladze (2016), who indicated that one of the attractions of incubators is their collaborative opportunities.

Although recognised by the above authors, this theme is rarely discussed in the incubation and technology entrepreneurship literature. It was discovered that one of the ways that

technology incubators influence technology ventures is through facilitation of partnerships and collaboration. These partnership and collaboration opportunities could either be found within the incubator or with corporate bodies and institutions outside of the incubator. The theme clustering effect has been discussed in the general technology entrepreneurship literature but has not been included in the incubation literature. As technology entrepreneurship is a social phenomenon, new technology ventures tend to gravitate towards each other and form networks for speedy access and sharing of resources within the local area (Özcan, 1995; Engel and del-Palacio, 2009; Özcan and Islam, 2014). This study found that incubators play a pivotal role in stimulating these clusters by attracting interests and resources in the region in which they are embedded. This attraction creates a clustering effect which is beneficial to the ventures in the incubators as resources in the form of human capital, funds, market, and knowledge, which become readily available through networks.

Advocating is a theme that does not exist in previous literature. Incubators are instrumental in standing in the gap for their incubated ventures. They not only attract resources; they also venture out to advocate for resources for their incubated ventures. The theme of advocacy can be related to the function of incubators as 'middlemen', as recognised by Soetanto and Geenhuizen (2005), who discovered that technology business incubators are 'intermediary agents' between firms and non-cooperative institutions. More interestingly, it reinforces arguments by Apa, Grandinetti and Sedita (2017) that community-based relationships and the intermediation of incubator management are crucial for supporting tenants in product and business development activities.

### 8.3.2 Originality

This research is original in how it was designed to capture the phenomena being studied. The argument put forward is that, if incubators are considered as a necessary catalyst in entrepreneurship development in emerging economies (Scillitoe and Chakrabarti, 2010), then surely it makes sense that their effectiveness is studied in developing countries, particularly in the sub-Saharan region of Africa, where this kind of study is rare and sometimes almost non-existent. This study was carried out in Nigeria, which is Africa's largest economy. The study was mainly based in Lagos, a metropolitan city often referred to as the business hub of the nation of Nigeria and one of Africa's most successful cities, while the initial pilot study was carried out in Abuja, the capital city of Nigeria. This is unlike the few studies on incubators in Nigeria, which focused on incubators that existed in other parts of Nigeria apart from Lagos and Abuja. Considering the city of Lagos is where most private businesses locate their

headquarters and is the home to 95% of the technology ventures in Nigeria, it was more appropriate to base these studies in a place known for vigorous entrepreneurial activities.

Another original aspect of the research design is the use of the researcher's embeddedness, that is, on-site observations in the community, to draw out important data. The researcher and the researched shared nationality, background, and entrepreneurial experiences which helped to improve the quality of understanding of the subject area. It provided the opportunity to form a deeper understanding of how technology incubators in Nigeria at times facilitate, and at others constrain the development of technology entrepreneurship. The idea of a 'researcher as number one research instrument' (Xu and Storr, 2012), although proposed in the literature, is hardly evidenced in the entrepreneurship field. Researchers in the field of entrepreneurship and business incubation tend to observe detachment from the research in order to maintain objectivity. This study, however, replaces objectivity with participation, involvement and knowledge of the study's environment through the concept of researcher as a research instrument. As a result, this research is designed in a way that brings alive the unique experiences and worldview of the researcher as the number one research instrument in the entrepreneurship field.

## **8.4 Policy Contributions**

The findings from this research have policy implications for key stakeholders involved in the process of supporting and creating new technology ventures, particularly in developing countries, including the incubator management, incubator funders, entrepreneurs, and regional policy makers. The implications for these various individuals are discussed further below

### **8.4.1 Incubator management**

First and foremost, it was found that incubators in Nigeria mostly adhere to informal means of selecting entrepreneurs to join their incubators. In other words, the incubators have a weak selection process and unclear selection criteria. A suggestion would be to have very clear objectives for the incubator, which drive the type of ventures which will be admitted. The incubator goals and objectives inform the selection criteria, which should also be made very clear to the entrepreneurs at the onset of the selection process.

Also, the entrepreneurs should be involved in the selection process to understand how they fit into the process and their role in helping the incubator achieve their goals and objective.

Selection is particularly important to both the incubator management and the entrepreneurs, as it helps both parties measure their performance. The study found that entrepreneurs were mostly isolated from the selection process and unclear about the progress of their venture, which led to longer time spent in the incubator. Management, on the other hand, had several entrepreneurs who were marking time in the incubator, using the incubator resources without making progress on their venture ideas.

It was found that Nigerian incubators mostly attract home-grown entrepreneurs; that is, entrepreneurs who have studied in local universities, have little entrepreneurial experience and miniscule domain experience. As a result, most of the entrepreneurs still require practical entrepreneurial education and real entrepreneurial experience.

This puts incubators in a somewhat difficult position because they essentially exist to encourage entrepreneurial activities but, at the same time, need to operate profitably. As a suggestion, the incubator management needs to accommodate both enthusiastic but inexperienced entrepreneurs and entrepreneurs with slightly more established ventures. Nigerian incubators ought to recognise themselves as advanced universities for enthusiastic entrepreneurs. They should strengthen their entrepreneurial education division and actively provide real entrepreneurial experience by placing entrepreneurs in internship programs with ventures that have graduated from the incubator. In order to attract more advanced entrepreneurs and ventures, incubator management would have to include previous entrepreneurial experience and domain expertise in the selection criteria.

