Understanding factors affecting technology entrepreneurship of university-incubated firms

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DECLARATION

I, **Patient Rambe**, do hereby solemnly declare that this thesis titled *Understanding factors affecting technology entrepreneurship of university-incubated firms*, submitted in fulfilment of requirements for the degree PhD (Business Management) at the University of the Free State, is my authentic work and that the sources used in this study have been indicated and duly acknowledged using complete Harvard referencing style, and that this doctoral thesis has not been submitted previously in partial or full fulfilment for the attainment of a higher education qualification or equivalent at any this or any other higher education institution.

29 July 2022

DEDICATION

This thesis is dedicated to my immediate family, my late mom, my dad and extended family.

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ABSTRACT

Despite the consensus in entrepreneurship literature on the significant contribution of technology business incubation to the realisation of technology entrepreneurship, the range of factors that merge with technology business incubation to shape technology entrepreneurship remains highly contentious. For instance, some studies have placed exclusive emphasis on individual psychological and cognitive factors (e.g., poor business knowledge, limited experience and perceived entrepreneurship capabilities) as explanations for low technology business incubation and poor technology entrepreneurship outcomes. Yet, other studies have concentrated on institutional levels factors such as inadequate incubation support (e.g., the lack of physical capital, social capital and intellectual capital) as critical explanations for suboptimal technology business incubation and technology entrepreneurship outcomes. To further compound the puzzle on key drivers of these business outcomes, other scholars have foregrounded systemic level factors (e.g., national entrepreneurship policy, regional innovation culture, regional SMME funding, the legitimacy of incubators' mediation of business networks, and system-wide partnerships and collaborations) as contributing to technology business incubation and technology entrepreneurship.

The emphasis on the aforesaid different layers of analysis (i.e., individual, institutional and environmental factors) precludes entrepreneurship scholars from developing an integrated picture of these factors to provide a more nuanced and holistic account of factors affecting technology business incubation and technology entrepreneurship. The scientific gap this study explores, therefore, is the varying, hierarchical but partial explanations for low technology business incubation and suboptimal technology entrepreneurship outcomes (i.e., few commercialised applications, low business growth and financial sustainability), which complicate the creation of synergy from individual, institutional and environmental factors affecting technology business incubation to generate technology entrepreneurship, when these factors are considered individually and selectively.

The study draws on a humanist perspective and interpretive phenomenology involving two cases of university-based incubation ecosystem actors drawn from a population of 65 participants to provide a comprehensive account of the diverse factors that coalesce around technology business incubation to influence technology entrepreneurship. The phenomenological study which covered 30 in-depth semi-structured interviews, 2 focus group discussions and an extensive review of documents revealed that, scripts, intuition, physical capital, social capital, intellectual capital, national entrepreneurship policy and regional innovation culture were the main individual, institutional and environmental factors that merge with technology business incubation to influence technology entrepreneurship.

Moreover, the study established that, at technology business incubation level, gut feelings were critical in incubation decisions such as investment deals, procurement decisions, concluding sales deals, determining product prices, investigating reasons for cancelling of product purchases and managing partnerships. Regarding the realisation of technology entrepreneurship, gut feelings were instrumental in optimising opportunity exploitation in the innovation ecosystem, especially locating new customers, new investment and funding opportunities, which culminated in increased revenue base, return on investment and profit margins of technology startups. Scripts were instrumental in navigating the entrepreneurial stages, especially ascertaining the value proposition, prototype development, securing client feedback during product tests, launching new technology innovation products and ascertaining perceived risks for products in the market. Concerning the advancement of technology entrepreneurship, when the lean canvas business model was applied as a script, the script enabled incubatees to develop an innovative lens to the entire technology business development process – optimising the pricing of products, revenue generation and sustainable technology innovation for startups.

From a technology entrepreneurship perspective, the provision of physical capital to incubatees provided a central nodal point for incubatees to access new customers, augmenting opportunities for concluding more sales of technology products and services and increasing the revenue base for these tenants. Incubation sponsors' availing of social capital through the creation of an innovation platform for promoting incubation sponsor-incubatee networking enabled incubatees to hone their innovative ideas, perfect their technology products and solutions leading to more effective commercialisation of their innovations. The provision of human capital training in legal matters, technical and advisory services, grant proposal development, and accessing venture capital catalysed incubatees to develop a more sophisticated view of the venture development process, enabling them to better identify and exploit new scientific and technology innovations, which created avenues for firm expansion and financial growth.

From a technology business incubation perspective, national policy shaped the regional innovation development programmes that strengthened the formation of the regional innovation ecosystem, which influenced the localisation of technology innovations at the grassroots. Regional innovation culture enabled knowledge spillovers that unfolded among universities, industry and firms in the incubation ecosystem, allowing business startups to leverage the intellectual property created by or through universities, even though a dearth of technology innovations persisted outside university contexts. Regarding its contribution to technology entrepreneurship, national entrepreneurship policy directed universities to identify academics and students that possess innovative ideas with potential for commercialisation to form technology startups and emphasised the creation a cohort of entrepreneurs who could generate patents, startups and spinouts that create jobs, fuelling economic growth and national wealth creation.

The study contributes to theory, model development, methodology, policy and practice. The study contributes to theoretical knowledge on university technology business incubation by illustrating the combination of individual, institutional and environmental factors that merge to shape technology business incubation in ways that contribute to the realisation of technology entrepreneurship. The study draws on complementarities of institutional theory and resource-based view to demonstrate how incubation rules and norms shape incubatees' venture development behaviours and how the superiority of resources served as a differentiating factor in incubatees' decisions to join private technology business incubators or remain in their incumbent university-based incubators. The study employed contextual embeddedness and resource differentiation as concepts that integrate the resource-based view and institutional theory in showing how different incubatees at various stages of their entrepreneurial journeys need distinct types of resources and forms of support to realise technology incubation and technology entreprepreneurship. The study also employed policy diversity and strategic alignment of institutional stakeholders and incubation processes to the resource endowments and situated contexts of these actors to establish entrepreneurial and incubation ecosystems germane to the level of entrepreneurial maturity, resource affordances and capabilities of these stakeholders in that ecosystem. The study developed a conceptual model based on the combination of individual, institutional and environmental factors whose synergy with technology business incubation contributed to the realisation of technology entrepreneurship. Methodologically, the study develops an integrated approach that merged the supply-side approach (technology business incubator perspectives) with demand-side approach (technology business incubatees perspectives) thereby providing a more inclusive, comprehensive perspective on the dynamics of business incubation and technology entrepreneurship.

The study makes some policy recommendations concerning the development of resource mobilisation strategy for incubatees well aligned to their preferred funding mechanisms, development of comprehensive policies explaining different funding models, mechanisms, and instruments and their trade-offs. It also recommends the development of a context-embedded approach to modelling and implementing regional innovation ecosystems to improve the effectiveness of innovation ecosystems and developing an ecological policy framework for incubation ecosystems framed around the prioritisation and ranking of incubation factors in terms of their importance, relevance and socio-economic impact.

ACRONYMS AND ABBREVIATIONS

AM	Additive Manufacturing
AsgiSA	Accelerated and Shared Growth Initiative South Africa
AOI	Area of Innovation
AURP	Association of University Research Parks
BBBEE	Broad-Based Black Economic Empowerment
BIS	Black Industrialist Scheme (BIS)
BICs	Business Innovation Centres
BVIZ	Federal German Association of Innovation, Technology and Business Incubation Centres
CAQDAS	Computer-Assisted Qualitative Data Analysis Software
CIDB	Construction Industry Development Board
CIIE	Centre for Innovation, Incubation and Entrepreneurship
CNC	Computer Numerical Control
COIDA	Compensation for Occupational Injuries and Diseases Act
CRE	Centre for Rural Entrepreneurship
CSE	Chalmers School of Entrepreneurship
CSES	Centre for Strategy and Evaluation Services
CSR	Corporate Social Responsibility
CSIR	Council for Scientific and Industrial Research
DESTEA	Department of Small Business Development, Tourism and Environmental Affairs
DHET	Department of Higher Education and Training
DSI	Department of Science and Innovation
DST	Department of Science and Technology
DTI	Department of Trade and Industry
EBN	European Business Innovation Network
EDHE	Entrepreneurship Development in Higher Education
EERS	European Entrepreneurial Region Scheme
EC	Entrepreneurial Cognition
EC	European Commission
EE	Entrepreneurship Ecosystem
EO	Entrepreneurial Orientation
EU	European Union
EUCR	European Union Committee of the Regions
FDC	Free State Development Corporation
FEDC-HEIs	Forum of Entrepreneurship Development Centres at Higher Education Institutions
FGEs	First Generation Entrepreneurs
FMST	Federal Ministry of Science and Technology
GBSN	Global Business School Network
GEIR	Global Entrepreneurship Index Report
GST	General System Theory
HEIs	Higher Education Institutions
HEIF	Higher Education Innovation Fund
HERDIC-SA	Higher Education Regional Development Initiative of Central South Africa
HREC	Human Research Ethics Committee (HREC)

ICTs	Information and Communication Technologies
IDC	Industrial Development Corporation
IDP	Information for Development Programme
IP	Intellectual Property
IPAP	Industrial Policy Action Plan
IASP	International Association of Science Parks
InBIA	International Business Innovation Association
ICEB	International Consortium for Dynamic Entrepreneurship Benchmarking
ISO	International Scientific Organisation
KPIs	Key Performance Indicators
KIC, UK	Knowledge and Innovation Community, United Kingdom
KSTE	Knowledge Spillover Theory of Entrepreneurship
MOST	Ministry of Science and Technology
NACI	National Advisory Council on Innovation
NASA	National Aeronautics and Space Administration
NADSME	National Agency for Development of Small and Medium Enterprises
NBIA	National Business Incubation Association
NDP	National Development Plan
NEP	National Empowerment Fund
NEW	National Entrepreneurship Week
NIPF	National Industrial Policy Framework
NOTAP	National Office for Technology Acquisition and Promotion
NSBA	National Small Business Act
NGOs	Non-Governmental Organisations
NIA	National Innovation Agency
NSTDA	National Science and Technology Development Agency
NSTEDB	National Science and Technology Entrepreneurship Development Board
NWC	National Water Commission
NYES	National Youth Enterprise Strategy
NYDA	National Youth Development Agency
NTBFs	New Technology-based Firms
OSMEP	Office of Small and Medium Enterprises Promotion
OECD	Organisation for Economic Co-operation and Development
PEA	Perceived Entrepreneurial Ability
PEC	Perceived Entrepreneurial Capabilities
PLM	Product Lifecycle Management
PIPS	Programme Impact and Performance Score
RTRAP	Red Tape Reduction Action Plan
RISP	Regional Innovation Support Programme
RBV	Resource Based View
R&D	Research and development
SEDA	Small Enterprise Development Agency
SAMTI	Seda Agricultural and Mining Tooling Incubator
SMMEs	Small, micro and medium enterprises
SPEED	Student Placements for Entrepreneurs in Education
STEPs	Science and Technology Entrepreneurs Parks

STPs	Software Technology Parks
SAB	South African Breweries
SUPER	StartUp Promotion for Entrepreneurial Resilience
SKA	Square Kilometre Array
TBI	Technology Business Incubation
TBIs	Technology Business Incubators
TE	Technology Entrepreneurship
THRIP	Technology and Human Resources for Industry Programme
TIs	Technology Incubators
TIA	Technology Innovation Agency
TICs	Technology Innovation Centres
TPs	Technology Parks
TTI	Technical Training Institutes
TTOs	Technology transfer offices
UIF	Unemployment Insurance Fund
UBC	University-Business Corporation
UBI	University-based Incubation
UBI	University Business Incubator
UCDP	University Capacity Development Programme
UCT GSB	University of Cape Town Graduate School of Business
UFS	University of the Free State
UNIDO	United Nations Industrial Development Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UP	University of Pretoria (UP)
VAT	Value Added Tax (VAT)
VC	Venture Capital
VIP	Venture Incubation Programme
VRIN	Valuable, rare, inimitability, non-substitutability
WB	World Bank
WCTT	Wroclaw Centre for Technology Transfer
WDPC	Wuhan Donghu Pioneers Centre

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CHAPTER 1: ORIENTATION TO THE STUDY

1.1. INTRODUCTION

This orientation to the study covers salient issues relating to technology business incubation (TBI), incubation outcomes, especially technology entrepreneurship (TE), including the factors that drive these variables. Business incubation describes business development and support that is provided to organisations and processes (Bajmócy, 2007; Baraldi & Havenvid, 2016). Such incubation refers to rendering physical facilities, technical, entrepreneurial and business training as well as social networks that ultimately enhance business startup activities and success. Following this definition, TBI therefore, constitutes a special variant of business incubation that is facilitated by technology/business incubators, innovation/technology centres, science/research/technology parks and business/seed accelerators (Mian, Lamine & Fayolle, 2016). TE is defined as a style of business leadership that identifies high-potential, technology-intensive business opportunities, gathers resources such as talent and cash, and manages rapid growth using principled, real-time decision-making skills (Byers, Dorf & Nelson, 2014). Since the creation, development and support of technology startups precede the management of their rapid growth as sustainable ventures, it follows that the realisation of TE presupposes the development and support of technology ventures (i.e., TBI).

Since business incubation emphasises property-based initiatives providing tenant firms with new venture support infrastructure, business services networking (Bergek & Norrman, 2008), capital (Aernoudt, 2004), access to professional services (Sherman & Chappell, 1998), and other university resources (Mian, 1996), technology business incubators (TBIs) have been hailed worldwide for many reasons. They are conceived as institutional mechanisms designed to prevent startup failures (Rothaermel & Thursby, 2005), and platforms for buffering, bridging and mediating access to essential resources (e.g., support infrastructure, capital and specialised services) (Grimaldi & Grandi, 2005, Hausberg & Korreck, 2021). TBIs are also strategies for increasing employment opportunities and revitalising neighbourhoods (International Business Innovation Association [iNBIA], 2017). Consequently, they are conceived as conduits that facilitate the transformation of industrial clusters (Yusubova & Clarysse, 2016) and develop innovation hubs for supporting regional economic development (Plonski, 2016). In the United States, TBIs have accelerated the maturity of new startups that create new jobs and increase taxes levied (Wiggins & Gibson, 2003; Khalil & Olafsen, 2010). In Sweden, TBIs located at Karolinska Institute are sources of value creation for incubatees that develop medical discoveries in Nordic countries and have generated spin-offs within 10-15 years (Baraldi & Havenvid, 2016). In South Africa, TBIs serve as policy interventions for developing survivalist entrepreneurs as they offer general business training and funding opportunities even though such training often lacks a specific focus (Tengeh & Choto, 2015). However, compared to the advanced economies (e.g., US and UK) with over 60 and 40 years of TBI experience respectively (Bruneel, Ratinho, Clarysse & Groen, 2012, Mian, 2021), TBI is a recent phenomenon in South Africa. In this context, TBI is operationalised in a resource-constrained emerging economy with fledgling institutions created to support it. Therefore, the outcomes of TBI in advanced economies cannot be assumed to be readily transferrable to those of such an emerging economy.

The current chapter is structured as follows: first, it commences with a discussion of pertinent lacunae observed pertaining to TBI as a concept and those relating to the association of TBI with TE. Second, the scientific gap in the literature on TBI as it relates to incubation outcomes such as TE is exposed. Third, the motivation for undertaking the current study is laid out. Fourth, the theoretical argument is presented. Fifth, the motivation for conducting the study is articulated. Sixth, objectives and research questions for the study are formulated. Seventh, the context of the study under investigation is discussed together with the justification of its choice. Eighth, an outline of the research methodology is presented. Nineth, an outline of the thesis chapters is provided together with the chapter summary. The next section presents lacunae identified concerning TBI and pertaining to the association between TBI and TE.

1.2. TECHNOLOGY BUSINESS INCUBATION AND TECHNOLOGY ENTREPRENEURSHIP LACUNAE

There exists in entrepreneurship literature a burgeoning body of research on TBI in advanced countries (Mian, 1996b; Colombo & Delmastro, 2002; Grimaldi & Grandi, 2005; Bergek & Norrman, 2008; Mian, Lamine & Fayolle, 2016; Lamine et al., 2018; Van Stijn, Van Rijnsoever & Van Veelen, 2018; Rice & Noyes, 2021) and in emerging economies in the last decade (Adelowo, Olaopa & Siyanbola, 2012; Bulsara, Gandhi & Porey, 2013; Masutha, 2013; Khorsheed, Al-Fawzan & Al-Hargan, 2014; Lose, Nxopo, Maziriri & Madinga, 2016; Nordling et al, 2020). This proliferation of literature on TBI can be attributed to business incubators' acknowledged capacity to nurture fledgling startups, provide resources and capabilities to these nascent firms (Hausberg & Korreck, 2021) and create a conducive climate for the growth of these startups (Spigel & Harrison, 2018), even though these affordances are yet to be extensively tested in the under-researched contexts of emerging economies.

Despite the burgeoning research on business incubation, ideal type incubation frameworks, practices and outcomes remain fragmented due to the heterogeneity of incubation objectives, diversity of incubation stakeholders and the complex configuration of services and resources that incubators offer (Grimaldi & Grandi, 2005; Bruneel et al., 2012). Moreover, the absence of a theoretical anchor for incubation support and its effects on operational practices of incubated firms (McAdam & McAdam, 2008; Soentano & Jack,

2016) further compound the coherent and complete characterisation of TBI. The heterogenous thinking around TBI and under-theorisation of this subject with reference to realising effective incubation outcomes such as TE (e.g., sustainable startups, increased job opportunities and economic growth) can be attributed to multiple levels of analyses, including entrepreneurial challenges prevalent at those levels of scrutiny. First, at the individual entrepreneur level, while technology business incubatees may know the resources that universities offer such as research, intellectual property, space, expertise and workforce potential, entrepreneurs may lack confidence in the capabilities of these institutions to support them (Cowell, Lyon-Hill & Tate, 2018). Therefore, a lack of confidence in the delivery capabilities, including the prevalence of cognitive deficiencies (e.g., lack of entrepreneurial self-efficacy and capabilities), could undermine technology business incubatees' ability to exploit resources and competencies availed by university business incubators. Second, at the institutional level, the success of TBI support in delivering sustainable incubation outcomes depends on the availability of innovative ideas (Gans & Stern, 2003) and the quality of human capital of incubators and incubatees in the incubator (Wright, Hmieleski, Siegel & Ensley, 2007). Third, at the systemic level, the presence of germane innovation policies that create favourable institutional environments for developing generic innovation capabilities or increasing innovation (Nguyen, Mariussen & Hansen, 2020), supportive regional culture for entrepreneurial activities (World Economic Forum, 2013; Stam, 2015) and regional funding support (White Paper on Science, Technology and Innovation, 2019) determine the extent to which TBIs can deliver on their intended outcomes.

Another typical expression of such under-theorisation of the literature on TBI is limited knowledge on the extent to which business incubation *actually* translates into TE. Given the high failure rate of incubated businesses, the capacity of business incubation to advance TE remains a grey area in literature (Kropp & Zolin, 2005; Bertha Centre for Social Innovation and Entrepreneurship, 2011; Albort-Morant & Oghazi, 2016). Yet, TBI is advanced as a promising policy mechanism for nurturing new ventures through their development lifecycle, promoting the development of technology-based and growth-oriented firms (Mian, Lamine & Fayolle, 2016; Galbraith, McAdam & Cross, 2019), pointing to a plausible link between TBI and TE. Ratinho et al. (2015) define TE simply as recognising, creating and exploiting opportunities, and assembling resources around a technological solution, irrespective of the organisational context. The core focus of TE, therefore, is the amalgamation of complex and specialised resources (raw materials, financial and human skills) to deliver technological solutions that create economic and social value to the organisation such as substantial growth, cost efficiency and sustained revenue streams. TE involves the integration and deployment of specialised individuals and heterogeneous assets related to advances in scientific and technological knowledge to create and capture value for a firm (Bailetti, 2012). Following these definitions of TE and the claim that availing TBI support contributes to TE through fostering high performing new technology ventures, increased job creation opportunities, facilitating the commercialisation and transfer of technology for graduated companies and creating a germane climate for entrepreneurship (Al-Mubaraki & Busler, 2017), it is collollary to postulate that one of the key outcomes of TBI is the realisation of TE.