Another policy contribution for incubator management is to manage the expectations of entrepreneurs and ensure a stricter time frame for each venture. In technology entrepreneurship, resources are scarce and should be adapted to each venture. Nonetheless, each venture should be given a time frame to fully utilise the resources they are given. This will enable the incubators to accommodate more entrepreneurs and improve the rate of development of new technology ventures. Essentially, incubators should recognise that it is a numbers game and the more quality ventures they churn out, the more chance they stand to reap success from one of the ventures.

In the literature, it is widely perceived that incubators must work with local universities to be successful. Nigerian incubators defy this general conception. This is because the local universities are seriously outdated and not sufficiently equipped to support the incubators in any way. Nonetheless, incubators should look for other ways they can work with the universities or students still in the university. The university offers a place where potential entrepreneurs can try their ideas without too much pressure of becoming immediately

successful. Nigerian incubators can work with entrepreneurial societies in Nigerian universities to set up hubs and train potential entrepreneurs even before they become graduates.

Findings from this thesis also have policy implications for how incubator managements manage interaction with regional organisations/actors. Currently, Nigerian incubators are engaging regional actors and organisations in one way or the other. However, more can be done in terms of strategically match-making the ventures with funders, pairing entrepreneurs with mentors that have entrepreneurial experience and are in a similar sector. Recognising the importance of network connections in delivering technical and business support to the entrepreneurs, incubator management should invest more in meaningful relationships and interactions. Nigerian incubators should recognise their place as mediators and play the role of connectors by sustaining interest and involvement from external actors and regional organisations with incubated entrepreneurs.

Finally, incubator management should think of the value of the resources they currently provide to tenant ventures. As Nigeria as a nation develops, conditions are set to improve. For instance, the cost and quality of internet access is becoming more and more affordable. As this study revealed, the most valuable resources to the incubated ventures are in the cluster of community they create around the incubator and the network with external actors they have been able to develop. In other words, in a more developed Nigeria, the value of resources incubators provide will lie in the community they have created and the depth of their external network.

#### 8.4.2 Technology venture and Incubator Funders

The findings from this thesis also have policy implications for technology venture and incubator funders. The findings from this thesis highlights two issues with funding technology ventures in incubators in Nigeria. First, wealthy individuals in Nigeria have a risk averse attitude towards Nigerian technology ventures. They are unaware of the potential of technology ventures and would rather bet on safe investment vehicles, such as properties and land. Second, there is a lack of incentive that motivates local investors to invest in Nigerian technology ventures.

The first suggestion to technology venture funders would be to first and foremost educate themselves on the process of technology entrepreneurship, particularly as it pertains to Nigeria. The best way and place to understand this is to form strong ties with technology incubators who are constantly helping young technology ventures on their entrepreneurial journey.

Second, funders should immerse themselves in the entrepreneurial journeys of the entrepreneurs. This can be done through spending more time at the incubator premises and with the incubator management constantly reviewing how the ventures are progressing on their journey.

Third, funders should consider tweaking their investment approach. Rather than investing in individual ventures, they should instead partner with incubators who better understand the performances of each technology venture and entrepreneur. An investment structure can be set up where funders give the incubator management the lead to invest in ventures, they believe have real potential to be successful. This way, funders reduce the risk they take with individual ventures by spreading their investment across different ventures. Finally, funders should exercise patience with technology ventures in incubators. Although incubators have made some important improvements to the development of technology entrepreneurship in Nigeria, they are still seeking their best practices and still have to improve in areas like selection process and resource adaptation. Thus, funders should not expect a quick return on investment but instead invest for long-term returns.

The findings also have policy implications for funders in relation to the amount of financial resources they provide to Nigerian incubators to achieve their objectives. It was found that incubators require capital to ensure they meet the objectives they set for themselves and their tenanted ventures. Incubators have very few ways of making extra income because they put their bet on tenanted ventures to be successful. As identified in this thesis, if incubators are to upgrade the quality of resources they provide for their ventures and improve their selection process, then they need adequate capital to fulfil these tasks. Funders should communicate clearly with incubators to understand what exactly they require to meet their objectives and find ways to meet these objectives.

#### 8.4.3 Entrepreneurs

The findings from this thesis have implications for entrepreneurs who would like to participate in incubation programs. First, it was found that entrepreneurs with previous experience, particularly in the sector where they were starting their business, that is, domain expertise, were more easily able to recognise new opportunities and access more dynamic resources. This suggests that entrepreneurs should seek to gain experience and knowledge in the sector they would like to start a business or partner with someone with domain expertise in that particular sector. It also suggests that entrepreneurs should start ventures in a sector they are familiar with and have some experience in.

Additionally, it was found that Nigerian incubators vary in their selection process. This suggests that entrepreneurs should be aware of the selection criteria that got them into the incubator. The selection process is the best place for entrepreneurs to hold an extensive discussion with the incubator management aligning their goals and expectations. Finally, as most Nigerian entrepreneurs are home-grown with novice experience, they should confirm that whatever incubator they apply to will provide dynamic resources that are peculiar to their needs and gaps in knowledge, such as entrepreneurial knowledge and access to networks. Provision of dynamic resources specific to each incubated entrepreneur and their venture, as opposed to generic resources, would positively affect potential new venture creation.