The lack of clarity on the role of TBI in facilitating TE could be attributed to several factors such as technology startups' lack of resources post-incubation (Younkin & Kashkooli, 2016; Giones & Brem, 2019), entrepreneurs' lack of managerial knowledge and entrepreneurial experience to facilitate continued business growth and sustenance in post incubation phases (Bøllingtoft & Ulhøi, 2005; Soentano & Jack, 2016), startups' inadequate technological capabilities (David-West, Muritala & Umukoro, 2019) and the time lag between incubation and the realisation of TE outcomes. First, literature suggests that although technological entrepreneurs have strong technical and innovative capabilities when they are introduced into the market by their incubators, they often lack the financial resources, managerial and market experience to penetrate the markets for which their innovations are most relevant and appropriate (Gan & Stern, 2003; Kropp, & Zolin, 2005). Therefore, TBI may not automatically translate into TE outcomes when technology incubation tenants are served by under-resourced incubators with limited market knowledge. Second, given that TBI unfolds during the inception stages of the business development cycle, research (Kropp & Zolin, 2005; Albort-Morant & Oghazi, 2016) demonstrates that the realisation of TE may be undermined by technology entrepreneurs' lack of managerial knowledge and entrepreneurial experience (Plosila & Allen, 1985; Soentano & Jack, 2016, Mian, 2021) to translate their promising technological and innovative ideas and prototypes into sustainable products, services and inventions in the post-incubation phase. Third, in view of the time lag between TBI and realisation of TE (Gan & Stern, 2003; Kropp & Zolin, 2005; Albort-Morant & Oghazi, 2016), the fact that TE lies at the tail end of the entrepreneurial journey, coupled with the reality that TE involves multiple intersecting institutions, processes and actors (Petti, 2012), it may be hard to attribute specific TE outcomes to TBI exclusively.

The complexity of the relationship between TBI and TE persists despite some literature pointing to some significant associations. For instance, the provision of TBI support is considered instrumental in promoting entrepreneurial outcomes such as TE (Lotz, 2006; Rasmussen et al., 2013; Rasmussen & Wright, 2015). Moreover, the provision of TBI support is deemed to contribute to TE through fostering high survival and sustainability rates of graduated companies, accelerating innovation with smart products and services and promoting greater diversification of the economy from companies' innovation and technology exploits (Al-Mubaraki & Busler, 2017). Since the studies cited above largely focused on advanced and high-income emerging economies, the assessment of middle- and low-income emerging economies provides a compelling rationale to explore this TBI phenomenon as it relates to TE in an emerging economy, a context underexplored in mainstream entrepreneurship literature.

1.3. SCIENTIFIC GAP IN LITERATURE

Despite the inherent promise of technology business incubators (TBIs) to integrate capital incentives, technology and technical know-how in leveraging entrepreneurial talent, accelerating new technology business growth (Smilor & Gill, 1986; Oakey, 2012; Mian et al., 2016) and eliminating business failures, the success of university-based TBI and its outcomes, especially TE, remain disappointingly low. When incubation performance is measured in terms of the number and size of innovative firms incubated, revenue generated and size of investment attracted by incubators (Khalil & Olafsen, 2010), the results across South African universities are sub-optimal. For instance, University of Cape Town (UCT) Graduate School of Business' (GSB) Venture Incubation Programme (VIP) only supported 30 startups between 2016 and 2018 (UCT GSB, 2018). Similarly, the Central University of Technology (CUT), incubated 9 technology startup firms in three years (2017-2019). Although the University of Pretoria (UP) launched TuksNovation, a business incubator that supports postgraduate students and industry to create high-tech business startups in 2018 (UP Alumni News, 2018), substantive incubation performance outcomes are yet to emerge.

What remains confusing in literature are the varying, hierarchical but partial explanations for the low TBI and poor incubation outcomes, especially TE (i.e., few commercialised applications, low business growth levels and financial sustainability of incubatee firms). At the individual entrepreneur level, poor business knowledge, limited experience, ineffective business strategies, limited risk mitigation strategies and limited perceived entrepreneurship capabilities are often cited as key explanations for low TBI and poor incubation outcomes (Tengeh & Choto, 2015; Ndofirepi & Rambe, 2017; Bhorat, Asmal, Lilenstein & Van Der Zee, 2018). Conversely, possession of personal psychological dispositions such as entrepreneurship cognition is hailed as one of the prime sources of business creation (Shapero, 1982; Kruger et al., 2000) and the generation of TE among South Africa incubatees (Lose et al., 2016). Despite these explanations, other studies criticise the individual traits approach for ignoring institution-level factors fundamental to TBI and TE such as the availability of institutional resources, incentives and contextual factors (Mitchell et al., 2002; McAdams & Pals, 2006) that enable the translation of business ideas into incubation outcomes.

The provision of TBI support is a critical institutional factor in TBI and promoting TE (Lotz, 2006; Rasmussen et al., 2013; Rasmussen & Wright, 2015). Such institutional support includes provision of specialised training and coaching programmes (Patton & Marlow, 2011; Patton, 2014), incubatees' proximity to university research libraries and research groups (Rubin et al., 2015), access to business networks (Bruneel et al., 2012) and incentive systems (European Creative Industries Alliance, 2014). Similarly, the institutional factors that undermine successful incubation and optimal incubation outcomes include incubatees' limited access to physical spaces for conducting business operations (Lee & Osteryoung, 2004), constrained access to finance (FinFind Access to Finance Report, 2018), limited access to markets, paucity of business networks (Carayannis & Von Zedtwitz, 2005; Díez-Vial & Montoro-Sánchez, 2016) and the lack of systems support and well-trained human resources (South Africa Business Incubator Establishment Handbook, 2014). However, an over-emphasis on institutional factors such as supply-side interventions tend to undermine the significance of individual and environmental factors critical to successful business incubation. This entails other considerations such as individual entrepreneurs' incapacity to recognise their resource gaps (Vohora et al., 2004) and the lack of sophistication of incubators' broader business networks respectively (Patton, 2014).

Environmental factors relating to business incubation cover the entire technology innovation ecosystem and its support of TE. Studies have demonstrated that national entrepreneurial policies (Tang et al., 2013; Clarysse, Wright & Van Hove, 2016); regional innovation culture and ecosystems (Pinillos & Reyes, 2011; García-Rodríguez et al., 2017), regional SMME funding (M'Chirgui et al., 2011; Solomon & Lind, 2016) and legitimacy of incubation among incubatees and local communities (Batchelor & Burch, 2011; Messeghem; Sammut & Beylier, 2014) have a bearing on TBI and incubation outcomes. Other studies have emphasised the role of supply-side factors such as the incubators' mediation of business networks (Soetanto & Jack, 2016), their brokering of system-wide partnerships and collaborations with investors, government and venture capitalists on incubatees' behalf (Patton & Marlow, 2011) and incubators' support for peer-to-peer interactions through shared office spaces, networking events and business introductions (Cooper et al., 2010) as fundamental to the realisation of TBI and TE. However, the supply-side approach emphasised by the environmental approach seems to downplay the role of individual factors in realising optimal TBI and TE outcomes. For instance, Solomon and Lind (2016) warn that the supply-side focus of incubators that emphasises creating germane environmental ecosystems for incubatees often downplays incubatees' lack of initiative, their culture of entitlement and their expectations that incubators ought to do everything for them.

The research gap in this study, therefore, is the difficulty in creating synergy from individual, institutional and environmental factors affecting TBI to generate optimal incubation outcomes such as TE when these factors are considered individually and selectively. The chasm between demand-side approaches (i.e., individual entrepreneur factors) and supply side interventions (i.e., institutional and environmental factors) contradicts the exhortation for researchers to develop incubation frameworks that consider factors located at different levels where multiple relationships unfold between internal and external players (McAdam et al., 2016)

1.4. THEORETICAL ARGUMENT

Although TE involves multiple actors and necessitates different levels of analysis (Garud & Karnøe, 2003), studies that investigate the interface between these levels of analysis (e.g., individual technological entrepreneurs, research institution groups, the technology venture organisations) such as university incubators are hard to encounter (Link et al., 2015). Yet, through aggregating different configurations comprising individual entrepreneurs' idiosyncrasies, university incubators, and the broader university ecosystem, robust frameworks of TE can be developed drawing on an examination of individual, institutional and system-wide factors.

Various studies exploring the interface of individual entrepreneurs and technological ventures have spawned in literature (Mosey & Wright, 2007; Eesley & Roberts, 2012; Guerrero & Pen˜a-Legazkue, 2013; Guerrero et al., 2015). These studies have explored inter alia, the impact of human capital on the development of technology ventures (Mosey & Wright 2007; Wright et al., 2007), and the contribution of entrepreneurial experience to the thriving of new technological ventures (Eesley & Roberts, 2012). Although these studies focus on the enduring individual traits and capabilities in the incubation and success of technological ventures, they tend to ignore the meso-level of analysis covering universities and research groups.

Another strand of research casts a spotlight on the influence of institutional provisions such as support initiatives (e.g., incubators, entrepreneurship education and business plan competitions) on the development of talent and experience of technology-based entrepreneurs (Wright et al., 2004; Guerrero et al., 2015). Institutional provisions such as venture capital are also credited for fostering innovation by providing early-stage equity and strategic support critical to the success of technology-based firms (Ariyo, 2000; Daramolo, 2012). Research in this line also demonstrates how the prevalence of a strong culture of supporting academic entrepreneurship positively impacts the performance of TE within academic departments (Rasmussen et al., 2013). However, some studies have contested the usefulness of these initiatives by emphasising that some university-bestowed support and incentive regimes may exert some negative effects on technology startups. For instance, Meyer (2003) highlights that the provision of incubation support has a negative impact on the growth of spin offs. Schwartz and Hornych (2010) report on the inconsequential effects of internal networking activities on incubated firms even though incubators' linkages to the university have greater impact. This demonstrates that the effects of incubator support on incubatees' performance are circumstantial and dependent on types of support and situated contexts in which such support systems are rendered. Despite their invaluable emphasis on the contribution of institutional support to incubation outcomes, these studies provide little insights into the impact of environmental factors (e.g., society-wide dynamics) on incubation performance outcomes.

Studies foregrounding society-wide levels of analysis concentrate on the effects of collaborations between multiple actors such as universities, research groups, public and private institutions, and communities on TBI outcomes, especially TE (Doganova & Eyquem-Renault, 2009; Beckman et al., 2012a; Roja & Năstase, 2014). These studies shift attention from individual entrepreneurs to groups and collectivities embedded in TE ecosystems. These include institutions, new technology ventures, communities, universities, corporations, capital and investments, markets, government, professional advisors, incubators, accelerators and hubs (Roja & Năstase, 2014). While TE studies that explore the interactions between organisations (e.g. incubators) and the external environment have investigated organisational strategies to tap into during innovations (Beckman et al., 2012b), the formation of prudent commercialisation strategies (Gans & Stern, 2003) and appropriate business models (Doganova & Eyquem-Renault, 2009), studies that consider individual, organisational and technological environment ecosystem determinants and frameworks of TE are yet to emerge. This negation of a multi-level analysis has contributed to the lack of a systematic framework that enables an understanding of incubators and companies located in them, their dynamics and incubation performance outcomes (Phan, Siegel & Wright, 2005; Rubin et al., 2015). More so, some issues such as how incubatees' entrepreneurial cognition and perceived entrepreneurship capabilities merge with the incubator incentive regimes to realise TE, remain relatively unexplored, hence the relevance and efficacy of this study.

1.5. MOTIVATION FOR UNDERTAKING THE STUDY

The study was motivated by several considerations. First, the fragmentation in TBI literature, which complicates a coherent and unified analysis and investigation of this literature, especially as it relates to TE. Most of the early literature on TBI was fragmented and anecdotal, with a focus on success stories and outcomes, and much of it was predominantly theoretical (Hackett & Dilts, 2004; Mian 2011, Hausberg & Korreck, 2021) and therefore, lacked a strong empirical foundation. Although empirical studies covering TBI have proliferated in recent years (Plonski, 2016; Zhu, 2016; Fukugawa, 2021; Guerrero, 2021, Rice & Noyes, 2021), this literature largely focused on advanced (Bone, Allen & Haley, 2017; OCED, 2019; Van Hove, Thiel & Clarysse, 2021) and middle-income economies in Latin America (Plonski, 2016; Nordling et al., 2020) and Eastern Europe countries (Williams & Tsiteladze, 2016) and patently ignored contexts in the Southern Hemisphere and critically African countries. Where emerging economy contexts were covered (Hichri, M'chirgui & Lamine, 2016; Solomon & Lind, 2016), no definitive focus and explicit attention was devoted to exploring the linkage between TBI and TE. Therefore, the extent to which TBI impacts TE in emerging, middle-income African economies remains a grey area yet to be sufficiently problematised. As Phan et al. (2005) and Mian (2021) rightly observe, the theoretical focus of studies with a developed economy emphasis coupled with the lack of systemic longitudinal studies make the development of a generalisable theory of incubation challenging. This study strives to bridge this gap.

Second, the need for a more contextualised and situated investigation of key drivers of TBI relevant to the context of emerging economies warrants critical enquiry. Since the idiosyncrasies of incubators in relation to geographic, political, social and economic systems make the development of a unified theory complicated (Mian et al., 2021), and the First generation "configuration" models were considered deficient in providing process-oriented incubation support to incubatees (Autio & Klofsten, 1998), a context-informed examination of factors that drive TBI remains critical to the emergence of incubation models that are unique for and relevant to the needs of startups and entrepreneurs in emerging economies. The development of incubation models founded on an in-depth understanding of the situational factors shaping TBI provides a direct response to the urgent calls for a strong consideration of regional and country level variations when researching drivers of incubation to provide "context sensitive" entrepreneurship studies (Chlosta, 2016; Scott, Sinha, Gibb & Akoorie, 2020). This also contributes to developing contextualised approaches to examining micro- and meso-level processes of TBI (Stenholm, Acs & Wuebker, 2013). The need to develop an inherently contextualised study on entrepreneurial behaviours such as TBI contributes to addressing what Roper (2013:2) has criticised as "the inadequacy, or perhaps more accurately, the irrelevance of many of the standard taught "models" of entrepreneurship behaviour for many countries."

Third, the need to synergise the disparate yet partial analysis of individual (Mitchell et al., 2002; Krueger, 2005; Santos, Curral & Caetano, 2010; Ahmad, 2021), institutional (Unger et al., 2011; Human Resource Development Council of South Africa, 2014; FinFind Access to Finance Report, 2018; Breivik-Meyer, Arntzen-Nordqvist & Alsos, 2019; Soentano & Klofsten, 2021) and environmental factors (Hart, 2003; Kim & Kim, 2016; Salman, 2016) affecting business incubation to make a coherent sense of and to develop a more integrated picture of how these different factors can be merged to promote TE, was self-evident. The need to integrate the three perspectives arise from the realisation that while individual entrepreneurs are the primary leaders and drivers for the creation of startup entrepreneurial ecosystems

(Spigel & Harrison, 2018), institutional frameworks for providing different resources support the thriving of startups and incubators (Bøllingtoft & Ulhøi, 2005; Soentano & Jack, 2016; Nguyen, Mariussen & Hansen, 2020), and environmental conditions facilitate the development of strong incubation ecosystem (Mian et al., 2016; Lima 2017; Lamine et al., 2018), none of these factors are exclusive and sufficient explanations for advancing TE. As Petti (2012) observes, a sufficient attempt at explaining TE requires the examination of several factors and players, their roles and their interactions in the transformation of raw technologies, as well as institutional and environmental conditions that set the momentary boundaries in which such a system operates.

There are some compelling reasons for adopting an integrated, systemic view of TE that considers individual, organisational and system-level factors and interfaces between these contexts. First, technology entrepreneurship transcends single individual entrepreneurs and is inextricably linked and affected by a set of specific organisational, institutional and environmental circumstances (Petti, 2012). Second a multilevel approach is not only a necessity in TE but constitutes a robust response to promoting effective and relevant research in the context of emerging economies (Petti, 2012) where a phenomenon is rarely an outcome of a single factor but a constellation of factors and actors. This is particularly the case given the paucity of studies located at and exploring the individual, institutional and environmental factors affecting TE (Link et al., 2015).

Fourth, the absence of a compelling theory exploring the intersection of TBI and TE was another motivation for this study. In the absence of a unified theory of TBI and TE, a synthesis of theoretical lens exploring these concepts is ultimately necessary (Mian, 2021). As such, the current study draws on a multi-theoretical framework integrating entrepreneurial cognition theory, institutional theory and entrepreneurial system theory to cater for the individual, institutional and environmental focus of the study, with the resource-based theory and market failure theory serving as supporting epistemological foundations. Drawing on a multi theoretical lens ensures that not only is each level of analysis comprehensively covered but that inter-level links are also sufficiently considered and investigated across multiple players in the ecosystem.

1.6. OBJECTIVES

The next sections present the primary and secondary objectives of the study.

1.6.1. Primary objective

The primary objective of the study is to understand the individual, institutional and environmental factors that affect university-based TBI and how they coalesce to support TE.

1.6.2. Secondary objectives

To realise the primary objective, the following *theoretical objective* is formulated:

1. Review prior studies on individual (i.e., entrepreneurial cognition [EC], perceived entrepreneurial capabilities [PEC]), institutional (i.e., incubation support and incentive regime) and environmental (i.e., entrepreneurial ecosystem) factors affecting university-based TBI as they relate to TE.

The *empirical objectives* to be realised are:

2. To investigate the dimensions of individual (i.e., EC, PEC) factors that are fundamental to the incubation of technology businesses and TE.

3. To assess the role of institutional (i.e., incubation support and incentives rendered by incubators) factors in the successful incubation of technology businesses and TE

4. To ascertain aspects of the environment (i.e., entrepreneurial ecosystem) that facilitate (or undermine) the successful incubation of technology businesses.

5. To ascertain aspects of the environment that facilitate (or undermine) the realisation of TE of university-incubated businesses.

6. To develop a conceptual framework for advancing technology entrepreneurship based on the coalescence of factors that affect technology-based incubation and grasp its constitution.

1.7. RESEARCH QUESTIONS

The main research question that this study addresses is:

> How do individual (i.e., EC, PEC of incubation tenants), institutional (i.e., incubation support and incentive regime of TBIs) and environmental (i.e., entrepreneurial ecosystem) factors that affect university-based TBI coalesce to support TE?

To address this main research question, the following subsidiary research questions are posed:

1. What key issues emerge from prior studies on individual (i.e., EC, PEC), institutional (i.e., incubation support and incentive regime) and environmental (i.e., entrepreneurial ecosystem) factors affecting university-based TBI as they relate to TE?

2. Which dimensions of individual (i.e., EC, PEC) factors are fundamental to the incubation of technology businesses and TE?

3. What is the role of institutional (i.e., incubation support and incentives rendered by incubators) factors in the successful incubation of technology businesses and TE?

4. Which aspects of the environment (i.e., entrepreneurship ecosystem) facilitate (or undermine) the successful incubation of technology businesses?

5. Which aspects of the incubation environment facilitate (or undermine) the realisation of technology entrepreneurship among university-incubated businesses?

6. How is the conceptual framework for advancing technology entrepreneurship based on the coalescence of factors that affect technology-based incubation constituted?

1.8. RESEARCH CONTEXT AND JUSTIFICATION

Despite the espoused benefits of TBIs in supporting TE, hard evidence on their essence has been disappointing in African countries. With international donors shifting their funding from institutions (e.g., TBIs) to governments, the funding availed to university-based TBIs through national budget allocations is far exceeded by the financial obligations of startups. For instance, in 2006, Kenyan startups needed between $10 000 to $30 000 to purchase licenses and equipment and between $30 000 to $60 000 to formalise business and market development at the business development stage (Information for Development Programme, 2006). Furthermore, Ugandan entrepreneurs' knowledge of funding alternatives coupled with their inability to secure bank lending due to complex collateral requirements undermined the survival of their startups at pre-incubation stage (Information for Development Programme, 2006). Literature reports that 80% of independently incubated businesses and SMMEs fail to survive their first year of existence (Ključnikov et al., 2016; Androniceanu, 2017; Kozubíková et al., 2017) and lack of funding remains a major explanation for ineffective incubation performance outcomes in South Africa (Tengeh & Choto, 2015). Precisely, the espoused benefits of TBI such as technology business development and business survival continue to be impacted adversely by fragile states' limited resource provisions and institutional endowments such as insufficient and inconsistent funding of technology incubatees. Therefore, an investigation into the role of resource availability and institutional support in facilitating (or constraining) TBI and TE becomes necessary in African contexts, especially those of South Africa.

A reasonable proxy to calibrating the entrepreneurial performance of emerging economies such as South Africa is ascertaining their standing on the global entrepreneurial ranking. The Global Entrepreneurship Index (GEI), a tool that accurately evaluates national entrepreneurial ecosystems and the quality of opportunity-driven entrepreneurship of countries, ranked South Africa at 33%, two points below Botswana's 35% in 2018 (Ács, Szerb & Lloyd, 2018). South Africa also fared poorly in GEI ranking compared to developing countries such as Chile (59%), Cyprus (48%) and Tunisia (42%) (Ács et al., 2018). These suboptimal results are attributed to South African incubators' limited self-sufficiency, their operation in weak entrepreneurial ecosystems that constrain their effectiveness and their modelling based on the Silicon Valley, which has little resonance with developing country contexts (United Nations Framework Convention on Climate Change [UNFCCC], 2018). This further affirms that, apart from environmental limitations of entrepreneurial ecosystems, institutional constraints such as weak business incubation frameworks, business models and institutional incapacities are at the heart of poor incubation performance and entrepreneurship outcomes. South Africa's entrepreneurial ecosystem was rated one of the most challenging in the sample of participating economies in 2019 and has exhibited little sign of improvement over the past few years. In 2019, South Africa ranked 49th out of 54 economies on GEM's National Entrepreneurship Context Index, ahead of only Croatia, Guatemala, Paraguay, Puerto Rico and Iran (Bowmaker-Falconer & Herrington, 2019). This challenging terrain necessitates the conduct of research to ascertain how it can be improved in terms of entrepreneurship performance, hence the focus on this country.

With reference to South Africa, although large sums of money have been devoted to the establishment and development of state sanctioned public incubators, the incubation performance has been sub-optimal. For instance, while financial support to the tune of R24, 46 million was leveraged from Small Enterprise Development Agency (SEDA) partners to support business incubation, only 1,563 new jobs were created by these supported incubators (SEDA Annual Report, 2018). The limited employment opportunities generated must be assessed against the increased budgetary allocation devoted to SEDA in terms of government grants. For instance, while the South African government increased the grant allocations disbursed to SEDA from 620 682 million to 721 912 million between financial year 2017/2018 (SEDA Annual Report, 2018), evidence suggests that only 40% of incubators have managed to generate employment through their graduated firms. In the same vein, while the government financial allocations availed through SEDA Technology Programme (STP) increased from 139 187 million to 146 146 million in the same period (SEDA Annual Report, 2018), there is no compelling evidence to demonstrate that technology commercialisation, job creation and survival rate of incubated firms increased considerably during the same period. For instance, recent studies demonstrate that 30% of firms failed in their post incubation phase in South Africa, and incubated firms have a 68% chance of surviving four years post incubation (Schutte & Barbeau, 2022). This demonstrates that while TBI increases the chance of survival of incubated firms, this concept is not waterproof in terms of guaranteeing TE outcomes. As such, research into the contextual conditions that interact with TBI in shaping TE require much closer scrutiny if survival rates of graduated firms is to be increased.

In view of the high failure rate of South African startups (approximately 90%) in their first two years of operation (Kamdar, 2016; Barbeau, 2019), this country having one of the highest unemployment figures in the world (OECD, 2019) currently at 63,9% and 42.1% for those aged 15-24 and 25-34 years respectively (Quarterly Labour Force Survey (QLFS), 2022), the potential of universities as centres of knowledge production and funders of university-based TBIs in reducing startup failure and reducing youth unemployment cannot be downplayed. However, despite prominent South African universities such as the University of Cape Town, Stellenbosch University, University of Pretoria and University of Witwatersrand having attained diverse milestones in establishing TBIs within the last half decade, there is no compelling evidence of large numbers of graduated startups, large technology commercialisation efforts and increased employment opportunities. The unemployment woes mentioned previously, coupled with the suboptimal performance of publicly funded incubators and university-based TBIs, justify the need for a rigorous understanding of the diverse factors that affect TBI, including how these factors coalesce to facilitate specific incubation outcomes, especially TE. This study, therefore, develops a muti-level investigation of these diverse factors drawing on multi-theoretical lenses.

1.9. OUTLINE OF THE RESEARCH METHODOLOGY

Since Chapter 7 presents and discusses the methodology more comprehensively, it suffices to say that this research study is approached from an interpretivist epistemological stance. Interpretivists foreground the intersubjective, socially constructed meanings that participants assign to their experiences (Husserl, 1965; Jansen, 2016) as they engage with each other. Given the researcher’s interest in unravelling the experiences and meaning that different incubation stakeholders (e.g., incubation sponsors, incubator management, incubatees, entrepreneurial and innovation champions) assign to TBI processes, the support structures that incubators provide to incubatees and their implications for technology entrepreneurship, an interpretivist stance is deemed appropriate for this investigation.

Interpretive phenomenology was adopted as the research design for this investigation. In interpretive phenomenological studies, the researcher examines the phenomenon in its naturalistic setting and detaches themselves from their judgements and preconceptions about the nature of events in the everyday world (Schram, 2006). The cognitive distancing of the researcher from the object of research allows the phenomenon to unfold naturally unconstrained by the intervention of the researcher. The process of business incubation, including its management and regulation is experienced differently by the incubators, incubatees, technology champions and technology innovation leaders and hence the need for their emic, subjective experiences of this social reality. To prevent the repetition of methodological issues in the methodology chapter, the detailed accounts of the paradigm, approach, the population, sample, access and selection of participants, data collection techniques, data analysis techniques, dependability and credibility and research ethics the researcher abided by are elaborated in Chapter 7, the methodology chapter.

1.10. OUTLINE OF THESIS CHAPTERS

The study consists of nine chapters, and these are summarised as follows:

Table 1.1: Individual chapters and their respective objectives

Chapter	**Objective**
Chapter 1: Orientation to the study	To provide an overview of salient concepts and issues examined in the study.
Chapter 2: Theorisation of TBI and its outcomes	To provide the conceptualisations, perspectives and theories of TBI and incubation outcomes especially TE.
Chapter 3: Individual level factors affecting TBI and its outcomes	To describe and discuss the individual entrepreneur-level factors that explain university-based TBI and TE.
Chapter 4: Institutional factors affecting TBI and its outcomes	To identify and discuss the institutional factors that affect TBI and TE.
Chapter 5: Environmental factors affecting TBI and its outcomes	To describe and discuss the environmental factors that affect TBI and TE.
Chapter 6: Conceptual chapter	To render a synopsis of relationships of individual, institutional and environmental level factors excluded in Chapters 3, 4 and 5) and their synergy with TBI and TE. Relationships examined in chapter 3, 4 and 5 are also integrated into the model proposed.
Chapter 7. Methodology chapter	To describe and discuss in detail all methodological issues, procedures, activities and actions followed in this study and their justifications.

Chapter 8: Presentation and discussion chapter	To present and discuss the findings of the study drawing on relevant theory and contemporary literature.
Chapter 9: Conclusion and recommendations	To provide a conclusion, address the research questions, provide study contributions, implications for future research and limitations of the study.

1.11. CHAPTER SUMMARY

This chapter commenced with definitions of business incubation, TBI and TE. Second, the reasons for the exponential growth in the literature on TBI in advanced countries and in emerging economies were presented. Third, the lack of convergent thinking around TBI, under-theorisation of this subject with reference to its outcomes, including the extent to which TBI processes translate into TE, were discussed. Fourth, the gaps in scientific literature regarding the relationship between TBI and TE were examined. At the core of this gap was the varying, hierarchical but partial explanations for the low TBI and poor incubation outcomes especially TE, which complicate the creation synergy among individual, institutional and environmental factors affecting TBI to generate optimal incubation outcomes (such as TE) when these factors are considered individually and selectively. Fifth, the theoretical argument that despite TE involving multiple actors and necessitating different levels of analysis, studies that integrated individual, institutional and environmental level of analysis are sparse in literature – thereby necessitating a systemic perspective that considers all the different levels of analyses in one study.

Sixth, the motivation for undertaking the study was presented, leading on to an explicit articulation of the objectives and research questions. Eighth, the research context in which the study unfolded was presented together with a justification for its choice. Finally, the research methodology was outlined, culminating in an outline of thesis chapters.

The next chapter, the theoretical development of the study, renders some conceptualisations, and theories of TBI and incubation outcomes especially TE.

CHAPTER 2
CONCEPTUALISATION, PERSPECTIVES AND THEORISATION OF TECHNOLOGY BUSINESS INCUBATION AND ITS OUTCOMES

2.1. INTRODUCTION

The previous chapter, which defines the orientation to the study, set the stage for a synthesised conceptual discussion of technology entrepreneurship of university-incubated technology businesses. It rendered an introduction, study background, a presentation of parallel studies on factors affecting technology business incubation (TBI) processes and their outcomes, especially technology entrepreneurship. Thereafter, the aim of the study, study objectives, research questions of the study were formulated. The contribution of the study to the incubation process and the broader field of technology entrepreneurship was subsequently articulated. A brief outline of the methodology and research ethics the study adhered to was then presented.

The current chapter builds on Chapter 1 by rendering conceptual definitions of business incubation and venture creation, typologies of business incubation and differentiating technology business incubators (TBIs) from technology parks. Thereafter, the chapter traces the historical evolution of TBI and provides multi-level perspectives and theories on TBI. The chapter concludes with a synopsis of these theories and terminates in a summary of the key tenets.

2.2. BUSINESS INCUBATION

The definition and semantic field of business incubation is highly contested. The diversity in definitions developed from an eclectic, ever evolving foci of business incubators from their time of inception. Kuratko and LaFollette (1987) bemoan the challenges of defining the term “business incubators” due to its continuous adaptation to multiple and often competing economic commitments and social goals. The multiplicity of incubators performing similar and complementary roles (e.g., science parks, innovation centres, technology centres, and technology hubs), different funding models (e.g., public-funded incubators, privately-operated and hybridised ones) and incubators operating in different industrial/sectoral domains have contributed to the diverse nomenclature of business incubators, thereby compounding the conceptual confusion. Hausberg and Korreck (2020) explicate that the confusion surrounding business incubation is a consequence of myriad of concepts that have evolved before and during the development of the incubator concept leading to considerable overlap and conceptual clutter. For instance, incubators, accelerators and eggubators have naturally evolved and interfaced with each other, thereby complicating their precise definition, orientation and purpose. Appreciating business incubation calls into question the different definitions and categories of incubation, which are physical structure-based, service-bound, process-centred and instrumental-oriented definitions.

Some traditional definitions have narrowly characterised business incubation as locations rendering specialised services for business development and growth (Organisation for Economic Co-operation and Development [OECD], 1999; Bøllingtoft & Ulhøi, 2005; Lewis et al., 2011). Other studies have emphasised the heterogenous nature of services provided (Hansen et al., 2000; OECD/European Union, 2019; Hausberg & Korreck, 2020) while others have privileged a process-centered perspective emphasising resources, processes and outputs (Khalil & Olafsen, 2010; National Business Incubators Association [International Business Innovation Association (InBIA], 2016). These are discussed in subsequent sections of this chapter.

2.2.1. Physical structure-based definitions

Traditional definitions of business incubation that prioritise physical locations (Lumpkin & Ireland, 1988; OECD, 1999; StartUp Promotion for Entrepreneurial Resilience [SUPER], 2018) tend to consider them as shared spaces, premises and buildings offering diverse opportunities for startups and sustained growth of business ventures. For instance, the OECD (1999) defines business incubators as the rendering of workspaces to tenant entrepreneurs who operate in a specific industry on preferential and flexible terms. In the same vein, Lumpkin and Ireland (1988) understand incubators as large buildings offering low-rent space, shared office services and management advice to startups that are run by emerging entrepreneurs. Weinberg et al. (1991) regard business incubators as multi-tenant buildings that provide affordable, flexible space, and multiple offices and support services for the purpose of nurturing small fledgling firms to become sustainable healthy businesses. Other scholars conceive them as organisations that render access to affordable office space and shared administrative services to new startups (Bøllingtoft & Ulhøi, 2005). The common trait in these definitions is the economies of scale arising from the benefits of agglomeration (i.e., locational advantages), flexibility of spatial-based operations and support, the protection of nascent businesses from external shocks (such as competition) and risks of failure. Even though such definitions provide geographically informative scope given their locational foci, they are deficient in offering a panoramic perspective on the specific strategies and mechanisms that incubators adopt for their competitiveness as well as the diverse contexts (e.g., virtual incubators) in which incubation services are rendered.

2.2.2. Service-bound definitions

From a service-bound perspective, business incubation is a useful platform for deepening knowledge of international markets for the incubatee. In this respect, business incubation becomes a vehicle for soliciting customer feedback, and an instrument for developing task-relevant teams and spaces for developing first versions of their products (Halme, Salminen, Wiikeri, Rouvinen, Kotiranta et al., 2018). In the same vein, the service-based approach to characterising business incubation emphasises the incubators' social construction as conduits for accessing capital and specialised services that accelerate time-to-market for the startups. These translate into platforms for developing networked affinities to technological and commercial corporations (Grimaldi & Grandi, 2005; Hausberg, & Korreck, 2020). At the core of business incubation is a pre-occupation with incubators as facilities for dispensing utilities (e.g., electricity, internet, water), specialised managerial services (e.g., accounting and entrepreneurial training), and support services to nascent entrepreneurs. These support services range from business planning, management advice, training workshops, coaching and mentoring, business development financing, access to business networks and legal services (OECD/EU, 2019) to ameliorate the economic burden of financially and network-constrained startups. At the core of such services is the conviction that, startups cannot overcome business failure if allowed to operate independently as they lack the muscle to marshal diverse resources, capabilities and support mechanisms such that their businesses operate efficiently, profitably and sustainably.

2.2.3. Process-centered definitions

This perspective to business incubation zooms on the resources, processes and outputs that are integral to business success at different stages in the business life cycle. The European Commission (2010) and Gerlach and Brem (2015) elucidate the process perspective to business incubation by identifying three main stages namely, *pre-incubation, main incubation* and *post incubation*. The pre-incubation stage emphasises the *pre-entry programme support*, which concentrates on selecting potential entrepreneurs and bestowing support to their business idea, development of the business model and business plan to ensure that entrepreneurs have logical ideas upon the commencement of the incubator programme. Initial assessment of the business idea, entrepreneurship training, and individual coaching are conducted at this phrase to ensure entrepreneurial readiness in the main incubation phase.

The main incubation stage covers a nested range of specialised support services that are rendered either institutionally or in collaboration with actors comprising universities, government, private sector and non-governmental organisations. Such services range from increasing financial access, marketing and networking opportunities, coaching, training and mentoring services. These services could be rendered over a period of three to four years upon which incubatees are expected to graduate (European Commission 2010; Gerlach & Brem, 2015).

The post incubation phase, which occurs within three to five years, involves transitioning the incubatees out of the incubation process upon their outgrowing the incubator in terms of the scale of their operations and services. This “after care” service involves networking opportunities, technical and social support on innovation or exporting to international markets and training workshops on various entrepreneurial matters. However, given the reality that incubatees desire different resources and capabilities from incubators, the unacknowledged shift in incubation service provision in mainstream literature is the use of modular services that cater for incubatees at different stages of the incubation process. As such, many incubators are now integrating services previously bestowed at different stages of incubation process to incubation tenants (OECD/European Union, 2019).

2.2.4. Instrumental definitions

Instrumental definitions of business incubation emphasise the contribution of incubators to certain incubation performance outcomes. Hackett and Dilts (2004) understand business incubators as a strategic vehicle for steering sustainable socio-economic development. The World Bank (2014a) professes the transformative effects on startup ventures arising from cushioning them with business and technical support services, fostering their maturation into financially and operationally independent entities. Campbell (1989) and Maier (2015) view business incubators as instrumental change agents in the economy through their capacity to foster and sustain entrepreneurship. The transformative character of business incubators is widely touted, judging from their potential to foster new job opportunities, regenerate neighborhoods, and strengthen national economies (Theodorakopolaous, Kakabadse & McGowan, 2014; Maier, 2015).

2.3. TOWARDS AN INCLUSIVE, INTEGRATIVE AND ECLECTIC DEFINITION

The researcher draws on the diversity of definitions, and postulates that business incubation is:

> A formalised / informalised institutional structure, virtual platform or broad ecosystem comprising multiple actors (e.g. incubator, incubatees, university staff, government departments, financiers and NGOs) geared at transforming incubatees’ entrepreneurial capabilities, averting business failure risks, and commercialisation of their business outcomes through the provision of physical premises, shared spaces and specialised services, training and (technical, financial, entrepreneurial, social networks) support to incubatees

operating at pre-conception, development and sustainability stages of their business development.

This eclectic definition appreciates the multi-dimensional nature of business incubators in terms of their conception, their inherent capabilities and the heterogeneity of services and support they bestow at different stages in the business life cycle. This definition also acknowledges the dynamic evolution of business incubators from physical structures to cohesive business development ecosystems including the plethora of intentions embedded in their metamorphosis. Although comprehensive enough to capture the integrative and vibrant nature of this term, the definition may not be exhaustive of the broad spectrum of responsibilities and activities of this dynamic phenomenon.

2.4. TYPOLOGIES OF BUSINESS INCUBATORS: A FUZZY TERRAIN

Just like business incubation, there is no universally agreed typology under which business incubators can be classified. In view of this messy terrain, this study established that typologies of business incubators vary depending on whether they are privately or publicly sponsored and operated, the broad goals they seek to fulfil, the philosophies and intentions which guide their creation and management. While subsequent sections classify them under public-private distinctions, goal-driven variations and their philosophies and intentions, these typologies are often blurred due to the diverse and multidimensional imperatives and partnerships that contribute to their existence. The next section discusses public, private and mixed purpose distinctions of incubators.

2.4.1. Public-private and mixed purpose distinctions

The classifications of business incubators defy precision and compartmentalisation. Rudimentary classifications have privileged the public-private binaries of funding, not for profit and for-profit business incubators (Temali & Campbell, 1984). However, Jørgensen (2014) distinguishes between publicly funded and university-based business incubators. Publicly funded incubators are developed principally to serve as engines for job creation, economic growth, social cohesion, the full capacity development of dilapidated and unused buildings and empowering local communities. To the contrary, university-based business incubators are premised on the ultimate commercialisation of inventions and innovations from academics, students, innovators and technology champions within the university ecosystem. However, these classifications are only instrumental as they stretch on a continuum – as university-based incubators may also contribute to employment generation and social transformation despite being anchored in technological breakthroughs and knowledge spillovers. Similarly, commercialisation of inventions and innovations may not be uncommon to publicly funded incubators even though that is not their prime mandate. While Lalkaka and Shaffer (1999) submit that "public-private partnerships" pervade incubation programmes worldwide as government bodies render initial (and subsequent) financial support, some literature confirms the dominance of publicly funded incubators (Maier, 2015; Tshikwathamba, 2017).