#### 8.4.4 Regional Policy Makers

Findings from this thesis also have regional policy implications. It was found that Nigeria as a regional environment suffers from knowledge deprivation and lack of synergy amongst stakeholders. This suggests that policy makers should focus on improving the quality of entrepreneurial education in local universities. For instance, the government can equip business and entrepreneurship departments of public universities with resources, such as incubator hubs and funding. This, however, should be done in partnership with existing privately-operated incubators, who have a track record of incubation. Such hubs would educate students with practical entrepreneurial knowledge and skills and provide a safe environment to attempt launching their venture whilst still at university.

The study also revealed that policy makers are not responsible for building and launching incubators, but rather responsible for creating an enabling environment that spurs creativity and motivation to solve problems through launching new ventures. Thus, policy makers should find more collaborative ways of working with existing incubators and their management to expand their offerings.

This study revealed that weak regions like Nigeria are not favourable for either entrepreneurs who are launching new ventures or funders who would like to invest in them. This suggests that policy makers should consider focusing on introducing regional policies and incentives that promote entrepreneurship and collaboration between more established private businesses and new technology ventures.



## 8.5 Personal Reflection

This PhD research has contributed significantly to my personal development. First, it has provided me with the opportunity to develop critical understanding of the literature of various areas, including technology entrepreneurship, incubation, entrepreneurship, and resource-based view literature. This has not only helped me become more knowledgeable about the diverse views that exist in this literature, particularly as it pertains to developing countries, but also to understand the gaps and how to connect the literature together to discover new knowledge.

Second, the thesis has enabled me to develop further skills around qualitative methods, which is an essential research methodology used in management research. I learnt how to analyse qualitative data through the use of familiarisation, identifying a thematic framework, coding, charting, mapping and interpreting data according to key issues and themes.

Third, the research enabled me to develop further skills around designing research for the collection and analysis of data. Conducting any research requires thorough understanding of how to design the research to derive and measure data.

Fourth, this research exposed me to the challenges of conducting research in a developing country. Conducting studies in developing countries can be challenging as well as exciting. This is because, as a researcher, you have to come up with innovative ways to achieve the objectives of the study, as field work can be unpredictable and challenging, due to the lack of reliable data, infrastructural issues and access.

Fifth, this research greatly improved my presentation and negotiation skills. At the field work, I constantly found myself explaining my research work and trying to convince participants to work with me on the research. I was also privileged to attend a conference during my field work which enabled me to build an academic PowerPoint presentation, present and answer questions from the audience. Overall, the task of completing a PhD equipped me with self-management skills, such as goal setting, decision-making, planning, scheduling and task tracking to achieve objectives set for the thesis. These skills are transferrable skills for future projects and endeavours.

Finally, this process exposed me to how unpredictable life in general could be. For instance, I went into my field work with a preconceived knowledge that incubators simply exist to provide resources for their tenant ventures. I found, however, that there is more to the resources that incubators should be providing to their tenant ventures beyond generic resources. This taught me flexibility and adaptability, which are skills relevant for future endeavours.

## 8.6 Limitations

All efforts were made to create a thorough research design in order to address the research aims, objectives and questions set out in this thesis. However, there are still limitations, some of which can be attributed to the nature of qualitative research. As with most qualitative research, there is an inherent researcher bias that stems from the use of qualitative methods (Bluhm et al, 2011). A second limitation, as with most qualitative research, is the lack of generalizability of the findings to a wider population or region (Blumberg, 2014). To help increase the generalisability of the research findings, the research participants and location were carefully selected, and interviews conducted to contribute to general knowledge.

Another limitation was that not all the interviews were transcribed by the researcher. As a result of time constraints, the researcher employed an external transcription company to transcribe some of the interviews. To limit the errors, steps were taken to ensure the quality of the transcriptions. The steps undertaken include personally cross-checking the transcribed interview from the external company against the original interview recording. The researcher did this to ensure that the words on the interview recording matched the text that were transcribed. Additionally, the interview recording was sometimes difficult to understand as the incubators were located just off a major road and Nigeria is a very noisy place with cars honking and people speaking at the top of their voice. While the researcher ensured the interview was conducted in a quiet environment within the incubator or office of the participant, occasionally, noise from the background got into the recording, making some words and phrases difficult to transcribe.

There were also limitations in relation to data access to all the tenant ventures of the incubators, which limited the number of entrepreneurs interviewed. The aim was to speak to every entrepreneur in the incubator; however, getting access to some of the entrepreneurs was very difficult. Some did not respond to emails or calls and some were always absent from their office. To overcome this issue, in-depth interviews were carried out with entrepreneurs to whom the researcher had access, as well as interviews with other actors who had very good knowledge of the development of technology entrepreneurship in Nigeria.

Another limitation was that longitudinal data were not collected, due to time limitations of the study. To overcome this issue, entrepreneurs were selected at different stages of the entrepreneurship and incubation process to be able to obtain a more complete perspective of the process and to mitigate bias and 'retrospective sense making' (Blumberg, 2014)

## 8.7 Future Studies

Future studies could address a number of important areas which were outside the scope of the thesis. One area, in particular, could explore further the inductively derived themes on the implication of resources for the entrepreneurs (further education, collaborative learning, and experimental freedom), and their venture (corporate partnership and collaboration. Clustering effect, and collaboration). Each of these themes could be explored further to determine which has the greater effect on the creation of a successful venture.