However, some incubation models such as mixed-purpose general incubators are hybrids of public and private dimensions of business incubation. The main function of such incubators is to advance regional economic and industrial growth by supporting business development. They support both knowledge-intensive and low technology-intensive firms in services and light manufacturing with expanding access to local or regional markets in terms of technical, managerial, marketing and financial acumen (Mian, 2014).

2.4.2. Goal-driven variations

Other classifications of business incubators have put emphasis on foci as is the case with the Continental European and Anglo-Saxon models. The former model constitutes publicly funded arrangements which are geared at steering regional development and innovations while the latter model is premised on incubating science-based ventures that collaborate with research-based institutions as is predominantly the case in the United Kingdom and United States (Theierstein & Wilhelm, 2001). One could argue that it is the prominent tapestry and features pervading the system that conjure a given identity than it is about binaries between classifications. For instance, the publicly funded (e.g., the Small Enterprise Development Agency-funded in South Africa) incubators are geared at advancing a constellation of economic, social and political and developmental imperatives that span the two models.

2.4.3. Contesting philosophies and intentions

The more popular contours of classification converge on the stakeholders served, the objectives sought, and the complexity of infrastructure provided (Theierstein & Wilhelm, 2001; Aernoudt, 2004; Jørgensen, 2014). Aernoudt (2004) presents a convincing narrative of business incubators covering diverse philosophies, goals and stakeholders. Bøllingtoft and Ulhøi (2005) categorised incubators into those that concentrate on real estate development, those which are into business development and those which are a collaboration of the first two. Real estate incubators are classified into for-profit property development incubators and those which are non-profit development corporation incubators. Incubators focused on business development are mainly for-profit seed-capital specimens while academic incubators are on the continuum between collaboration-based and seed capital incubators. Incubators which focus on collaboration tend to emphasise developing collaborative and symbiotic potential of firms, developing their networks and firm-to-firm collaborations (Bøllingtoft & Ulhøi, 2005). The illustrations for these explanations are provided in Table 2.1.

Table 2.1: The BI continuum

Value added through				
◄				►
Real Estate		**Collaboration**		**Business development**
For-profit property development incubators	Non-profit development corporation incubators	For-profit collaborative incubators	Academic incubators	For-profit seed-capital incubators
Real estate appreciation	Job creation and enhancing of the entrepreneurial climate	Capitalize collaborative and symbiotic potentials	Commercialization of university research	Capitalize investment opportunity
Sell proprietary services to tenants	Regional/area development	Network development and nurture	Capitalize investment opportunity	Secure availability to risk capital
No interorg. collaboration	Interorg. Collaboration (multi stakeholder collaboration)	Firm-firm collaboration	University-industry collaboration	No interorg. collaboration

(Source: Bøllingtoft & Ulhøi, 2005:268 – Adapted from Allen & McCluskey, 1990)

While Bøllingtoft and Ulhøi's (2005) classification is useful to the extent that it provides layers of the business incubator, innovation centre, science park and technology park dichotomies, the framework is less useful in view of current developments where accelerators tend to combine multiple roles across the continuum and incubators equally play different roles from promoting employment creation, firm-industry collaboration and generating business networking-roles that interface real estate, collaboration and business development dichotomies.

As incubators proliferate, they are now organised around multiple dimensions, further blurring their typologies. Drawing on extensive literature on business incubators, Hausberg and Korreck (2020) categorise these dimensions into support strategy, business strategy, incubatee focus, institutional mission, partner/sponsor's focus and multi-dimensional – each variation encapsulating different types of business incubators. These dimensions are captured in Table 2.2.

Table 2.2: Business incubation types and dimensions

References	Types									Dimension
van Weele et al. (2016), Bergek and Norman (2008)	strong intervention incubator	laissez-faire incubator								support strategy
Brooks (1986)	property development (single-/multi-tenant) incubator	business assistance (shared space, services) incubator								
Bruneel et al. (2012), Aerts et al. (2007)	real estate (1st generation)	intangible assets (2nd generation)	network (3rd generation)							
Vanderstraeten and Matthyssens (2012)	generalist incubator	specialist incubator								business strategy
Etzkowitz et al. (2005)	mixed incubator	technology incubator	cooperative incubator	traditional incubator						
Peters et al. (2004)	non-profit incubator	university incubator	for-profit incubator							incubatee focus
NBIA, Lewis (2001)	mixed-used incubator	technology incubator	incubatee focus incubator	manufacturing incubator	empowerment incubator	targeted incubator				
Plosila and Allen (1985)	spin-off	start-up								
Sherman (1999)	mixed-use incubator	manufacturing incubator	product development incubator							
Aernoudt (2004)	mixed Incubator	technology incubator	econ. develop. Incubator	social incubator	basic research Incubator					institutional mission
Hackett and Dilts (2004), Allen and McCluskey (1990), Bollingtoft and Ulhoi (2005)	for-profit property development incubator	non-profit development corporation incubator	for-profit collaborative incubator	academic incubator	for-profit seed capital incubator					
von Zedtwitz (2003), von Zedtwitz and Grimaldi (2006)	university incubator	regional business incubator	virtual incubator	independent commercial incubator	company-internal incubator					sponsor/ partner focus
Etzkowitz (2001)	network incubator	university incubator								
Grimaldi and Grandi (2005)	business innovation center	regional public incubator	university business incubator	independent private incubator						
Kuratko and LaFollette (1987), Udell (1990)	publicly sponsored incubator	privately sponsored incubator	university-related incubator	nonprofit-sponsored incubator						
European Commission (2002)	industrial estate	managed workshop	multi-purpose BI	business park	ent. Center	BIC	science park	innovation center	tech. center	multi-dimensional

(Source: Hausberg & Korreck, 2018:12).

It is clear from Hausberg and Korreck's (2018) classification that the different philosophies sought (e.g., whether interventionist approach or laissez faire approach), the extent and type of resource provision, distinguishing characteristics or niche areas and activities of the incubator, the socio-economic contribution of the incubator and the identity of the main sponsor serve as key defining features of each dimension of incubators (see Table 2.2). Nevertheless, these classifications are complementary and not necessarily exclusive given the multidimensional character and features of most incubators that evolve with increased resource provision, the diversity of their clientele base and the developmental imperatives they are designed to fulfil. The mode of sponsorship, depending on whether they are publicly, privately sponsored or run through public-private partnerships, is also a key distinguishing feature in determining the philosophies sought and the activities pursued by incubators.

Research conducted by JPMorgan Chase and Company (2016) reports that the primary mission of high-tech incubators and accelerators is a useful principle for differentiating three models of incubators: sector, demographic and place. The JP report highlights that to the extent that high-tech incubators and accelerators are designed to blossom business in particular industries or sectors, they are sector specific.

From a demographic perspective, incubators and accelerators such as those in America have targeted businesses incubatees of previously disadvantaged groups such as women, minorities, or veterans. Lastly, place-based incubators and accelerators focus on business development in specific neighborhoods to promote local economic and community development (JPMorgan Chase & Co, 2016).

2.5. TECHNOLOGY BUSINESS INCUBATION: GRAPPLING WITH AN ELUSIVE CONCEPTUAL DEFINITION

Having provided a working definition of business incubation, it is logical to present technology business incubation (TBI) as a unique variant. Just like its parent, business incubation, TBI is plagued by conceptual clutter owing to multiple interpretations of this construct (United Nations Industrial Development Organisation (UNIDO), 1999; Phillips, 2002; Adelowo, Olaopa & Siyanbola, 2012; Somsuk, Wonglimpiyarat & Laosirihongthong, 2012; Jørgensen, 2014; Mian et al., 2016). For instance, UNIDO (1999:2) highlights that TBIs represent "special type of business incubator specialising in new technology-based companies [whose mission is] is to facilitate the commercialisation of research results as well as the acquisition and use of state-of-the-art technologies." The mandate of TBI is not necessarily to create job opportunities (even though that could be a spillover effect) but rather to steer domestic exploitation of resources and scale up the competitiveness of domestic industries on the international market (UNIDO, 1999). As such, the main intent of TBI is the diffusion and transfer of technology across regions and not necessarily creating new job opportunities.

Smilor and Gill (1986) contend that TBIs present the possibility of infusing and integrating technology, know-how, entrepreneurial talent, and capital. Adelowo et al. (2012) highlight that TBIs concentrate on fostering technology-intensive enterprises and knowledge-based ventures. It can be inferred that, ideally, TBIs present conducive environments through which technology-enabled innovation and creativity is unleashed, a congenial climate for resource mobilisation and assimilation of knowledge, as well as a platform for the flourishing of entrepreneurial, business management and development spirit. Precisely, TBIs constitute a distinct and dynamic amalgam of organised enterprise development processes that enable the development of fledgling businesses by fostering munificent environments for their survival and sustained growth (Lamine et al., 2018). To the extent that they allow knowledge spillovers, exchange of equipment, sharing of functional spaces, provision of technical and managerial support and unique capabilities, they serve as buffers that protect nascent ventures from established corporate rival competition. Mian et al. (2016) renders a more comprehensive definition of TBI as property-based initiatives providing their tenants with a "diverse mixture of value-added services encompassing infrastructure, business support services, networking opportunities, access to professional services, capital, and university resources as part of TBIs' value proposition". This definition captures physical structure, value proposition and service provision components at its core, making it appropriate for this study.

Jørgensen (2014) adopts a functional definition of TBIs as those institutional arrangements that foster and support innovative startups (created by research groups or university students) and focus on high technological products, services and solutions. At the core of TBI, therefore, is not just the fostering of entrepreneurial culture and spirit and thereby increasing the depth of innovation but also the commercialisation of technological breakthroughs.

2.6. TBI AND TECHNOLOGY PARK'S BLURRED DISTINCTION

Originally, in entrepreneurial literature there was convergence on the distinction between TBI and technology parks (OECD, 1997; UNIDO, 1999; Adelowo, et al., 2012). The Organisation for Economic Cooperation and Development (1997) provides an illustrative distinction between TBI, innovation centre, technology park and science park.

Though useful in distinguishing TBI from other incubation arrangements, the OECD's (1997) definition fails to clarify what an incubator is and to appreciate that although academics remain main agents in TBI processes, TBIs have increasingly transcended academics through inviting students, non-academics and tenants from outside the university to incubate ventures with TBI. At the core of a science park is the fact that this institutional arrangement is a brainchild of sponsors outside a university even though a university can be the strongest partner. Moreover, a science park resides outside a university and what differentiates it from innovation centres is that the goals of innovation centres may transcend the development of firms to include regional economic development and economic cooperation.

While innovation centres and technology centres could be interpreted as larger than science parks in terms of their economic jurisdiction, the distinctions between these arrangements are increasingly blurred by the multiple interfaces and complementarities. For instance, Adelowo et al. (2012) admit that although technology parks (TP), research parks, science parks and TBIs often exist and operate in the same innovation ecosystem, they often operate as distinct and independent entities. UNIDO (1999:3) conceives technology parks as a "property-based initiative rendering startup ventures with high quality premises near a knowledge base (university or a complex of research institutions)".

Table 2.3: Definition of key terms in the business incubation family

Concept	Synthesised definition adapted from literature	Source
TBIs	TBIs describe incubators operating in specific industrial clusters and technologies (e.g., biotechnology, software, or ICTs) geared at technology transfer and diffusion, promoting entrepreneurship among researchers and academics and the advancement of technology-based firms by locating at or near universities and technology parks.	(OECD, 1997)
Innovation Centre	Like knowledge-based incubators, an innovation centre is an infrastructure-based venture that supports the development and growth of firms through regional innovation development, researcher-industry cooperation, provision of managerial, technical training and information that strengthen regional economic development through local and international affinities for enhancing cooperation between ventures.	Federal German Association of Innovation, Technology and Business Incubation Centres (BVIZ), 2010
Science or Research Park	A research park is a combination of activities in a limited geographic area in proximity to a university where entrepreneurs, academics and researchers combine high value-added research, industry and capital to transfer managerial and technical skills to tenant firms. Facility or area that supports and promotes technological development, through research and attracting technology-based companies. The purpose is to facilitate innovation and knowledge-based economies.	OECD 1997 United Nations Economic and Social Commission for Asia and the Pacific (2019)
Technology parks	Larger than science parks, a technology park or *technopolis,* is a larger geographical area that integrates the economic activities of universities, research centres, industrial and tertiary units, which realise their activities based on research and technological development.	OECD, 1997

In most cases, these new startups are creations of researchers and academics spurred by commercialising their inventions. Usually, but not exclusively, the businesses that ultimately locates TPs graduated from and had outgrown TBIs. Nevertheless, the complementarities of TBIs and TPs lie in that:

- Knowledge exchange and transfer persist between tenants and the TBIs or the TP.
- Tenants often draw on unique expertise, knowledge and networks which are either unavailable or inaccessible without the TBIs or TP.

- Tenants are in proximity to the TBI or within the innovation ecosystem of the TP.
- Tenants may share resources and equipment with their parent institution (TBI or TP).

Moreover, UNIDO (1999) acknowledges the similar evaluation criteria for TBIs and TPs, their mechanisms of monitoring maturation, post maturation and success of tenants, proximity to national and international networks for tenants and tenants' proximity to their parent institution (TBI or TP). However, Adelowo et al. (2012) have employed the terms science parks, research parks, technology parks, technology incubators (TIs), technology innovation centres (TICs) and TBIs interchangeably depending on the type and level of engagements of the research and development community, funding models applied and the industry in which tenants operate.

2.7. HISTORICAL EVOLUTION OF TBIs

The complex history of TBIs emerges partly from the lack of uniformity in the definition, the diversity of sectors and industries they have spanned and the semantic differences in terminology employed in applying them. The pioneer incubator was established in the Stanford Research Park in California in 1951 (Mian, Lamine & Fayolle, 2016). This was followed by another established in Batavia, New York in 1956, as a panacea to the rising unemployment levels precipitated by the closure of Massey-Ferguson, the biggest industrial company in the city (NBIA, 2012a). When the large building was abandoned and renting out the property to one company faltered, the building was partitioned and rented out to multiple companies that shared office services, were assisted with raising capital and given business advice (NBIA, 2012b). The idea of the Batavia Industrial Centre subsequently morphed into one of the oldest incubators worldwide which remains in operation to the present (Anselmo, 2009).

While there were only 12 incubators nationally in the United States in the 1980s, recent research (Kemp 2013; Tang, Baskaran, Pancholi & Lu, 2013; Xiao and North, 2018) draws on earlier literature to articulate some of the most significant developments that steered the exponential growth of incubators namely:

- The establishment of the National Science Foundation's Innovation Centres, whose heartbeat was the metamorphosis of incubation programmes (Bhabra-Remedios & Cornelius, 2003).

- The development of Pennsylvania's Ben Franklin Partnership Programme, which had a comprehensive technology and manufacturing agenda and business incubation as its integral component in 1982 (NBIA, 2012a).

- The roll out of other incubation programmes in the United States (US) with the Partnership Programme as a role model for benchmarking (NBIA, 2012a).

- Ripple effects felt with the creation of incubator models in the United Kingdom (UK) and Europe in the 1980s (Centre for Strategy and Evaluation Services [CSES], 2002) and the expansion of China's incubation programme, which was catalysed by the United Nations Development Programme in 1987 (CSES, 2002) leading to the growth of incubators in that region.

- Within the European Union region, the European Business Innovation Network (EBN) was established in 1984. By the mid-1990s, The Network had developed over 120 Business Innovation Centres (BICs) in Europe and offered incubation support to many technology-based firms (OECD, 1997).

- The first Chinese TBI, Wuhan Donghu Pioneers Centre (WDPC), was founded in 1987. It was established on the Eastlake new technology development zone, close to Wuhan University which specialised in science and engineering in the Central region (Xiao & North, 2018). The success of this model was replicated in the entire Eastern region, triggering the formation of 80 incubators housing 2 670 firms with 45 600 employees in 1997 (China Torch Statistics Yearbook, 2000). Nationally, TBIs increased from 228 in 2009 to 378 TBI in 2012 and incubatees surged from 27 920 in 2009 to 39 635 in 2012 in China (Xiao & North, 2018).

- The launch of the first TBI programme by the National Science & Technology Entrepreneurship Development Board (NSTEDB) under the custody of the Department of Science and Technology (DST) in the 2000s in India. Subsequently, 18 Software Technology Parks (STPs) were launched by the Department of Electronics and 15 Science and Technology Entrepreneurs Parks (STEPs) have been spearheading TBI initiatives in India (Tang et al., 2013). In 2009, there were 120 TBIs in India, 40 of which were established in the Software Technology Parks (STPs), promoted by the Ministry of Information and Communications Technology (Gupta, 2010; Tang et al., 2013).

The key messages from the foresaid narrative are the strong infrastructure and economic development focus of TBIs, the use of successful examples for rolling out and benchmarking successive incubators and the strong public, financial and technical support for pioneering TBIs.

2.8. GENERATIONS OF TBI

Although hard to clearly mark by year due to the multiple co-evolving activities, there is general convergence of opinion that three main generations of TBI are discernible from mainstream incubation literature. These generations of incubation (or waves as they are popularly called) are First Wave, Second Wave and Third Wave and these are discussed next.

2.8.1. First wave of TBI

While the meaning, model and nomenclature of TBI are generally contested, what is clearly discernable are the generational cycles with the first wave concentrating on the conversion of physical infrastructure such as abandoned dilapidated buildings, factories and industries into rented and shared spaces for supporting nascent businesses to roll back the frontiers of unemployment (Kemp, 2013). It is not accidental that the earlier economic benefits of TBI concentrated on physical infrastructure provisions such as building, shared office spaces, rent breaks ahead of business assistance, capital and network provisions (Allen & Rehman 1985; Smilor, 1987; Hisrich & Smilor 1988). The First Wave, therefore, was predominantly focused on providing basic services: public utilities (water, electricity, communication, and transport), offices, library, reception, photocopies and security to incubatees (Tang et al., 2013).

The central focus of the first wave of TBI unmistakably remains the provision of hard, physical infrastructure fundamental to new ventures' overcoming market failure and the availing of "reactive business support" (Information for Development Programme [infoDev]/The World Bank, 2014a:4). As such, at the core of this genesis wave was conversion and leveraging of old abandoned buildings, factories, and premises into productive spaces for sheltering and nurturing nascent businesses. Therefore, TBI targeting manufacturing businesses may need greater floor space than those facilitating service-based firms, and they also need specialised equipment such as fabrication and industrial space rather than office space (Kemp, 2013; Mian et al., 2016).

2.8.2. Second wave of TBI

While the first generation of TBI was generally geared at the individual entrepreneur, the second phase was technology-led with specific focus on providing pro-active support to mixed-use and sector-specific TBIs (InfoDev]/The World Bank, 2014a). To increase the capacity of incubatees investing in research and development-driven innovation or incremental innovation founded on the appropriation of existing technologies (Mian, 1996; Fritsch & Slavtchev 2011; Barbero et al., 2014), TBIs generally rendered support in four areas namely, technical, financial, entrepreneurial and professional services (Xiao & North, 2018). These key support areas are elaborated in subsequent sections.

2.8.2.1. Technical service support

Technical service support encapsulates shared laboratories, equipment, including research facilities a TBI renders to tenants to increase their access to affordable technical and scientific resources (Xiao & North, 2018). Normally, the broad range of such technical services is beyond the financial and technical capacity of an individual nascent tenant to provide. Such technical support is credited with capacitating Indian TBIs to foster technology-based new enterprises; creating value-added jobs and services, enabling technology transfer and facilitating the commercialisation of research and development (R&D) output (Tang et al., 2013).

2.8.2.2. Financial service support

One of the determinants of incubatee success is the size of financial investment in R&D necessary for the development of innovative products and processes (Colombo et al., 2010; Perez-Luno, Wilklund & Cabrera, 2011). The financial performance of the incubatee is often tied to the volume of funding availed by the TBI in the form of grants, loans or equity funding, levies for their utilisation of external research facilities or intellectual property (IP) applications (Xiao & North, 2018). Although financial capital from the TBI constitutes monetary resources integral to the fulfillment of organisational operations (Barney, 1997) of incubatees, these startups are also dependent on other external financial support for their product and technology development, including the creation of their organisations (MacMillan et al., 1987; Bhave, 1994; Van Stijn, van Rijnsoever, & van Veelen, 2017). The provision of financial capital to incubatees is particularly relevant to emerging economies such as South Africa with less sophisticated and illiquid capital markets and where retail banks with restrictive lending requirements remain significant constraints for incubatees.

2.8.2.3. Entrepreneurial service support

For Xiao & North (2018), TBIs tend to provide entrepreneurial assistance services to entrepreneurs who have technological expertise but often lack the experience. However, the irony is that the TBIs' management team may also be deficient in financial and managerial skills critical to successfully direct the TBI's operations (Grimaldi & Grandi 2005; Lose & Tengeh, 2015). The incapacity of TBI to deliver is partly attributed to managerial control that is not derived from an entrepreneurial background of the TBI management team, and this contributes to sup-optimal support to incubatees (Lalkaka, 2002). One could also contend that where confidence and trust deficits persist between the TBI and incubatees regarding the entrepreneurial skills and business networks of TBI, the incubator's entrepreneurial support tends to falter. The overall argument here is that university-based TBI are integral to fostering of new technology-based firms that drive entrepreneurship, serve as the main vehicles for the commercialisation of innovative ideas and render a “training ground” for entrepreneurs (OECD, 1997; Mian et al., 2016).

2.8.2.4. Professional service support

TBIs are hailed for providing diverse professional services to tenants. These services include advice on licensing, legal protection, patent searching and networking with multiple stakeholders (Xiao & North, 2018). These specialised consultancy services also include accounting, law, intellectual property rights, equity and technology transaction (Tang et al., 2013). Engagement in professional training of incubatees often covers improving their capacity to innovate and commercialise inventions. For instance, with reference to Swedish firms, literature established a positive correlation between these firms’ innovativeness and their proximity to university researchers where firms’ research groups are located (Andersson & Ejermo, 2005). Moreover, the innovativeness of a firm and the size of the firm’s R&D staff are also significant considerations in the performance of incubatees (Andersson & Ejermo, 2005; Širec & Močnik, 2018).

2.8.3. Third wave of TBI

The third wave of TBIs concentrates on providing seed finance and the dominant players are early-stage seed accelerators (InfoDev/The World Bank, 2014a). These forms of seed funding range from venture capital, bank loans, equity, regional/national innovation funds, grants and other funding arrangements (Tang et al., 2013). Apart from increasing access to venture capitalists, TBIs may serve as the main platform for creating business networks and broadening the social networks vital for increasing incubatees’ funding opportunities. Without establishing a strong funding base, the organisation development (i.e., development of the physical infrastructure), technology (i.e., R&D in the laboratories) and product development (the creation of tangible products and services), and market development (e.g., market research) (Gartner & Vesper 1994; Gaglio & Katz 2001; Van Stijn et al., 2017) stages of the business are inconceivable.

Despite the clear delineation of these stages, in practical terms, an individual TBI may offer varying and diverse services located in all three waves depending on the mission for its creation, years of its existence, the financial model guiding it and the combination of sponsors that have a direct bearing on institutional provisions.

2.9. DIMENSIONS OF TECHNOLOGY BUSINESS INCUBATION

Although there are many dimensions of business incubation such as the business incubators' philosophy (its value systems, assumptions, vision and missions), business model and resource generation models, those most relevant to TBI relate to the selection criteria (selection strategies, approaches and models) of tenants (Hackett & Dilts, 2004; Bergek & Norrman, 2008; Jorgenson, 2014), intellectual property and patenting issues (Mian, 1996; CUT Intellectual Property Policy, 2020), technical and technological competencies of incubation managers (Vohora et al., 2004; Van Stijn et al., 2018), and incubation norms and procedures (CSES, 2002; Tang, Baskaran, Pancholi & Muchie, 2011). For the sake of developing a coherent structure, each of these TBI processes is discussed in subsequent sections.

2.9.1. Incubation selection criteria

Since TBI often starts with the conception of a unique idea, the development of appropriate selection criteria for incubatees with ideas amenable to commercialisation is often considered a fundamental stage in the TBI process (Vohora et al., 2004; Hannon, 2004). Before prospective incubatees are selected to participate in the TBI programmes, they must meet the criteria as defined by TBI standards and requirements. Selection, therefore, entails decisions concerning which ventures to accept for incubation and which to reject. Such criteria can be based on quality of the business concept and the traits of the entrepreneur (Bergek & Norrman, 2008). Selection is an important managerial task involving critical resource allocation (Lumpkin & Ireland, 1988) as it requires sufficient knowledge of the market for the product to be commercialised, incubation models relevant to this specific business and incubatee needs in defined contexts. The strong managerial experience in venture creation guides the incubator manager in identifying weak but promising incubatees and excluding those unsuitable for business incubation (Hackett & Dilts, 2004). While the selection of weak and promising incubatees requires shielding them from unfavourable market conditions (Maital, Ravid, Seshadri & Dumanis, 2008), this approach may be limited by selection bias. Therefore, incubators must employ comprehensive screening and selection criteria to identify successful incubatees and entrepreneurs (Jorgenson, 2014).

2.9.2. Intellectual property and patenting

After the selection criteria issues are concluded, the decision to proceed with the TBI process for TB tenants may involve the determination of and filing for the intellectual property (IP) and patents. This process is designed to protect the idea from market rivals. The CUT Intellectual Property Policy (2020:3) defines IP as "any creation of the mind that is capable of being protected against unauthorised use by any other person, whether in terms of South African law, or foreign Intellectual Property Law, and includes any rights in such creation." To the extent that patents, copyrights, trademarks, and other intellectual and artistic works are intellectual goods and products, they are all components of IP. Therefore, IP are goods, information and intangible creations that are products of human intellect such as scientific or nonscientific discoveries and inventions; artistic works such as music and writings, developed words, symbols, and phrases (Copyrighted.com, 2018).

A patent is a monopoly or an exclusive registered right for a specific period (typically 20 years subject to the payment of prescribed renewal fees) in exchange for a full disclosure of the invention to the public (CUT Intellectual Property Policy, 2020). Patents denote intellectual property rights granted to inventions such as industrial processes, machines, chemical compositions, and manufactured commodities and artifacts (Copyrighted.com, 2018). Patents are only granted to specialised technical, industrial and manufactured goods of promising economic and monetary value in exchange for their disclosure for the benefit of the public.

The broad field of intellectual property management covers patent registration, copyrights, trademarks, technology licensing, technology transfer and commercialisation (Mian, 1996; OCED, 2015a). It is critical to acknowledge that registration of trademarks, filing of patents and registration of copy rights/intellectual property, though critical for high-technology oriented businesses (such as those in additive manufacturing, dental instrument development, application development), may not be required of all technological businesses. Nonetheless, apart from strategic vision and control over academic resources, one of the virtues of entrepreneurial universities is their capacity to build intellectual property from their research, and their capacity to transfer technology through patenting, licensing and incubation (Etzkowitz, 2002; Rizzi, Wescinski, Poli & Jacoski, 2017). TBI can also play a critical role in IP development and protection. ParqTec, a technology incubator in Brazil, has been instrumental in incubatees' incorporation, patent application, trademark registration and proposal writing. Its tenants specialise in opto-electronic products, digital sound, processing technology, industrial process controllers, time delay switches for safety and energy conservation, software applications, microterminals for automation and test equipment for automatic braking systems (Lalkaka & Shaffer, 1999).

2.9.3. Incubator manager competence

Apart from the variables already discussed, the competence of the incubation manager is another important dimension of TBI in the generation of effective TBI processes and incubation outcomes. Competencies are defined as "observable and applied knowledge, skills, and behaviour that create a competitive advantage for an organisation" (Jauhari, 2006: 123). As such, competences can be observed and measured at the individual entrepreneur, inter-personal or at organisational level. They comprise knowledge, skills, abilities, dispositions and behaviours that enable the TBI manager and entrepreneurs to fulfil their responsibilities of ensuring high incubation performance for incubatees. For Fejfarová and

Urbancová (2015: 111), managerial competencies denote “specific knowledge, abilities, skills, traits, motives, attitudes and values necessary to improve management performance”. For this study, the consequence of effective application of managerial competencies is not necessarily organisational performance per se but specific incubation outcomes, especially technology entrepreneurship. The next section discusses entrepreneurial knowledge types, as the search for knowledge is often cited as the main reason for incubatees’ decision to join incubators (Cohen & Levinthal 1990; Von Hippel, 2007; Van Stijn et al., 2018).

2.9.3.1. Types of entrepreneurial knowledge

Van Stijn et al. (2018) highlight the three types of knowledge required of new entrepreneurs operating new technology-based firms (NTBFs) namely business knowledge, technical/scientific knowledge and market knowledge. Business knowledge comprises information and experience deemed fundamental to the effective operation of a business venture (Vohora et al., 2004). This business knowledge is fundamental to the identification of opportunities, development of business concepts, creation of the venture, marketing of the products and soliciting customer feedback (Chan & Lau 2005; Van Stijn et al., 2018). Therefore, business knowledge is essential to the life cycle of the venture from its conception, testing of ideas, creation of organisational structures to guaranteeing its growth.

Technical or scientific knowledge entails information and experience with a specific technology and could be a consequence of engagement in academic research (Rosenberg & Nelson 1994). For NTBFs, such knowledge is instrumental in effective product design (Rosenberg, 1994), optimal deployment of technology’s potential and the interpretation of new information (Cohen & Levinthal 1990; Van Stijn et al., 2018) to generate new products, designs and services.

Market knowledge involves information and experience needed for the organisation to make accurate forecasts of commercialisation opportunities in the market and for taking strategic action (Cohen & Levinthal, 1990). Such knowledge relates to customer demands, their preferences, and market dynamics which are essential in product development and marketing strategies of new startups (Shane, 2000; Von Hippel, 2007; Van Stijn et al., 2018).

2.9.4. Incubation norms and procedures

The last components of TBI processes are incubation norms and procedures. Norms describe “standard practices that guide experts to perform correctly in their area of specialty” (Leddo & Abelson 1986: 107). Therefore, an incubation norm describes the standard procedure that incubation managers adopt in executing incubation activities, models, procedures and processes. Incubation procedures imply the systematic sequences taken in fulfilment of the said incubation activities. Although there is a diverse range of critical factors required for the success of TBIs, Mian (1997) considers programme goals, structure and governance, financing and capitalisation strategies, target markets, entry and exit policies, tenant performance review policy, equity and royalty policy and intellectual property as norms and practices critical to incubation. However, the significance of these critical success factors may vary widely depending on region and the stage of the incubation process. For instance, entrepreneur training and virtual networking have been reported as fundamental among European TBIs while venture financing and managerial functions have been considered integral to successful incubation performance of US TBIs (CSES, 2002; Tang, Baskaran, Pancholi & Muchie, 2011). Similarly, for new startups, the development of intellectual property may be more critical at the development stages of new ventures than at their level of conception because patent and licensing would be more critical at creating competitive advantage and credibility for well-developed ventures than for new startups in their conception stages. Therefore, a systematic and integrated framework for understanding the various factors fundamental to TBI outcomes necessitates an appreciation of the diverse factors at the heart of the incubation process.

Although incubation norms and procedures remain hotly contested, the broad norms and procedures which are cited in literature are incubation selection criteria, support types provided, organisational structures, marketing strategy, innovation capacity and entrepreneurial capacity and decision making (Soentano, 2004). Since the diversity of these factors demonstrates that no one factor may singly account for the success of NTBFs, the current study examines the incubation selection criteria as the main incubation procedure as it is widely discussed in literature (Solomon & Lind, 2016; Wachira, Ngugi & Otieno, 2017; Bakkali, Messeghem, Sammut & Swalhi, 2021).

2.10. PERSPECTIVES ON TECHNOLOGY BUSINESS INCUBATION

Although there is a wide range of perspectives that resonate with the creation of technology businesses, those most relevant to TBI include the individual traits, social networking, social capital, and business ecosystem perspectives, which are discussed in subsequent sections of this study. These are elaborated on in the sections below.

2.10.1. Individual traits perspective

The individual trait-based perspective is founded on David McClelland’s psychological work (McClelland, 1961; Karabulut, 2016), especially individuals’ need for achievement. As such, entrepreneurs distinguish themselves from non-entrepreneurs through their motivation to achieve, locus of control (self-efficacy), innovativeness and risk-taking attributes (Frese, 2009; Karabulut, 2016) in entrepreneurial pursuits. The entrepreneurial traits perspective predominantly addresses two complex questions on whether entrepreneurs are made or born and why some people become entrepreneurs while others do not (Shane & Venkataraman, 2000). The argument is that through an understanding of the psychological orientation of entrepreneurs, researchers make entrepreneurial thinking an integral component of leveraging the quality and quantity of entrepreneurs (Tran & Von Korflesch, 2016). Entrepreneurial action is associated with capacity to exploit and harness market opportunities through technical and/or organisational innovation (Schumpeter, 1965); taking bold risks (Drucker, 1985), taking initiative and engagement in creative thinking (Hisrich; 1990) and the capacity to mobilise resources to generate value embedded in perceived opportunities (Bolton & Thompson, 2004; Tran & Von Korflesch, 2016). As such, technology business incubators are instrumental in enhancing entrepreneurs' cognitive capabilities to identify, mobilise and implement business opportunities as well as assisting them in exploiting risks and innovations.

The psychology of entrepreneurship is captured in the compendium of personalities entrepreneurs must exhibit and apply coherently in business environments. These include risk propensity, locus of control, innovativeness, autonomy (Rauch & Frese 2007), stress tolerance, neuroticism; openness to experience, agreeableness and extraversion (i.e., Big five personality dimensions) (Zhao & Seibert, 2006; Zhao et al., 2010). The central theme in these studies is that entrepreneurs who exhibit these proactive personality traits tend to have a stronger inclination to succeed in business creation and the performance of their ventures than those who lack them. The caveat, however, is the need to appreciate the importance of aligning these personalities with the task characteristics of entrepreneurship (Frese & Gielnik, 2014) which facilitate the realisation of business operations. This study explores entrepreneurial cognitions such as intuition, heuristics, scripts and perceived entrepreneurial cognitions, qualities that are often researched in relation to venture creation and the entrepreneurial process (Mitchell et al., 2000; Urban 2015). We assume that the decision to be affiliated and remain in an incubator, including the identification of entrepreneurship opportunities, is attributable to the entrepreneurs' possession of such traits.

2.10.2. Social network perspective

The social network perspective fuses ideas extracted from structuralist network tradition (Wellman & Berkowitz 1988; Kenis & Oerlemans, 2007), embeddedness (Granovetter, 1985) and social capital perspectives (Burt, 2005). The argument is that interactions between actors embedded in specific contexts are more critical than the individual traits of these individual actors (Kenis & Oerlemans, 2007). This social networking perspective conceives a social network as collectivities of individuals or organisations tied together by social relationships, steered by friendship, professional relations, exchange of resources and information (Garton et al., 1997). The university TBI and incubatee relationship constitutes a social morphology where a network of service encounters is experienced and internalised by both parties. While social networks are characterised by strong (i.e., bonding ties based on family and kinship connections) and weak ties (relations based on bridging connections), the strength of ties (i.e., the degree of intimacy with which a person engages with individuals) is a function of time invested in relationships, intensity of emotions, mutual confidence, and reciprocity of services (Granovetter, 1973; Simpeh, 2011). It is postulated that individuals situated in weak ties are more inclined to access novel information compared to those in networks characterised by strong ties (Granovetter, 1973; Bøllingtoft & Ulhøi, 2005). Since most university business incubators are publicly owned/sponsored and operated in constrained financial markets, literature (Mian, 1997; Chandra & Silva, 2012) suggests that incubatees tend to draw on multiple weak ties with diverse actors to access financial, human and social capital. Therefore, dynamic and fluid interactions between university TBI, incubatees and partners are credited with rendering diverse contact points that foster weak (and sometimes strong) ties (Granovetter, 1973) which are integral to accessing and diffusion of new innovative ideas, transfer of knowledge and learning within and across networks (Rangan, 2000; Chandra & Silva, 2012).

From an organisational studies perspective, the social network perspective entails grasping the contribution of individual actors in groups to resource generation and the complexities of their collective activities and processes (Bastos & Santos, 2007), especially the intensity and frequency of contacts, information flows and how experiences are exchanged (Miranda & Borges, 2019). In the TBI ecosystem, the constellation of actors (i.e., TBI, tenants, the technology transfer officers, the technology demonstration centres, government sponsors and other public agencies) are directly mandated to share knowledge, expertise, resources and capabilities with each other. Such individual and group level analysis permits an examination of how incubator networks generate economic and social value by generating institutionalised values, processes and structures for exchanging knowledge and resources, which are integral to the survival of TB firms (Hansen et al., 2000; Chandra & Silva, 2012).

2.10.3. Social capital perspective

The social capital perspective has its intellectual roots in economics, sociology, anthropology and political science literature and is associated with the theoretical works of Émile Durkheim, Georg Simmel, Karl Marx and Max Weber (Claridge, 2004). The perspective resonates with the concepts of civil society and social connectedness (Adam & Roncevic 2003) and is associated with theories such as social exchange theory and psychological contract theory (Watson & Papamarcos, 2002; Claridge, 2004). The social capital perspective links with the social network perspective even though there are some slight variations between them. For instance, while the main thrust of the social networks is on the nature (e.g., bonding and bridging ties), strength (e.g., weak and strong ties), durability (e.g., ephemeral and durable ties) and configuration of networks, the focus of social capital is the resources essential in these networks. For instance, social capital is often construed as those resources embedded in specific social structures, and such resources are perceived to be accessible and driven by purposive actions (Lin, 2001). As such, social capital is constituted by individual and collective social networks, ties and structures which are integral to the individuals' access to prime resources such as information and technical know-how (Bøllingtoft & Ulhøi, 2005). In a university incubation ecosystem, university TBIs, incubatees, academics and researchers, financiers and government regulators share vacant buildings and leased workspaces (i.e., physical spaces), investment opportunities (i.e., economic incentives), risky capital opportunities, technical (e.g. financial, marketing, business management, entrepreneurial) expertise, capabilities and support to ensure that incubatees transition their nascent stages to become fully-fledged businesses. From a social capital perspective, the aim of university-based TBI, therefore, is the transformation of research and development into new technologies, services and products (i.e., resources) (Kemp, 2013) by fostering and advancing entrepreneurial talent, commercialising the entities and generating profits through venture creation (Bøllingtoft & Ulhøi, 2005).

At the heart of social capital perspective is the need to grasp the centrality of individuals in networks drawing on their extent of proximity, degree of contact, and intermediation (Miranda & Borges, 2019). Proximity captures the capacity of individuals to monitor resource flows and to grasp the developments within their networks (Fellman & Wright, 2008). When the proximity of individuals in networks increase, their ability to share resources, information, knowledge, and promote innovative processes intensifies (Miranda & Borges, 2019). The level of trust, reciprocity and social exchange increases as university TBI and incubatees become close to each other and share resources and information among them and their stakeholders. For Johnson (2011), the degree of contact captures the bonds developed by network actors in collaboration with other individuals. To the extent that these bonds could comprise weak and strong ties, it remains unclear which ones produce the most valuable resources. However, strong ties tend to have limited breadth as they are founded on intimate and kinship relationships, while weak ties tend to have wider impact due to their diversity. Lastly, contact intermediation encapsulates how individuals connect to peers within their networks.