Another area of research could focus on the entrepreneurial characteristics (myopic education, amateur experience, and determination) outlined in this study. Future studies can extend research in this area beyond the incubator to inquire if these characteristics are synonymous with technology entrepreneurs across the nation. Additionally, future studies could comparatively investigate how incubated entrepreneurs differ from non-incubated entrepreneurs.

More research data is required in the area of incubation in sub-Saharan African countries. This study identified three main categories of incubators in Nigeria (government-sponsored non-autonomous incubator, government-sponsored autonomous, and privately sponsored incubators). Further studies could explore this categorization further across other developing countries in Africa. Additionally, future research could further explore selection process biases identified in this study – formal selection process, informal selection process, and selection contest. An interesting investigation would be into how different entrepreneurs admitted through different selection processes compare to each other.

Methodology. Future research could focus on more longitudinal studies that explore the growth process of the venture after incubation over a period of time. Although different entrepreneurs were at different phases of the venture creation process which gave this thesis varied responses and experiences, future studies can collect more longitudinal data for better coverage of the entire experience and effect of the interaction between the venture creation process and technology incubators.

Quantitative Enquiry. In order to gain complementary insights from a wider data set, it would be useful to carry out quantitative investigations on some of the emerging themes in the study. For instance, a study could collect empirical assessments of the implications of resources provided by the incubators on the entrepreneurs and their ventures. It will also facilitate objective measurement of which resources have the most bearing on entrepreneurial survival and success from an incubator.

Comparative Studies. Although Nigeria is Africa's largest economy and has its largest population, African nations still vary vastly from each other. There is a need for inter-African technology entrepreneurship and incubator comparisons to figure if the findings in this study are similar to other countries. It will also enlighten other researchers and ensure that future studies do not categorise African incubator and technology entrepreneurship research into a single unit. Further, comparative research is also required for the purpose of clarifying structural and contextual influences on analysis results, by comparing incubators and technology ventures in Nigeria, for example, with Kenyan incubators and technology ventures. The analysis of different countries could produce the opportunity of making a national comparison which would strengthen this qualitative more densely.

Finally, future research could focus on longitudinal tracking of technology entrepreneurs in incubators in real time. This approach was not possible in this study because of the time limit of the PhD period. An interesting investigation would be to analyse how resources provided by incubators affect the entrepreneurs over time. This type of research would probably focus on technology entrepreneurs who have graduated from the incubators.



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## Appendix I

### INTERVIEW GUIDE

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#### **Part A: Entrepreneur Interview Guide**

##### **Introductory Questions**

- ❖ Briefly explain the company you are currently developing / have developed during your time within the incubator?
- ❖ Where are you currently in the process of starting a business within the incubator ( Discovery – Idea Generation – Product Development – Launch)
- ❖ How long have you been a tenant in this technology incubator?
- ❖ Can you describe how the incubation process function
- ❖ Did you undergo a selection process?
  - How did it function?
  - What criteria was used by the incubator to select you to join?
  - What was involved in the selection process?



### **Part I – Discovery**

- ❖ How did you discover the opportunity that led to the founding of your venture?
- ❖ What personal attributes do you possess that was most relevant to founding and operating your technology venture (need for achievement, innovativeness, proactive personality, self-efficacy, stress tolerance, need for autonomy, internal locus of control and risk taking.)
- ❖ How much background experience did you have prior to starting the venture and how has it helped in the entrepreneurship process?
- ❖ Do you come from a business/entrepreneurship oriented family?
  - How do you think it affected the technology entrepreneurship process?
- ❖ What and where did you attain your education before launching your venture and what other qualifications do you possess?
- ❖ What resources were provided by the incubator to help you discover and explore new opportunities for your venture?
  - Who was responsible? (incubator management or external stakeholders)
  - How?

### **Part II – Idea Generation**

- ❖ What role did the incubator play in helping you generate new ideas for your venture?
- ❖ How does the incubator ensure that your ideas are articulate and market attractive?
  - What resources are provided by the incubator to make this possible?
  - Who is responsible? (incubator management or external stakeholders)
  - How?

### **Part III – Product development**

- ❖ What role did the incubator play in the product development of your venture?
- ❖ What resources were provided by the incubator to help with research, prototype, market validation and reiteration?
- ❖ Who is responsible? (Incubator management or external stakeholders)
  - How

### **Part IV – Launch**

- ❖ What role did the incubator play in launching your venture?
- ❖ What resources were provided by the incubator to aid this process.

- Who was responsible?
  - How?
- 

- ❖ Did you have any criteria for joining a technology incubator? What are they and how have they been met (or not)?
- ❖ What are the pros and/or cons of been in an incubator?
- ❖ Did the regional environment play any role in helping or constraining you from starting and running a technology venture?
  - How and why?
  - Did you utilise any regional actors or organisation in developing your venture?
  - What role did the incubator play in helping you gain access to regional actors /organisations
- ❖ Do you think technology incubators play a significant role in the development of technology entrepreneurship in Nigeria?
  - If so, Why?
- ❖ How do you think technology incubators can better influence the development of technology entrepreneurship in Nigeria?

### **Part B. Incubator Management Interview Guide**

- ❖ Brief introduction about the technology incubator
  - ❖ What is your role in the incubator and for how long?
- 

- ❖ What are the objectives of the incubator and how do you think it affects the technology entrepreneurship process?
  - ❖ How did you select entrepreneurs and ventures into your incubator?
    - What are your selection criteria?
    - Who was involved in the selection process and what were their roles?
-

- ❖ What type of resource(s) are provided to the entrepreneurs and their venture during incubation? (Human, Technological, Financial, Organisational)
  - Who is responsible for delivering the resource(s)?
  