2.10.4. Business ecosystem perspective

The business ecosystem is a highly contested term as it evokes aspects of competition vs cooperation inter-dependence vs rivalry and community vs individualism. However, the germane aspects of the concept are attributed to James Moore's 1993 article "Predators and Prey: A New Ecology of Competition" in which he borrows the biological metaphor "ecosystem" from ecology and applies it to a business environment. Moore (1993) conceives a business ecosystem as an economic community supported by interacting organisations and individuals – the organisms of the business world. Conceived from an economic perspective, the ecosystem becomes a rivalry-ridden environment where elements of cooperation and interdependence may co-exist with competition and individualism. As such, the fundamental logic of business ecosystem is unravelling the reciprocal relationships between firms and the surrounding business environment, which shares traits of a biological environment (Kim, 2016). Although all elements of original biological system as envisioned by Moore (1993; 1996) such as interdependence, loosely coupled systems, co-evolution and community (Parisot, 2013) may not manifest in each university-based TBI, these traits seem to be consistent with the developmental and supportive role of TBI in cushioning fledgling incubatees.

With their intellectual roots in wider innovation ecosystems that encapsulate economic, technical and political environments, business ecosystems tend to evolve around new innovations (Rinkinen & Harmaakorpi, 2018). Since TBI and incubates rely on the generation of new knowledge from research and development (e.g., networked collaboration of communities of researchers, academics, technology transfer offices, and research centres and technology parks), innovations are therefore consequences of sharing and transfer of such knowledge drawing on these academic connections, professional affinities and personal networks.

For Moore (1996), the business ecosystem perspective emphasises an economic community rendering products, goods, services and solutions which customers value and for which they are constituent components of that ecosystem. The argument according to this perspective, therefore, is that different stakeholders (suppliers, lead producers, competitors, and regulators) serve as member organisms of a business ecosystem who co-evolve their capabilities and responsibilities, and strategically align themselves with the directions set by one or more central companies (Parisot, 2013). Moore (1996) further argues that while leading companies may transform themselves over time, ecosystem leaders are valued to the extent that they steer members towards shared visions which are aligned to their investments. Within the university incubation environment, ecosystem leaders could include financiers that influence the business case of projects and their envisaged financial trajectory, the government that provide the cohesive and regulative mechanisms that new incubatees comply with and seasoned university researchers who use their research and development expertise to guide the innovation behaviours of incubatees.

Therefore, the business ecosystem transcends the value chain by rendering a dynamic perspective of relations between actors and the roles of indirect actors such as firms from other sectors and industries that render complementary products and services, outsourcing companies, regulatory agencies, financial institutes, research institutes, media, universities and competitors (Moore, 1996; Li, 2009; Yu, Li, & Zhao, 2011; Baghbadorani & Harandi. 2012).

2.11. THEORETICAL UNDERPINNINGS OF INDIVIDUAL PERSPECTIVES ON TECHNOLOGY BUSINESS INCUBATION

Despite the complexity of retaining a theory at a particular level of analysis, for simplicity the theoretical approaches on TBI can be crystallised into individual, institution and system-wide theories. The next sections discuss one individual level theory namely, entrepreneurial cognition theory.

2.11.1. Individual level theory

At the individual level/micro level of analysis, entrepreneurial cognition theory provides a useful understanding of TBI. Here, attention is devoted to psychological dispositions individual entrepreneurs bring to their encounter with technology business incubation and technology entrepreneurship and inter-personal arrangements that facilitate these entrepreneurial endeavours.

2.11.1.1. Entrepreneurial cognition theory

The next section provides a brief outline of the origin of entrepreneurial cognition theory, its theoretical foundations and relevance to the study. It also assesses the merits and demerits of this theory.

2.11.1.1.1. Origin of the theory

In entrepreneurship circles, the foundational work on cognition were laid by Joseph Schumpeter, David McClelland and Israel Kirzner (Frese & Gielnik, 2014). While Schumpeter (1934) emphasised entrepreneurs' adoption and internalisation of risk propensity and pursuit of an innovative mindset to enhance the growth of their firms and transformation of society, from an organisational psychology perspective, McClelland (1967) placed emphasis on the need for achievement as a motivation and a cognitive disposition that drives entrepreneurs to exploit entrepreneurship opportunities. Kirzner's (1979) targeted entrepreneurial alertness (i.e., the ability to recognise opportunities without searching for them) as fundamental to the pursuit of entrepreneurship. In the mid-1990s, entrepreneurial cognition research gained currency with scholarly works on cognitive biases and heuristics in decision-making (Busenitz, 1992), feasibility and desirability perceptions of entrepreneurship (Krueger, 1993), entrepreneurial cognition of entrepreneurs (Mitchell, 1994) and the use of cognition theory to explain risk taking by entrepreneurs (Palich & Bagby, 1995). Baron also (1998) employed cognitive constructs such as counterfactual thinking, attributional style, the planning fallacy and self-justification as useful in explaining the decisions of entrepreneurs.

2.11.1.1.2. Foundation and relevance of the theory

As a variant of the entrepreneurial traits perspective, entrepreneurial cognition adopts a process perspective to entrepreneurship and business incubation. Precisely put, entrepreneurial cognition encapsulates "knowledge structures which entrepreneurs employ in making assessments, judgements or decisions on business opportunity evaluation, venture creation and growth" (Mitchell et al., 2002: 97). At the heart of entrepreneurial cognition are mental models that entrepreneurs bring to evaluate opportunities, mobilise resources and to regulate the cognitive load arising from the complexities and vicissitudes of the business environment. As such, in complex environments characterised by information overload, high uncertainty, strong emotions, time pressure and fatigue can be interpreted as manifestations of bad entrepreneurial cognition (Cacciolatti & Lee, 2015). Given the reality that entrepreneurs make fundamental decisions with imperfect information, the cognitive strategies they formulate concerning entrepreneurial choices and the application of information are fundamental to their entrepreneurial behaviours (Busenitz & Barney, 1997; Zichella, 2017). Therefore, thinking styles and shortcuts such as heuristics, cognitive biases, effectuation, inductive and deductive reasoning, inferences and memory, probability estimation (Mathews, 2008) including prior knowledge, entrepreneurial competencies and intentions exert an impact on entrepreneurs' perceptions of the environment and their orientation to incubate businesses. For instance, those with linear thinking patterns tend to perceive higher environmental state and response uncertainty in business contexts compared to those with a nonlinear style of thinking (Jahanshahi, Brem & Shahabinezhad, 2018).

The entrepreneurial cognition theory has some relevance to technology business incubation, especially the application of cognitive properties to business development. Some positive associations have been established between individuals' cognitive properties and their capacity to identify, mobilise and exploit entrepreneurial opportunities (Mitchell, et al., 2007; Zichella, 2017), even though some variations in the ability to recognise opportunities have been attributed to individuals' fragmented construction of the business world and the variations in heuristics they employ to make sense of this world (Cacciolatti & Lee, 2015). From an entrepreneurial cognition perspective, attention is cast on the entrepreneurial process as a socio-cognitive activity involving the entrepreneur' cognitive orientation, search for business opportunities, assessment and consideration of such opportunities, the pursuit of these opportunities, the incubation and operation of a business and the evaluation of entrepreneurial outcomes (Koh, 1996). Perceived this way, technology incubators are conceived as 'safe havens' where incubatees with diverse mental dispositions are presented with resources and opportunities and their capabilities are honed to recognise, value and pursue entrepreneurial action. This study contends that since incubatees could be incapable of disrupting economic markets in emerging economies in the true Schumpeterian sense (i.e., causing economic disequilibrium through creative destruction) (Schumpeter, 1965) due to the hostility of the market to new entrants, incubators may need to transcend the germination and incubation model to embrace accelerator approaches that could be disruptive of the market. From an entrepreneurial cognition perspective, business incubators must serve as processors of idiosyncratic knowledge and mental models that facilitate and intensify opportunity recognition and optimise the exploration of recognised business opportunities (Shane, 2003; Shane & Venktaraman, 2000; Pokharel, 2018).

2.11.1.1.3. Merits and demerits of the theory

Given the scholarly contestations on how entrepreneurs think and engage in decision making, the entrepreneurial cognition theory provides a window into how entrepreneurs harness simplifying mental models to integrate disparate information in their identification of opportunities and invention of new products or services, as well as collate the critical resources for establishing and expanding their firms (Mitchell et al., 2000). Frese & Gielnik (2014) also affirm that cognition research provides valid explanations on why certain cognitive traits and orientations are associated with business creation, business success and entrepreneurial decision making than others. However, the critique often levelled against the entrepreneurial cognition theory is its over-emphasis on how entrepreneurs think and make decisions distract researchers from other social and environmental factors that interact with opportunities to shape entrepreneurial decision making. Moreover, the theory is critiqued for presenting entrepreneurs as a homogeneous group that think and act differently from non-entrepreneurs (Mitchell et al., 2000) despite the growing evidence disqualifying the trait-based approach.

2.11.2. Institutional level theories

Resource-based view (RBV) theory and institutional theory cast light on resources availed at institutional levels to support business incubation, organisational practices, activities and processes unfolding at the intra and inter-organisational levels, including facilitative and regulatory mechanisms that enable and constrain TBI. These theories and their application in TBI are explained in subsequent sections of this study.

2.11.2.1. Resource-based view (RBV) theory

The next section articulates the origin, theoretical foundation and relevance of the resource-based view theory. The section also assesses the merits and demerits of resource-based view (RBV) theory.

2.11.2.1.1. Brief origin of the theory

Edith Penrose, an American born British economist is widely credited with developing the first foundation of the resource-based view in her book titled "The theory of the growth of the firm." Penrose (1959) contended that organisations comprise a bundle of resources and the ability of firm managers to marshal these resources enables the firm to exploit market opportunities and sustain performance. Although this view was expanded by Robert Grant who asserted resources as the most vital unit of analysis in organisational processes (Grant, 1991), it was Jay Barney who popularised the theory drawing on qualities of resources that make organisations sustain their strategic competitive advantage (Barney, 1991). Barney (1991) explored the relationship between resources and the sustenance of competitive advantage of firms and established the importance of four indicators namely, value, rareness, imitability and sustainability if resources were to generate sustained competitive advantage. Although the focus of analysis has been broadened to include the effects of critical resources on performance, profitability and strategic alliances (Das & Teng, 1998), the resource-competitive advantage link remains the main point of departure for understanding the role of resources in organisations.

Closely linked to resources are capabilities that are largely associated with the works of Nelson and Winter (1982). Conceived as the ability of the firm to perform an activity more effectively than its competitors with otherwise similar resource endowments (Collis, 1994; Winter, 2003), capabilities either have intrinsic value or are increased by augmenting the value of a resource (Taher, 2012). Just like resources, the capabilities that are rare, inimitable and non-substitutable are more strategic (Teece et al., 1997) than those that are not. Despite the lack of precision in definition of resources and capabilities, subtle differences persist. For instance, capabilities are deemed to comprise a higher order than resources and are not easily transferable compared to resources (Eisenhardt & Martin, 2000; Taher, 2012). Moreover, resources are those assets that firms are in possession and control of while capabilities are what the firms can do in terms of technical know-how and skills (Luo & Huang, 2008; Murage, 2018).

2.11.2.1.2. Foundation and relevance of theory

The fundamental foundation of RBV is its adoption of an 'inside-out' view or firm-specific perspective on the reasons why some firms succeed or fail in the marketplace (Dicksen, 1996; Madhani, 2010). Valuable, rare, inimitable and non-substitutable (VRIN) resources (Barney, 1991) enable firms to develop and maintain their competitive advantage as well as deploy these resources and competitive advantages for superior performance (Collis & Montgomery, 1995; Grant, 1991; Wernerfelt, 1984). Therefore, valuable, rare, imperfectly inimitable and imperfectly substitutable resources drive the sustainable competitive advantage for sustained superior performance (Barney, 1991). Rarity points to the uniqueness of these resources, that is they must be scarce, being valuable denotes their capacity to generate strategic value and significant outcomes, imperfect inimitability signifies the complexity and prohibitive costs of acquiring or manufacturing such resources which makes their reproduction unfeasible. Non-substitutability symbolises the lack of alternative replacements to such resources. For TBIs, tangible resources range from physical buildings, technology, finance, machinery, human resources and technical personnel while intangible resources relate to non-physical aspects such as internet networks, competences and capabilities and time.

Barney (1991) perceives the resources as valuable when they enhance the capabilities of a firm to implement strategies that guarantee efficiency and effectiveness. University TBI improves the competitiveness of incubatees by channeling their resources to developing strategies that improve the quality of the technological product or service rendered, brings them in proximity to their customers and refines the value proposition of these firms. For Barney (1986: 658), valuable resources enable firms "to do things and behave in ways that lead to high sales, low costs, high margins, or […] add financial value to the firm" and thereby contribute to their competitive advantage. TBIs improve the competitive advantage of their tenants by developing their technological capabilities and accelerating the speed to the market of their technological products, services and solutions, without which they are incapable due their resource constraints. TBIs enable organisational development, technological and product development for incubatees (Van Stijn, van Rijnsoever & van Veelen, 2018). For instance, university TBIs facilitate incubates' organisational development by configuring the conceptual and physical attributes of the organisation (Bhave, 1994) at the levels of opportunity recognition, (2) business concept development and (3) organisation creation (Van Stijn et al., 2018). RBV theory is relevant to understanding decisions about founding a business based on an identified technological opportunity, the development of a proof concept and value proposition of the business including the development of physical infrastructure in pursuit of the business opportunity (Delmar & Shane, 2003; Ries, 2011). The university TBIs provide key resources and competencies such as entrepreneurial competencies, technical, marketing support and training (e.g., through business proposal development, investment pitches, case studies, entrepreneurial training). The provision of these resources is integral to the realisation of their critical operational objectives.

In terms of technical support, technological and product development, a university-based TBI renders nascent technology-based incubatees with laboratories and research knowledge to perform R&D to proof the technology concept (Bhave, 1994). As such, the successful application of technology development improves the entrepreneurs' confidence and capability to exploit the business opportunities related to the technology (Park, 2005; Van Stijn et al., 2018). The university-based TBI can be instrumental in market development through market outreach and acquiring and responding to customer feedback (Van Stijn et al., 2018). It serves as a safe launch pad for reaching out to first customers as well as generating the necessary feedback relating to the quality of the product. Such incubators allow the incubatees to conduct market research and to evaluate and respond to customer feedback through their product's interaction with customers (Gartner, 1985; Bhave, 1994).

2.11.2.1.3. Merits and demits of the theory

The RBV has its own merits and demerits. It is instrumental in explaining resource orchestration in organisations, which is the arrangement of organisational resources that culminate in the firm performing technology-related projects (Taher, 2012). The theory also proffers a theoretical lens for investigating and explaining how information technology resources contribute to firm strategy and performance (Taher, 2012). However, the criticisms levelled against RBV relate to conceptual muddiness of resources and capabilities and lack of precision in the definition of each concept (Grant, 1991; Amit & Schoemaker, 1993, Teece et al., 1997). RBV lacks clarity on the distinction between resources and capabilities. Moreover, although capabilities comprise processual ability to direct resources and the capability development is path dependent (Teece et al., 1997), multiple pathways could contribute to the realisation of a given capability across organisations (Eisenhardt & Martin, 2000). This complicates the location of pathways that exert the most impact on a given capability. Moreover, the time lag between the conception and the realisation of a capability obfuscates the cause-and-effect link of such a capability.

2.11.2.2. Institutional theory

The next sections discuss the origin, theoretical foundation and relevance of institutional theory. In the penultimate, the section assesses the merits and demerits of institutional theory.

2.11.2.2.1. Origins of the theory

Institutional theory has its origins in Philip Selznick's work on organisations. Selznick (1957) contends that institutionalisation unfolds over time, reflecting the organisation's unique origin, the calibre of people in the organisation, their values systems and interests and the adaptation of the organisation within its environment. At the core of his argument, organisations evolve into institutions as internal and external, formal and informal social and institutional forces merge with technical structures, processes and contexts of organisations (Butler, 2012). Selznick's (1957) work on institutionalisation was expanded by DiMaggio and Powell (1983) and popularised by Scott (1995). DiMaggio and Powell (1983) expanded institutional theory to include organisational fields which capture an aggregate of organisations comprising suppliers, consumers, regulators and other stakeholders that produce similar products and services. The concept of organisational field was further expanded to include social fields. The social field provides an institutional environment for organisational fields (DiMaggio & Powell, 1993) while organisations represent the institutional contexts where individual actors operate. Scott then further elaborated the concepts of institutions by specifying the dimensions of institutions into cognitive, normative and regulative structures that bring stability and meaning to social behaviours (Scott, 1995). While cognitive structures emphasise the mental structures that inform human behaviours and actions, Scott (1995) perceives regulative structures as dealing with the setting of rules, provision of monitoring mechanisms and sanctions by government agencies. Normative structures deal with prescribed structures, arrangements and practices by industry associations and professional bodies (Scott, 1995).

2.11.2.2.2. Foundation and relevance of institutional theory

Institutional theory captures the relationship between formal structures of organisation and the social processes which are fundamental to development of such structures (Dillard, Rigsby & Goodman, 2004). Therefore, institutionalisation is the coalescing of new norms, beliefs, values and structures with existing norms, values and constructions (Tamer & Seymen, 2006; Aldemir & Uysal, 2017). These beliefs, rules, roles, and symbolic elements affect organisational forms irrespective of the supply of resources and technical specifications (Scott, 1991; Scott, 2013). In a business incubation context, norms could involve the evaluation criteria for the admission of incubatees, funding models of TBIs, uncodified rules of engagement in incubator environments, and the measures of successful incubation performance used by university incubators. Structures would encapsulate the philosophies and principles that govern the conduct of university incubators as informed by incubation models, resource base and existing partnerships in existence.

At the core of institutional theory is the claim that organisations maintain their legitimacy and relevance through their continual adaptation to norms, social processes, practices, without which they lose their legitimacy (Rodrigues & Craig, 2006; Aldemir & Uysal, 2017). The survival of university TBIs, therefore, is not only tied to their technical capacity (e.g., technical efficiency) and productive capabilities, but also the extent to which they are conceived as legitimate institutions (i.e., providing relevant expertise, resources and spaces) by their incubation tenants. Literature emphasises three forms of institutions: *regulative* (i.e., those enforced by law, accounting standards), *normative* (i.e., regulated by appropriate behavior e.g., expectation for ethical behaviour from leaders) or *cognitive* (i.e., taken-for-granted assumptions, mental models of how to behave in organisations) (Berthod, 2016). The expectation of incubatees to pay rental fees, for technical services, and engagement in ethically integrated corporate reporting are instantiations of regulative and normative institutions to the effect that they transcend utilitarian and relevance considerations. Since organisations do not operate in a vacuum but are products of their constant negotiations with their environments, the resultant norms, rules and expectations explain the choices of organisational structures and practices (e.g., International Organisation for Standardisation [ISO] norms, ICTs, corporate social responsibility [CSR] standards, or the divisional forms) (Berthod, 2016), hence the gravitation of institutions towards homogeneity in practices and design features (Meyer & Rowan 1977; DiMaggio & Powell 1983).

When founded on the principle of organisational learning, institutional theory shifts from resource provision towards unpacking the entrepreneurial journey from the perspective of incubatees (Phan, Mian & Lamine, 2016). Recent developments in institutional theory target the situated founding conditions for incubatees (Tolbert, David & Sine, 2011). The theory casts aspersion on the conventional assumption on the rational capacity of entrepreneurs to locate opportunities and gives credit to social groups' institutional features to which entrepreneurs belong and the symbolic environment as key forces for explaining organisation founding activities (Greve & Argote, 2015).