- ❖ What is the role of your incubator on the entrepreneurship process of your venture?
  - What resources does your technology incubator provide to help the entrepreneurs discover opportunities,
  - What resources does your technology incubator provide to help entrepreneurs formulate ideas
  - What resources does your technology incubator provide to help entrepreneurs develop products,
  - What resources does your technology incubator provide to help entrepreneurs launch their products/service in the marketplace
  
- ❖ Is your incubator part of a larger incubation system/organisation or is it a stand-alone entity?
- ❖ How would you describe the relationship between the tenant ventures and the incubator management board?
- ❖ Do you think regional actors/organisations are important in the technology entrepreneurship process?
  - If so, how and why?
  - How does your incubator facilitate engagement with external regional actors/organisations?
- ❖ How would you define the success for your incubator? Have you had any?
- ❖ What would you do differently if you had a chance to do it all over again?
- ❖ Do you think technology incubators play a significant role in the development of technology entrepreneurship in Nigeria?
- ❖ What government policies/initiatives are in place for technology ventures
- ❖ What challenges do you face in trying to achieve your aim as a technology incubator?



## Appendix II

### Informed Consent Form

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**Title of study:** Development of Technology Entrepreneurship in the context of Technology Business Incubators

**Researcher:** Patrick Giwa, a PhD candidate at the University of London.

**Supervisors:** Dr Gül Berna Özcan and Dr G Harindranath

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### Introduction

My name is Patrick Giwa, and I am a researcher at Royal Holloway, University of London. I am carrying out a study on the development of technology entrepreneurship in Nigeria. I am particularly interested in investigating the influence of technology incubators in the development of technology entrepreneurship in Nigeria.

As a prominent actor in the technology entrepreneurship ecosystem, I would like to invite you to join this research study.

### Background information

In emerging regions in sub-Saharan Africa, the advent of the internet and growth of the mobile industry has brought new opportunities for technology entrepreneurship. It is not necessarily about the mobile handset or cheap computers and tablets themselves, but the applications and information they can deliver. This growth in the mobile industry and an increasing number of internet users has stimulated the establishment of technology business incubators across the region to harness technology ideas and transform them into successful ventures.

## **Purpose of this research study**

New technology ventures are known to be high risk and most times end up failing. Technology Incubators aims to increase the lifespan of these technology ventures by providing certain resources. The purpose of my study is to explore how this has been helpful. Moreover, I am interested in finding out how these technology incubators have improved the process of technology entrepreneurship development in the region.

## **Procedures**

In this study, I will ask some questions about your organisation, experiences, and your thoughts on the role of technology incubators in the development of technology entrepreneurship in Nigeria.

Your participation in this study will be in the form of an interview lasting approximately one hour. You are not required to answer the questions. You may pass on any question that makes you feel uncomfortable. At any time, you may notify the researcher that you would like to stop the interview and your participation in the study. There is no penalty for discontinuing participation.

There may be additional follow-up/clarification through Skype calls or email unless otherwise requested by the participant. Privacy will be ensured through confidentiality.

## **Possible risks or benefits**

The benefit of participating in this research, is to contribute useful information that will aid in understanding the scope of the development of technology entrepreneurship in Nigeria and the influence of technology incubators.

This will enable researchers to gain more insight on the technology entrepreneurship process particularly in an emerging country.

At the end of this research, a report will be developed with recommendations which will be useful to practitioners. The report will be available in August 2017.

There are no risks associated with participating in the study

## **Confidentiality**

The interview will be tape-recorded; however, your real name and identifying information will not be associated with any part of the written report of the research; they will be referred to in 3rd person with fictional names in the thesis. Although if the participant wishes for the use of

their full name in the study, this request will be adhered to as well. Participation is voluntary and the interviewee has the right to terminate the interview at any time. All of your information and interview responses will be kept confidential. The researcher will not share your individual responses with anyone other than the research supervisor. Interviews will be transcribed and safely encrypted on a hard drive where no one will have access to the data.

If you have any questions or concerns, please contact the researcher or his supervisors using the email addresses below:

Researcher Patrick Giwa [Patrick.giwa.2014@live.rhul.ac.uk](mailto:Patrick.giwa.2014@live.rhul.ac.uk)

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## **AUTHORIZATION**

By signing below, I acknowledge that I have read and understand the above information and I am interested in participating in this research. I am aware that I can discontinue my participation in the study at any time.

Signature \_\_\_\_\_ Date \_\_\_\_\_

## Appendix III

### Case Study Vignettes

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#### The Case of Mamalette

Mamalette (<https://www.mamalette.com/>) is an online platform that provides tools and resources for Nigerian mothers. Its founder, Anike Lawal, is entrepreneur 8 of this study. Mamalette was founded in late 2013 and has since then become the go-to community for Nigerian mothers, with over 70,000 mothers and would-be mothers constantly seeking information that can help shape or improve their lives. While primarily an online platform, Mamalette has started taking its community offline by organising live events for mothers across the country.

Anike Lawal is a female Nigerian technology entrepreneur. She got her undergraduate education in Business studies and French from Trinity College in Dublin and an M.Sc. from the London School of Economics. She worked with KPMG as a management consultant and with a startup, Dealdey, as the financial controller. She is resilient and, although not technical, she is passionate about how technology can help mothers with important resources and solutions. However, she is a novice entrepreneur, as she has never started a business venture prior to Mamalette.

Anike joined Co-creation Hub in 2014, after she had already launched Mamalette. However, after participating and impressing in a competition organised by the incubator, she was invited into the incubation program. Although Mamalette was a launched venture, it was not 'well packaged'. As a novice entrepreneur, Anike leveraged the coaching and education provided by the incubator management and reshaped her venture to start offering offline solutions to mothers. Furthermore, through collaborative learning, she gained knowledge from fellow entrepreneurs in the incubator. According to Anike, seeing what other ventures within the incubator are doing boosts motivation rather than brewing rivalry. There was a pool of talented individuals within the incubator with useful information and knowledge on growing a technology venture, which contributed to how Anike built her team.

Most notable is the financial assistance Anike received from a telecommunication company. Anike was able to capitalise on the network of the incubator management to get funding for one of the offline events she was organising for mothers in Lagos state. As a novice entrepreneur, the implication of resources for Anike is the further education and collaborative learning opportunities the incubator provides. In the same vein, Anike has leveraged the corporate partnership and collaboration opportunities provided by the incubator. Also, she has seen results from the clustering effect the incubator generates. Anike believes the value and



personal growth associated with being in an incubator outweigh any negative effect. However, she admits that the resources provided by the incubator can sometimes lead to entrepreneurial passivity and over-dependence on the incubator.

The case of Mamalette is an example of a venture founded by a novice entrepreneur that had already launched but went through incubation because the founder believed there was value to be gained. Although already launched, the venture took advantage of the resources provided by the incubator to revamp their products and services. They were also able to build up a team of six and gain a corporate sponsor for one of their events.

### The Case of Beattraffik

Beattraffik (<http://www.beattraffik.com/>) is a venture with mobile solutions to provide real-time traffic reports to help commuters evade traffic jams due to the increasing incidence of traffic congestion in urban cities in Nigeria. The founder, Odionye Confidence, is entrepreneur 2 in this study. In April 2014, after conducting extensive research on the root cause of traffic congestion in Lagos state, decided to launch a web application and twitter handle on traffic reports. The application and twitter handle reached over 10,000 people in Lagos in its first year.

Odionye studied civil engineering at Yaba College of Technology but was not completely satisfied with his education. He mentioned in his interview session with me that he wanted to impact the 21<sup>st</sup> century but what he learnt was more like the 18<sup>th</sup>, 17<sup>th</sup> and 16<sup>th</sup> centuries. Odionye is an example of an entrepreneur who is a graduate of a myopic education system. Prior to founding his current venture, he started a venture with his brother that charged individuals for downloading media items (photos, music, games) from smartphone devices. As this was back in 2007-2008, the new wave of smartphone technology and bigger telecommunication companies quickly put him and his brother out of business. The experience taught Odionye to constantly innovate and be more open to collaboration. Odionye also dabbled in other ventures with family until he founded Beattraffik. Once he found Beattraffik and launched, he soon discovered that, although his application was reaching a good number of road users in Lagos state, the impact on traffic congestion was minimal.

Odionye applied to join an incubator – Passion incubator. The incubator manager at Passion incubator soon moved to IDEA Nigeria and, consequently, most of the ventures in Passion incubator moved to IDEA, including Beattraffik. As an unsettled entrepreneur, Odionye knew he needed certain resources that the incubator provides. One of the resources that he needed was guidance and coaching of more experience entrepreneurs and access to a network that

could potentially lead to some sort of collaboration. At IDEA Nigeria, Odionye was able to refine his initial idea after spending several brainstorming sessions with the incubator manager.

Through the mentorship provided by the incubator, he has been able to meet other successful entrepreneurs, such as the CEO of Jumia and CEO of Hotels.ng. Odionye believes that the advice he has received from these mentors has helped him determine the next steps for his venture. However, he points out that funding has not been forthcoming, which has hampered the growth of his venture. At the time of this study, Beattraffik had spent over a year in the incubator and was still developing its new mobile application for road users. Odionye mentioned that they will be collaborating with Google maps, Waze, Gidittraffic, and Tsaboin.

As an entrepreneur, Odionye has been helped by the incubator to improve his entrepreneurial knowledge and provided with the opportunity and freedom to trial his new idea. Through the incubator, Odionye has been able to secure partnerships and collaboration with other ventures operating within the same sector. The case of Beattraffik is an example of a venture founded by an unsettled entrepreneur. The venture is still in its product development stage and a more recent check on its website shows the venture is still developing its product. It is unclear why this venture appears to be stuck in the product development stage, but the founder attests to the fact that incubators have been useful in helping him think of his venture differently, though they still lack in certain areas, such as funding.

### The Case of Budgit

Budgit (<http://yourbudgit.com/>) is a venture that uses technology to ensure transparency and accountability in government spending. As at 2016, Budgit had over 2,000 unique data requests from private, corporate and government individuals and agencies. As a result, the venture is widely regarded as a trusted hub for public finance. One of the founders, Joseph Agunbiade, is Entrepreneur 15 of this study. Joseph is a seasoned entrepreneur, who has successfully started several technology ventures that are still in operation.