2.11.2.2.3. Merits and demerits of institutional theory

The institutional theory, especially the concept organisational fields, is deemed useful for identifying actors in a specific field including the determination of what counts as morally correct and appropriate behaviour (Scott, 1995) in the incubation environment. Moreover, the regulative, normative and cultural-cognitive pressures exerted on individuals and institutions through coercive, normative and mimetic mechanisms provide useful explanations for the comprehension, adoption and assimilation of technology innovations (Mignerat & Rivard, 2009) in incubation contexts. For instance, the payment of corporate tax and conformity to business operation bylaws (regulative mechanism) are critical to startups and spinouts' continued operations in the business environment the same way guidelines on technology innovations such as ISO standards increase the legitimacy of products such as patents and industrial designs. Coercive mechanisms such as ISO certifications require compliance from suppliers of technology products and these standards are becoming more influential as they cover different business processes (Field, 2008). The demerit of institutional theory is that apart from definitional crass that surrounds institutions and organisations, individual world views and socially constructed collective views of coercive, normative and cognitive mechanisms have flourished (Butler, 2012) further complicating the precise measurement of these mechanisms in the real world.

2.11.3. Systemic level theories

At the systemic level of theoretical analysis, attention is devoted to theories such as stakeholder theory and entrepreneurial ecosystem theory, which constitute macro level theories of explaining TBI processes and dynamics. The debates revolve around market-based imperfections that constrain the effective and smooth venture creation, necessitating intervention mechanisms such as TBIs, the role, interactions and synergies of quadruple helix partnerships between university-based TBI, government partners, private sponsors and technology transfer offices.

2.11.3.1. Stakeholder theory

The following sections discuss the origins, theoretical foundations and the pros and cons of the stakeholder theory.

2.11.3.1.1. Origins of the theory

The notion of stakeholders can be traced back to the Great Depression in the US (1929-1941) when General Electric Company identified four stakeholder groups in its operations namely, the shareholders, employees, customers and the public (Donaldson & Preston, 1995). The term reappeared in academic circles when an internal memorandum at the Stanford Research Institute in 1963 challenged the view that stockholders were the exclusive group to whom management was to account (Parmar et al., 2010). However, Edward Freeman is generally credited with having popularised the concept. Freeman (1984) presents a simplified version of a stakeholder model in which the organisation constitutes the hub of a wheel with its stakeholders comprising circles surrounding the hub, with double arrows illustrating connections between the organisation and its various stakeholders (i.e., shareholders, employees, customers, competitors, suppliers, civil society and government). He further distinguishes between internal stakeholders (i.e., owners, employees, suppliers and customers) from external stakeholders (i.e., government, competitors and interest groups). The argument is that though internal stakeholders may be key sometimes, the lifeblood of the organisation are external stakeholders without whose support the organisation may crumble or become dysfunctional (Bailur, 2007).

Donaldson and Preston (1995) expanded the stakeholder theory by demonstrating that it has descriptive, instrumental and normative properties. It is descriptive as it captures the firm as a collection of competing and cooperative interests with intrinsic value. It is instrumental as it provides a framework for using connections as stakeholder practices for the realisation of corporate goals. It is normative as it revolves around the acceptance of the view that stakeholders have legitimate interests in procedural and substantive aspects of corporate activity (Donaldson & Preston, 1995).

2.11.3.1.2. Foundation and relevance of the theory

The central argument of this theory is TBI serves as a platform for the realisation of multiple (triple, quadruple-helix) stakeholder needs, interests and expectations operating at national, regional and sometimes continental levels (Etzkowitz, 2002; Corona et al., 2006). The TBI environment becomes a key platform for the development and exchange of internal and external networks and collaborations between the TBI, tenants and external stakeholders by exchanging their own resources, experiences, business contacts, information and collaborations. Internal networks encapsulate those relationships that span formal and informal collaborations, partnerships, joint ventures and general exchange of information among tenants (Soentano & Jack, 2016). External networks can also be forged with universities, research centres and large industry partners, which enable poorly resourced firms to benefit from economies of specialisation (Schwartz & Hornych, 2010). Therefore, incubators serve as connectors which are critical to the alignment of resources, connections and business and social networks to incubatees' benefits.

The relevance of stakeholder theory in management studies has been expanded to corporate responsibility and business ethics (Valor, 2005), corporate planning, systems theory, organisational theory (Pouloudi, 1999) and strategic management to improve managers' strategic positioning of their organisations (Flood & Jackson, 1991; Mishra & Dwivedi, 2012). The theory explains which range of stakeholders are critical to organisational operations and survival and which stakeholders' interests can be downplayed with minimal damage to the organisation. With reference to TBI and TE, the most critical internal and external stakeholders are the TBIs, tenants, the TTO staff, entrepreneurial champions, innovation champions, funders and government regulators, whose diverse resources, interests and aspirations contribute to the success of TBI and incubation outcomes. Clarkson (1995) argues that stakeholder theory provides support to the view that poor generation and distribution of wealth or value of firms or if such value distribution were to favour one group of primary stakeholders at the expense of the other, may result in primary stakeholders withdrawing their support. The theory is also useful in explaining and distinguishing external stakeholders as those groups who are capable of mobilising public opinion in support or in opposition to a company in ways that influence its performance (Clarkson, 1995). Incubation associations, incubation sponsors and regulators play a significant role in not only availing critical resources for successful incubation but also render expert opinion on how incubators must be efficiently organised and managed to generate the expected incubation outcomes.

2.11.3.1.3. Merits and demerits of the theory

Stakeholder theory provides a useful framework for identifying and preserving those individuals and groups that have potential to increase the stock value and legitimacy of firms in the communities and external business world they operate in. Stakeholder theory demonstrates that stakeholders are not immaterial bystanders in business operations and the business environment but rather declare their interests and exert their power to influence the strategic direction of organisations (Pouloudi, 1999; Mishra & Dwivedi, 2012). Rowley's (2010) study reports that stakeholder theory is useful in (1) the identification of key stakeholders without whose cooperation organisational technology projects can fail, (2) the importance of engaging all stakeholders in the development of a shared understanding of their interests, perspectives, value dimensions and the benefits to the organisation arising from these stakeholders' participation in such projects. However, Islam and Grönland (2007) have argued that although stakeholder theory is useful for understanding the rollout of digital services, it is ineffective in demonstrating the organisation's adaptation to the needs, preferences and capabilities of stakeholders and in estimation of project resources of organisations such as the supply of human resources.

2.11.3.2. Entrepreneurship ecosystem theory

The next section discusses the origins of the entrepreneurship ecosystem theory, its theoretical foundations and relevance as well as its pros and cons.

2.11.3.2.1. Origins of the theory

The earliest foundation of the entrepreneurial ecosystem theory was laid in the idea of an ecosystem, a concept that emerged from biology, cybernetics and environmental studies to demonstrate how a group of living organisms situated in their environment interact and depend on each other for their survival. Moore (1993), who is generally credited with pioneering the use of the term "ecosystem" in social science from its ecological context, employs the phrase "business ecosystem" to describe the firm's external environment. Among the pioneering researchers on entrepreneurial ecosystems were Bahrami and Evans (1995), who described entrepreneurial ecosystems as involving the mutual dependence between innovation and entrepreneurship in the Silicon Valley ecosystem, including the transformation of old firms to new ones supported by angel investment and coherent service infrastructure. The term "entrepreneurial ecosystem" was coined by Spilling (1996) to describe the complexity and diversity of actors, roles, and environmental factors that interact to determine the entrepreneurial performance of a region or locality. In short, the work on entrepreneurial ecosystems is founded on the pioneering research on the interaction between entrepreneurship and regional environment in the 1990s (Spilling, 1996; Neck et al., 2004), emphasised the importance of the social context in enabling and constraining the pursuit of entrepreneurship.

However, the authors who popularised entrepreneurial ecosystems are Brad Feld, Boyd Cohen, Daniel Isenberg, Colin Mason, Ross Brown, and Erik Stam (Malecki, 2018). Cohen (2006:3) defines sustainable entrepreneurial ecosystems as an "interconnected group of actors in a local geographic community committed to sustainable development through the support and facilitation of new sustainable ventures". With reference to an entrepreneurial ecosystem, Stam (2015) argues that the success of entrepreneurship is tied to the interaction and synergy between a community of interdependent actors (Stam, 2015). At the core of entrepreneurial ecosystems are the maintenance of dynamic local processes of entrepreneurship as cumulative causation (or a virtuous circle) (Malecki, 2009) and role models, especially serial entrepreneurs, who serve as exemplars of entrepreneurial success, offering advice and investment capital as angel investors or venture capitalists (Mason, 2008; Malecki, 2018).

2.11.3.2.2. Foundations and relevance of the theory

The entrepreneurial ecosystem theory emerges from literature on the role of entrepreneurship in regional economic development. Stam (2015: 1765) conceives the entrepreneurial ecosystem as "a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship." The role of interacting partners/ stakeholders jointly working to promote effective entrepreneurship through mutual interdependence, cooperation and co-creation of knowledge lies at the core of the proposition. The definition, however, fails to specify the contexts in which entrepreneurial action unfolds and the strategic tactics and processes that these stakeholders engage to facilitate such action. Mason and Brown (2014:5) characterise an entrepreneurship ecosystem as a "set of interconnected entrepreneurial actors, entrepreneurial organisations, institutions and entrepreneurial processes which formally and informally coalesce to connect, mediate and govern performance within the local entrepreneurial environment." It can be inferred that actors engage in specific actions in situated contexts such as setting the incubation performance standards, incubation models, funding regimes and monitoring the maturity times of incubatees. In such an ecosystem, universities constitute integral components of the system whose influences, roles, strategies, and tactics, directly and indirectly affect the entrepreneurial ecosystem processes, outputs, and outcomes, both on and off campus (Sherwood, 2018).

Figure 2.1. demonstrates the multiple players at the heart of the university-based entrepreneurial ecosystem, including the nature of activities that may give rise to entrepreneurship in general and business incubation in particular. The ecosystem actors are faculty, staff, students, entrepreneurs and the broader community while the activities include curricula and extra-curricular activities, bridging mechanisms and the role of the technology transfer office and other informal engagements.

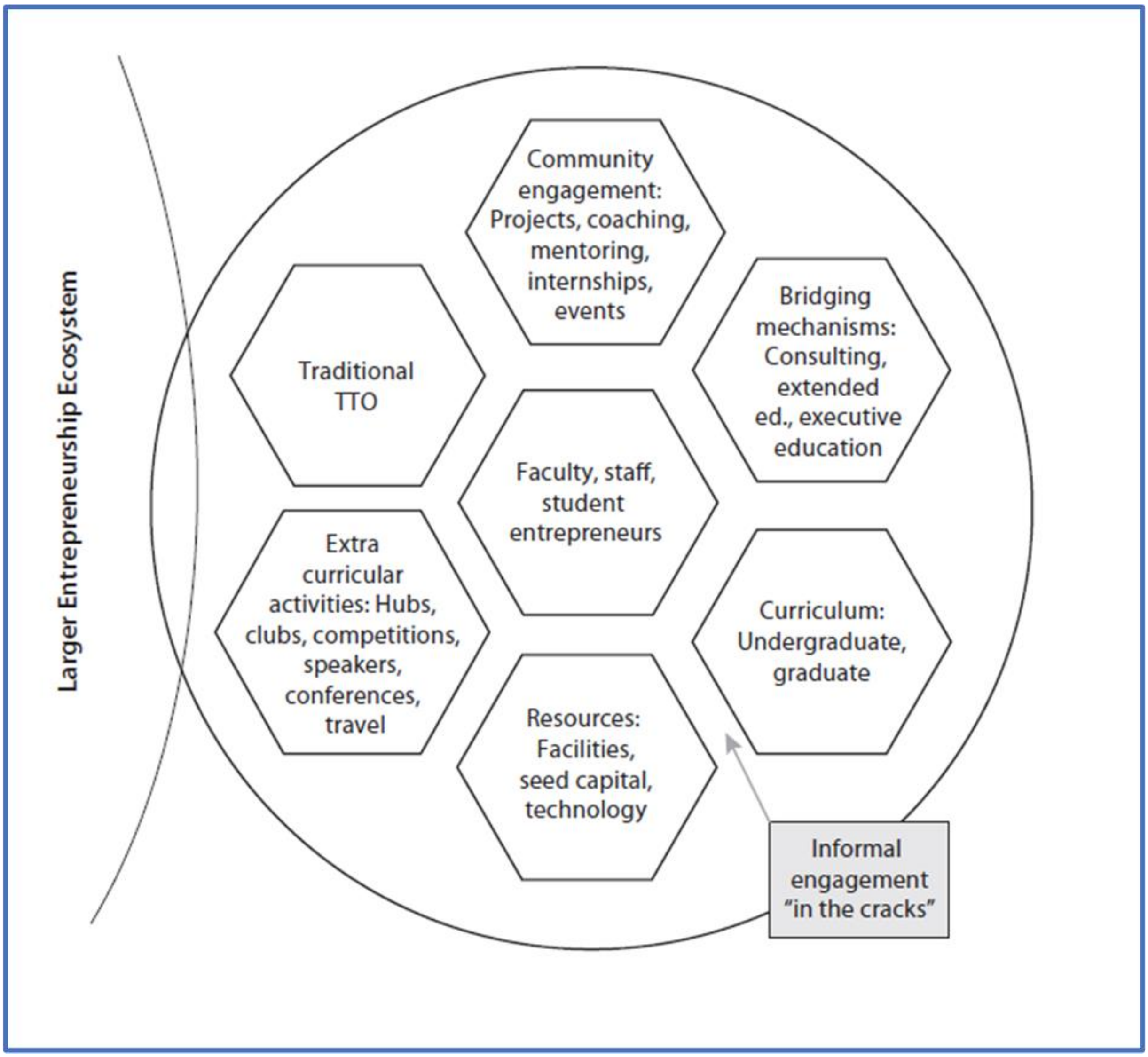

Figure 2.1. University-based entrepreneurial ecosystem (Source: Sherwood, 2018: 244 -Adapted from Fetter et al., 2010; Morris et al., 2013; Hechavarria & Ingram, 2014; Miller & Acs, 2017).

In the university entrepreneurial ecosystem, the multiple players whose interactions and exchanges of resources support the effective TBI include entrepreneurs, government departments, funding agencies, the technology transfer officers and financiers and other agencies – and comprise the quadruple helix relationships. The resources that these multiple actors share, exchange and process range from buildings, shared facilities, industrial complexes, technologies, financial resources, equipment and personnel that make the incubation process possible. Within the entrepreneurial ecosystem, the informal and informal interactions enable processes that give rise to specific outcomes. The formal interactions include “buyer-supplier relationships, shared board membership, co-working arrangements, consulting, and strategic alliances ranging from licensing agreements to joint ventures” (Sherwood, 2018: 242). The informal interactions manifest in “networking events, chance meetups at conferences, community and training events, trade shows, and gatherings after work” (Sherwood, 2018: 242).

The outputs of these interactions include the number of venture startup successfully incubated, the volume of financial investment generated, the total number of the workforce generated, the number of patents and IP produced, number of academic spin offs generated, size of the industry or market’s influence and the number of products and services commercialised.

2.11.3.2.3. Merits and demerits of the theory

One of the strengths of the entrepreneurial ecosystem theory is that entrepreneurship is not only conceived as the product of the system, but entrepreneurs are regarded as key leaders in the generation and maintenance of a healthy ecosystem (Stam, 2015). This “privatisation” of entrepreneurial policy diminishes the role of government from a leader to that of a “feeder” in the entrepreneurial ecosystem through its provision of finance, professional services and adjustment of laws (Feld, 2012). The receding of government’s influence into the entrepreneurial background locates the entrepreneurs at the centre of remedying market and system failures through addressing information asymmetry and collective organisation to create public goods (Stam, 2015). This gives entrepreneurs greater agency, control and influence in shaping the strategic direction of the entrepreneurial ecosystem.

Stam (2015) critiques the formulation and application of the entrepreneurial ecosystem theory. First, the theory lacks a unifying definition as it has been developed by multiple authors on an ad hoc basis. Second, the argument that entrepreneurial ecosystems comprise systems whose products are successful entrepreneurship, and contexts where there are successful entrepreneurs constitute good entrepreneurial ecosystem, is tautological and such reasoning offers little insights into entrepreneurial policy. Third, the theory renders a collection of factors relevant to successful entrepreneurship without a clear explanation of cause and effect – i.e., the coherent links that give effect to entrepreneurship. Lastly, the theory is unclear about its level of analysis -whether local, regional or national. Maleck (2018) bemoans theorisation of entrepreneurial ecosystems that tends to concentrate on essential ingredients for generating the ecosystem while downplaying the processes or “recipes” for their combination into a sustainable milieu with entrepreneurial vitality.

2.11.4. Synthesis of theoretical perspectives

While these aforesaid theoretical perspectives are distinct and can be pursued independent of each other, limited resource endowments, efficiency and economy imperatives and the need for an integrated provision of support may dictate that these interdependent theoretical positions be pursued jointly. An incubator must serve as a bulwark against external shocks and contingencies for incubatees, monitor entrepreneurial performance of incubatees and ensure organisational learning for incubatees such that their post incubation survives and succeeds. This is the clearest linkage between the entrepreneurial cognition theory and stakeholder theory. These imperatives can be jointly pursued by stakeholders operating in an entrepreneurial ecosystem – suggesting the complementarity of stakeholder theory and entrepreneurial ecosystem theory.

Alternatively, the norms, practices and activities of incubators and incubatees are more salient at the founding stages of the incubatees and tend to become more convoluted as incubatees progress towards maturity – a clear application of the complexity of institutional theory. By extension, material resources are critical at the establishment stages of incubatees rather than foundational stages (conception stages) while non-material resources are fundamental to the expansion and growth stages of the business as they operate with an entrepreneurial ecosystem. This demonstrates the fusion of the Resource-based theory and the entrepreneurial ecosystem theory.

2.12. THE OUTCOMES OF TECHNOLOGY BUSINESS INCUBATION

Although there are many outcomes of technology business incubation such as such national economic growth (Mueller, 2005), greater incentivisation of research and development by public and private agencies, the expansion of quadruple helix relationships among government, industry, universities and civil society organisations and the protection of intellectual property rights (Tripathi & Brahma, 2018), technology entrepreneurship is arguably one of the widely discussed outcomes of TBI recently (Hichri, M'chirgu & Lamine, 2016; Armellini, Dega, Garcia & Machado, 2021; Pelikka & Ali-Vehmas, 2021).

Technology entrepreneurship (TE) is defined as the establishment of a new technology venture (Jones-Evans, 1995) or as ways in which entrepreneurs draw on resources and structures to exploit emerging technology opportunities (Liu et al. 2005; Bailetti, 2012). At the core of these definitions is the exploitation of technology opportunities to generate distinct outcomes of value to society. Despite the variations in definitions of TE, the widely preferred definition of this concept is an investment in a project that assembles and deploys specialised individuals and heterogeneous assets that are intricately related to advances in scientific and technological knowledge for the purpose of creating and capturing value for a firm (Bailetti, 2012). As such, the main emphasis of TE is on creating and capturing value for new technology startups through scientific and technological innovations and breakthroughs.

The outcomes of TE are inter alia: the establishment of new technology ventures and spinoffs (Bailetti, 2012), the provision new technology and knowledge-based products and services to close market gaps (Ratinho et al., 2015) and the provision of proprietary technologies to clients via digital platforms (Tripathi & Brahma, 2018). Moreover, the commercialisation of technology innovations and applications to ensure wider reach in the market (Flaszewska & Lachiewicz, 2013), the transfer of research knowledge from academia to society (Jamil, Ismail & Mahmood, 2015) and the internationalisation of modernised management operations (Matejun, 2016). Other outcomes of TE include the high-potential capitalisation of technology enterprises and projects, managing accelerated growth, the creation of technology intensive commercial opportunities (Kordel & Wolniak, 2021), and generating a market, cluster or industry for commercialised innovations, ventures, products or services (Beckman et al., 2012b). Moreover, the generation of employment and increased technological, technical and innovative capabilities for startup staff are other outcomes of TE. To ensure that the research variables, the dimensions and relationships explored in this study were manageable, the TE outcomes covered in this investigation were: a high growth orientation for technology startups and spinouts, the commercialisation of technology innovations (i.e., commercial application) and high-potential capitalisation of the enterprise or projects (i.e., creating large financial outlays). These dimensions were most preferred as they were deemed to be well understood by incubatees and could be easily quantified.