Budgit is one of the very first successful ventures that was birthed by an incubator in Nigeria. The venture started when the business idea came second in a pitching competition organised by Co-creation Hub back in 2011. As a result, they got \$5,000 in seed capital to begin the venture. Joseph studied Physics and Electronics at the Federal University of Technology, Minna, while Segun Onigbinde, the founder, studied to become an engineer but ended up building a successful career in banking. Joseph on the other hand went on the entrepreneurial route and was building website platforms for private and government institutions.

Budgit is an example of a venture that began within the incubator and launched in the incubator. The founders attribute their growth and success to the support they received from the incubator, particularly the mentorship and access to networks the incubator provided for them. Segun notes how he felt scared to leave his comfortable banking job to become a full-time entrepreneur but encouragement and support from the incubator management made the leap somewhat easier. Once the venture became fully fledged, the incubator management was able to raise more funds for the venture through advocacy. It is important to note that, as Budgit is a social enterprise interested in helping governments simplify its budgets proposals and improve transparency, it is much easier to raise funds as opposed to a strictly profit minded venture without any social element to it.

Nonetheless, the entrepreneurs have been able to benefit from the experimental freedom which incubators provide, while their venture leveraged the advocacy and partnership opportunities available through the incubator. At the time of this study, Budgit was in its own office space within the Yaba area. They chose to remain in Yaba so as to stay close to the pool of talents and resources in the area.

The case of Budgit is an example of a venture started by more experienced entrepreneurs. They bundled different resources at different stages of their venture creation process, from mentorship to collaboration and funding. However, it is important to note that Budgit was one of the very first ventures produced by an incubator in Nigeria. Secondly, Budgit is regarded as a social enterprise, just like Mamalette above, because of its intention to help simplify and make government budgets transparent. As a result, they are able to leverage the different social funds available to social enterprises.

## Appendix IV Thematic Analysis

Key issue	Data collected/sources	Open codes	Axial/Candidate themes	Selective themes
<b>Resources provided by Nigerian privately operated incubators</b>	Entrepreneurs, incubator managers, and technology journalist.	<ol style="list-style-type: none"> <li>1. Grooming on entrepreneurial skills</li> <li>2. Provision of information on the ecosystem</li> <li>3. Understanding business concepts</li> <li>4. understanding distribution channels</li> <li>5. building network</li> <li>6. mentorship and partnership</li> <li>7. Mentorship and access to successful entrepreneurs in the ecosystem</li> <li>8. had a meetup session called fireside every Friday with mentors and got advice</li> <li>9. say the community, the community they power the internet</li> <li>10. They provided space and the internet.</li> <li>11. angel investment</li> </ol>	<ol style="list-style-type: none"> <li>1. <b>Subsidized office space</b></li> <li>2. <b>Internet</b></li> <li>3. <b>Stable electricity</b></li> <li>4. Mentorship access and support</li> <li>5. Motivation and support from other incubated ventures</li> <li>6. Support from other professionals within the incubator</li> <li>7. Technological information and knowledge</li> <li>8. Exposure to potential partnerships and collaborations</li> <li>9. Trainings and events</li> <li>10. Exposure to funding options and possibilities</li> </ol>	<ul style="list-style-type: none"> <li>• Basic Infrastructure</li> <li>• <b>Education and coaching</b></li> <li>• Exposure and Access to Network</li> </ul>

		<ul style="list-style-type: none"> <li>12. access to partnerships to other organizations</li> <li>13. market access to external stake holder</li> <li>14. office space / workspace</li> <li>15. internet connection</li> <li>16. network of technologically talented individuals</li> <li>17. Entrepreneurial support from mentors</li> <li>18. community of technology knowhow and experiences</li> <li>19. space</li> <li>20. human resources in form of teachers, talents</li> <li>21. space and address for the venture which is a show for seriousness</li> <li>22. meetups and micro events leading networking</li> <li>23. connection (Network)</li> <li>24. seeing what other ventures within the incubator are doing boosts motivation</li> <li>25. Access to a network of talented individuals within the incubator</li> </ul>		
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		<p>26. motivation/refinement from interacting with other tenant ventures</p> <p>27. operational assistance</p> <p>28. financial assistance when needed</p> <p>29. incubator provides workspace</p> <p>30. some financial investment</p> <p>31. brainstorming sessions with any of the incubator directors</p> <p>32. human resources in form of internal collaboration with other individuals in the incubator</p> <p>33. internet</p> <p>34. incubator partners with external stakeholders (intel) to bring firsthand information through trainings</p> <p>35. space, power, internet, business trainings</p> <p>36. financial investment of up to \$10k in 2 installments</p> <p>37. space is provided</p> <p>38. power</p> <p>39. internet</p>		
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		<p>40. brings in experts to offer training</p> <p>41. little funding support</p> <p>42. training on presentation skills and pitching skills</p> <p>43. maximizing every resource provided by the incubator is entirely dependent of the venture and their founder i.e the stage of the venture in the technology entrepreneurship process</p> <p>44. physical working space</p> <p>45. internet connection</p> <p>46. power supply</p> <p>47. support system such as mentorship and access to network and financing</p> <p>48. space, working space, internet facility, events and opportunities, electricity</p> <p>49. got some funding through winning the competition</p> <p>50. workspace and constant electricity</p> <p>51. community/talent of skilled individuals who were present at the incubator (collaboration)</p>		
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		<p>52. exposure to investors and donors. The incubator attracts donors and channels it to our venture</p> <p>53. Space, internet and stable power</p> <p>54. Subsidized working space</p> <p>55. Community of likeminded people</p>		
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Key Issue	Data collected / source	Open codes –	Axial/Candidate themes	Selective themes
<b>Selection process used by technology incubators in Nigeria</b>	Entrepreneurs	<ol style="list-style-type: none"> <li>1. application phase</li> <li>2. online application</li> <li>3. selection phase</li> <li>4. interviews</li> <li>5. pitching and explanation</li> <li>6. final selection stage</li> <li>7. category specific</li> <li>8. idea viability</li> <li>9. customer base</li> <li>10. social impact</li> <li>11. revenue model</li> <li>12. Initially started at a previous incubator which was merged into IDEA incubator</li> <li>13. rigorous application process to passion incubator</li> <li>14. involved interviews with shortlisted candidates</li> <li>15. moved over from passion incubator because of the proven concept</li> </ol>	<ol style="list-style-type: none"> <li>1. Applied online and invited to an interview</li> <li>2. Pitched idea to a selection committee</li> <li>3. No formal selection process</li> <li>4. Had a relationship with the incubator manager</li> <li>5. Invited to attend by the incubator manager</li> <li>6. Participated in a competition</li> </ol> <p><b>Selection criteria</b></p> <ul style="list-style-type: none"> <li>• <i>Unclear</i></li> <li>• <i>Social Impact</i></li> <li>• <i>Team</i></li> <li>• <i>Economic viability</i></li> </ul>	<p><b>Selection process</b></p> <ul style="list-style-type: none"> <li>• Selection by formal application (online)</li> <li>• Selection by relationship</li> <li>• Selection by contest</li> </ul>

		<p>16. absorbed into IDEA due to affiliation with passion incubator and its management team</p> <p>17. came through a national competition</p> <p>18. leveraged on the win of the team to secure place in incubator</p> <p>19. formal application</p> <p>20. shortlisted for interview</p> <p>21. no selection process as it's not a formal incubation process</p> <p>22. no formal selection processes</p> <p>23. preferential treatment due to personal relationship with the incubator manager</p> <p>24. incubator is benefitting from being a part of a social movement of including women in tech</p>		
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		<p>25. online application</p> <p>26. took about a month to get response</p> <p>27. selection committee where responsible for decision</p> <p>28. Criteria unaware to entrepreneur maybe entrepreneur don't preempt</p> <p>29. 7 people selected but only 5 entrepreneurs where present for an orientation</p> <p>30. after the orientation, dates where given for start of the program</p> <p>31. selection by event and pitching competition</p> <p>32. venture had already launched but not well packaged before incubation</p> <p>33. incubator is a part of the technology venture (automatic entry)</p>		
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		<p>34. the idea had to have some form of social impact i.e solving a problem</p> <p>35. well balanced team i.e presence of both technical and commercial knowledge</p> <p>36. interpersonal ties e.g. drive and motivation</p> <p>37. looking for tech ideas with abilities to scale fast - scalability of the idea</p> <p>38. the team behind the idea</p> <p>39. completed an online form about the venture</p> <p>40. invited to a pitch to the external management team</p> <p>41. same process for acceleration</p> <p>42. series of questions about venture &gt; invitation to pitch in person to selection team &gt; selection</p>		
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		<p>43. selection team were a mix of the incubator management team and external stakeholders which made up the advisory board</p> <p>44. involved interviews, and invitation to present to a panel</p> <p>45. based on a relationship</p> <p>46. came second in a competition in which the incubator was a part off</p> <p>47. no formal selection process</p> <p>48. walked in and spoke with the incubator manager to pitch idea and was admitted</p> <p>49. there was a call for ideas around tech in governance</p> <p>50. drilled down to a few and invited to a pitch and achieved second place</p> <p>51. all in the idea phase</p>		
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		<p>52. judged by people in the field of interests</p> <p>53. judges include successful entrepreneurs, MBA professors</p> <p>54. criteria involved workability and the team behind the idea</p> <p>55. No formal selection processes</p> <p>56. Applied online</p>		
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## Glossary

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AfDB	African Development Bank
BRIC	Brazil Russia India China
CCHub	Co-Creation Hub
CEO	Chief Executive Officer
CVC	City Venture Corporation
ECOWAS	Economic Community of West African States
EDP	Entrepreneurship Development Program
GDP	Gross Domestic Product
ICT	Information Communication Technology
IDE	Innovation Driven Entrepreneurship
IDEA	Information Technology Developers Entrepreneurship Accelerator
IT	Information Technology
ITBFs	Incumbent-technology-based Firms
MVP	Minimum Viable Product
NATIE	National Association of Technology Incubator Entrepreneurs
NDE	National Directorate of Employment
NITDA	National Information technology Development Agency
NSF	National Science Foundation
NTBFs	New-technology-based Firms
OECD	Organisation for Economic Co-operation and Development
RBV	Resource Based View
R&D	Research & Development
SCA	Sustainable Competitive Advantage
SME	Small and Medium Enterprise
SMEDAN	Small & Medium Enterprises Development Agency
STPs	Science, Technology, and Research Parks
TE-TI	Technology Entrepreneurship – Technology Incubator
TIC	Technology Incubation Centre
TST	Taedok Science Town
UKBI	UK Business Incubation

UTBI University Technology Business Incubators  
VRIN Valuable Rare Inimitable Non-substitutable