2.13. CHAPTER SUMMARY

This chapter commenced with some conceptual definitions of business incubation and technology business incubation, which appreciated the context-dependent nature of the terms. Next, the varying typologies of business incubation were discussed, including their complementarities as well as their marked divergencies. This was followed by differentiating technology business incubators from technology parks and related concepts in the incubation vocabulary such as innovation centres and science parks including their distinctiveness, associations and their interfaces. Thereafter, the chapter rendered an overview of the historical evolution of TBIs and the landmark developments that facilitate their wider rollout nationally and globally. Under these developments, the different waves that TBIs have undergone were unraveled. The multi-level perspectives and theories on TBI were subsequently unpacked. The chapter concluded with a synopsis of these theories and their complementarities. The next chapter examines individual factors that affect TBI and incubation outcomes.

CHAPTER 3

INDIVIDUAL LEVEL FACTORS AFFECTING UNIVERSITY-BASED TECHNOLOGY BUSINESS INCUBATION AND ITS OUTCOMES

3.1. INTRODUCTION

The previous chapter provided a picture of the conceptualisation of key terminologies in the business incubation terrain, multi-level perspectives that undergird technology business incubation (TBI), and the theories of TBI. Special emphasis was devoted to the definitions of business incubation and their variants, typologies of business incubation, definitions of TBI and the diverse terms that are often conflated with TBI such as science parks, innovation centres, technology parks to reduce conceptual clutter and confusion. Thereafter, the historical evolution and generational waves of TBI were unraveled. The last segment of the chapter interrogated multi-level perspectives and theories of TBI and provided a synthesis of these theories.

The current chapter builds on the previous one by examining the individual level factors affecting university-based TBI and its outcomes, especially technology entrepreneurship (TE). The highlights of the chapter include selected individual factors affecting TBI, the complex TBI processes and dynamics that unfold inside the incubator and individual level (i.e., at incubatee and individual entrepreneur levels) outcomes of TBI. Subsequently, parallel case studies on TBI and their consequences are unraveled, relationships involving individual level factors affecting TBI and TE are examined and a synthesis of the literature based on the contemporary literature is presented.

3.2. INDIVIDUAL LEVEL FACTORS AFFECTING TBI: A CURSORY VIEW

An important caveat is that while this study reviews literature on individual-level psychological factors affecting TBI, the predominant literature on this subject emphasises individual cognitive aspects affecting venture creation (Mitchell et al., 2002; Le Roux, 2005); entrepreneurship (Randolph-Seng, et al., 2015), entrepreneurship intentions (Krueger et al., 2000; Pihie, Bagheri & Sani, 2013; Córcoles-Muñoz et al., 2019), and not TBI per se. Nonetheless, while these arguments are often advanced with reference to entrepreneurship, they also resonate with business incubation because incubation cushions fledgling businesses from failure, optimises venture creation decisions and promotes entrepreneurial pursuits through provision of diverse forms of support to such businesses. For this reason, this chapter draws mainly on cognition as it relates to entrepreneurship behaviours (e.g., intentions, activities, venture creation) rather than incubation per se. For instance, in their exploration of the influence of selected factors on entrepreneurial intentions, Krueger et al. (2000) expand the conception of cognition to include its embedded nature. Another perspective on cognition research views cognitive processes (e.g., biases, heuristics and overconfidence) to entrepreneurial behaviour as ineffective in addressing risks, ambiguities and uncertainties inherent in the entrepreneurial process and venture creation (Busenitz & Barney, 1997; Hayward et al., 2006; Dew, Grichnik, Mayer-Haug, Read & Brinckmann, 2014). Concurrently, another body of literature privileges the role of adaptation of cognitive processes (e.g., pattern recognition, meta cognition and expert scripts) in enhancing venture performance (Mitchell et al., 2000; Baron & Ensley 2006; Haynie et al., 2010). For instance, Baron and Ensley (2006) provide evidence to demonstrate that, compared to novice entrepreneurs, experienced entrepreneurs tend to recognise patterns among seemingly unrelated events in entrepreneurship processes. This points to the centrality of expert knowledge or advanced procedural knowledge (or expert scripts) in the identification of entrepreneurial opportunities. The differences in cognitive research point to the need for new conceptualisations of entrepreneurial cognition that fully appreciate the dynamism of the qualities of the entrepreneurial process (Venkataraman, Sarasvathy, Dew & Forster, 2012).

Since the domain of entrepreneurship is undergirded by the discovery, evaluation and exploitation of opportunities and resources, and the development of new organisations, processes, assets and services (Sánchez, 2013), unravelling entrepreneurship (and TBI) necessitates an explication of why, when and how such resources are discovered, evaluated and exploited, from the sourcing of resources to the mobilisation of efforts for their exploitation (Shane & Venkataraman, 2000). To the extent that entrepreneurship and TBI are premised on discovery and exploitation of business opportunities, Krueger (2005) accedes that grasping these processes necessitates comprehension of the underlying cognitive structure. However, a clear distinction must be made between cognitive structure and cognitive processes. For Goktan and Gunay (2011), cognitive structures represent and contain knowledge, while cognitive processes imply the way knowledge is received and used. Therefore, one could argue that since entrepreneurial cognition constitutes an embodiment of knowledge, it represents a form of cognitive structure. To the extent that cognitive styles represent the way knowledge is appropriated and used, they constitute cognitive processes. Overall, the field of entrepreneurial cognition encapsulates all aspects of cognition that play an important role in different aspects of the entrepreneurial process (Goktan & Gunay, 2011). The recent prominence of incubation in explaining entrepreneurial processes (Peters, Rice & Sundararajan, 2004; Zang et al., 2019) implies that it would be an academic indictment for scholars to ignore an in-depth understanding of cognitive structures and processes that are fundamental to driving entrepreneurship and venture creation. This is because cognition research presents scholars with multiple theory-driven approaches and empirically robust mechanisms to build a deeper, richer understanding of how entrepreneurs learn to see opportunities and assess their skills and abilities along the entrepreneurial intentions process (Barbosa, Gerhardt & Kickul., 2007).

The understanding of cognitive processes has been considered non-negotiable in grasping entrepreneurial processes in entrepreneurship literature. For instance, an individual entrepreneur's cognitive style is credited with shaping their capacity to accumulate knowledge, process different types of information and their preference for different forms of learning and decision making- actions and behaviours that entrepreneurs are routinely pre-occupied with (Barbosa et al., 2007; Sánchez, Carballo & Gutiérrez, 2011; Lee-Ross, 2014). Similarly, research acknowledges that individuals who demonstrate high entrepreneurial behaviour often score high on the intuition dimension (Allinson, Chell & Hayes, 2000), an allusion to the centrality of intuitive thinking in entrepreneurial decision making. Since intuitive thinking affects the processing of information considered critical in entrepreneurship, it could be integral to developing one's perceptions of their capabilities to pursue entrepreneurship successfully (i.e., perceived entrepreneurial capabilities), effective location and exploitation of business incubation resources and the honing of entrepreneurial intentions.

3.2.1. Unpacking cognition and entrepreneurial cognition

Defining cognition is fundamental to understanding entrepreneurial cognition, which is a more specialised concept. Neisser (1967) defines cognition as all processes by which sensory input is transformed, reduced, elaborated, stored, recovered, and used. This implies that cognition does not unfold outside a context but happens in response to external stimuli from the entrepreneurial environment, which is subsequently altered and transformed through internal cogitative processes. In view of the complexities and uncertainties inherent in entrepreneurship and business incubation, it is logical to expect nascent entrepreneurs to harness cognitive structures such as cognitive biases, heuristics, inductive thinking and deductive thinking, to interpret, make sense and reduce the complexities of entrepreneurial decisions.

Mitchell et al. (2002: 97) define entrepreneurial cognition as "the knowledge structures that people use to make assessments, judgements, or decisions involving opportunity evaluation, venture creation, and growth." The argument often advanced with reference to entrepreneurial cognition is that entrepreneurs differ from non-entrepreneurs regarding how they process the information they receive from their environment. For instance, research highlights that entrepreneurs tend to discern and discover opportunities where non-entrepreneurs do not. Equally, entrepreneurs envision future possibilities that non-entrepreneurs fail to recognise (Shane & Venkataraman, 2000; Keh, Foo & Lim, 2002; Muzychenko, 2008). Consistent with this view, entrepreneurial cognition can be conceived as an antecedent to entrepreneurial processes such as venture creation and business incubation. Therefore, the entrepreneurial process (which involves all the functions, activities and actions associated with the perception of opportunities and the creation of the organisations to pursue these opportunities) (Bygrave & Hofer, 1991), is a consequence of cognitive processes such as entrepreneurial cognition.

Having defined cognition and entrepreneurial cognition, it is critical to provide an overview of both concepts before attending to the dimensions of entrepreneurial cognition and their relationships with TBI and TBI outcomes. Cognition has emerged as a new theoretical lens for explaining individuals' engagement in entrepreneurial behaviours (Mitchell et al., 2002; Sánchez, Carballo & Gutiérrez, 2011; Pihie et al., 2013), venture creation and business incubation decisions (Mitchell et al., 2000; Kirkley, 2016). The argument in entrepreneurship research is that, when making entrepreneurial decisions and choices, entrepreneurs (including those accommodated in TBIs) tend to rely on cognitive structures such as cognitive scripts that constrain their contemplation of real and perceived risks when dissecting venture creation decisions. This explains their commitment to invest in uncertain ventures where non-entrepreneurs would be too risk averse to invest in. Cognitive scripts denote knowledge structures that allow entrepreneurs to employ information on entrepreneurship opportunities in decision making (Sanchez, 2013). With reference to the application of cognitive scripts to entrepreneurship, the underlying assumption is that entrepreneurs possess a thought structure in relation to entrepreneurship that is significantly better than that of non-entrepreneurs (Lord & Maher, 1990).

Entrepreneurial cognition denotes that cognition which is deployed in pursuit of entrepreneurial processes and venture creation (Goktan & Gunay, 2011) as entrepreneurs rely on cognition to recognise opportunities and mobilise resources to act on those opportunities. As such, ingrained in entrepreneurial cognition is how aspiring entrepreneurs act on environment stimuli through their motivations and perceptions, thereby creating attitudes and intentions that sustain entrepreneurial behaviours (Fernández, Liñán, & Santos, 2009). Therefore, it is logical to consider entrepreneurial cognition a driver of entrepreneurial processes such as venture creation decisions (Bygrave & Hofer, 1991) even though the mechanisms through which entrepreneurship cognition affects entrepreneurship processes remains a contested terrain (Urban, 2011; Sanchez, 2013; Mitchell et al., 2014). Suffice to say, entrepreneurs use knowledge structures or simplified mental models (cognitions) such as judgements and assessments to mobilise and exploit resources to build products, services, and solutions in complicated situated contexts where other ordinary people would be unable to do the same naturally. Entrepreneurial cognition concerns how entrepreneurs operating in TBIs employ simplifying models (e.g., perceptions, memory, and thought processes) to make sense of disjointed information in the identification and invention of new products and services, amalgamation of resources in pursuit of opportunities, starting and expanding businesses (Urban, 2015).

3.3. SITUATED ENTREPRENEURIAL COGNITION AND ITS VALUE

Rather than conceive it as a mental activity, psychology literature (Wilson, 2002; Urban, 2011; Mitchell et al., 2014) conceives entrepreneurial cognition as situated. This means that it encapsulates perception and action in a human body but that operates in relation to the real-world. When situated in the external environment, perception (e.g., pattern recognition and attention) and thought process (e.g., inductive reasoning expressed in classification, judgement and analytical reasoning) are considered to influence entrepreneurial and venture creation decisions (Mitchell et al., 2000; Urban, 2011). As such, a situated entrepreneurial cognition approach allows researchers to overcome the main criticism of the Cartesian approach that dissociates the mind and body from its surrounding environment. It tackles the criticism that cognitive research rests on assumptions and methods that are ill-equipped to capture the complex, multi-level dynamics of entrepreneurship (Breslin, 2008; Gartner, 2007; Grégoire, Corbett & McMullen, 2011).

The conception and discussion of entrepreneurial cognition from a situated perspective presents several additional benefits. First, it allows entrepreneurs to imagine new opportunities for exploring entrepreneurship research by transcending what social cognition researchers call "boxologies" that is, seemingly static representations of abstract, disembodied cognitive structures (e.g., biases, heuristics, scripts) (Mitchell et al., 2007; Mitchell, Randolph-Seng & Mitchell, 2011). The socially situated view, therefore, presents a dynamic view of cognition research that illustrates the components of a broader explanatory process (Mitchell, Randolph-Seng & Mitchell, 2011) by incorporating the role of context in cognitive structure and processing. Second, a socially situated approach to cognition allows researchers to appreciate how social objects not only constitute the content of thought but also shape the process underlying thought and behaviour (Smith & Semin, 2004). Put differently, cognition is not exclusively about cogitative processes but the totality of material processes and objects that give rise to such mental processes such as speech, body movements, communicative processes and interactions. For instance, sense making as an expression of cognitive reasoning demonstrates a connection between language, cognition and the enactment of entrepreneurs (Cornelissen & Clarke, 2010). Third, a situated approach to entrepreneurial cognition allows research to discern the immediate and interactive conversational context, relationships with other individuals, and broader memberships in social groups as representing the three interpersonal levels at which cognition and action are situated (Mitchell, Randolph-Seng & Mitchell, 2011). Put differently, entrepreneurial cognition does not unfold in a vacuum but rather is mediated and facilitated by social action unfolding at individual, social and group levels through communication, interaction and group activities. Lastly, a socially situated approach to entrepreneurship cognition allows for the analysis of entrepreneurial action to be examined and analysed at three contextual levels – communicative context, social context and group context – which are consistent with the focus of this study that explores individual, institutional and environmental factors that trigger TBI processes and outcomes. For instance, Cornelissen and Clarke (2010) employ the concept of communicative context in their assertion that inductive analogical or metaphorical reasoning connects the brain and environment to generate verbally produced conceptual images or scenarios for new ventures.

3.4. CATEGORISATIONS OF SITUATED ENTREPRENEURIAL COGNITION

Since the value of adopting a socially situated entrepreneurial cognition approach has been explicated, it is logical to examine the dimensions of situated entrepreneurial cognition. Situated entrepreneurial cognition has been categorised into three main variants that have relevance to entrepreneurial action namely *embedded cognition*, *grounded cognition* and *distributed cognition* (Dew et al., 2014) as show in Figure 3.1.

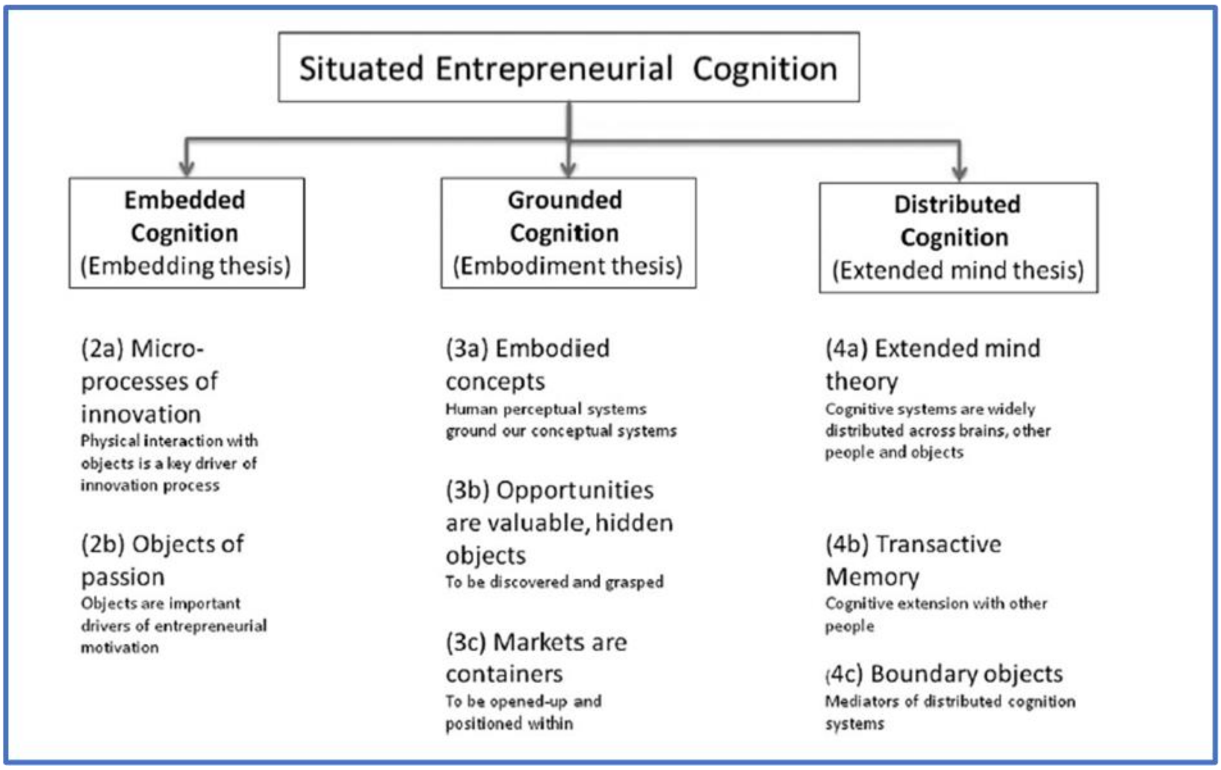

Figure 3.1: Categorisations of situated entrepreneurial cognition (Source: Dew et al., 2014:2)

The three ways of categorising situated entrepreneurial cognition culminate into three perspectives of approaching situated entrepreneurial cognition namely embedded thesis, embodiment thesis and extended mind thesis. Each of these perspectives is elaborated in subsequent sections.

3.4.1. The embedded thesis

The “embedded thesis” supports the notion of an active mind in constant interaction with the natural and social environment, and its dynamism derives from its capacity to exploit objects and social structures in these environments (Clark, 1997). Since entrepreneurial cognition unfolds within specific contexts, entrepreneurs are influenced by the networks that they are affiliated with and are shaped by other individuals in their environments (Aldrich & Cliff, 2003; Goktan & Gunay, 2011). This gels well with Mitchell et al.’s (2011) observation that social networks and mentoring affect the identification and exploitation of entrepreneurial opportunities. Therefore, traits such as creativity and innovation constitute concepts that are triggered by the entrepreneurial mind’s constant interaction with multiple physical artifacts (e.g., finance, pictures), material objects (e.g., technology, applications, tools), concepts (mind maps) and social structures in an entrepreneurial environment. The embedded thesis of entrepreneurial cognition, therefore, is an objection of a mind that acts independently and in isolation from the external environment in which it operates.

The body of entrepreneurial research focuses on the contribution of entrepreneurial passion and affect as an embodied experience in venture creation (Cardon et al., 2009), contribution of visual symbols in the derivation of entrepreneurial sense (Clarke, 2011), role of situated emotions in entrepreneurship (Dew et al., 2014; Drnovšek et al. in press) and the influence of memory in shaping an individual entrepreneur’s capacity to adapt (Bryant et al., 2014). It is incontrovertible that entrepreneurship involves learning by doing (i.e., action oriented) as much as it involves direct manipulation and interaction with objects (e.g., prototypes, technologies, gadgets and tools) in pursuit of innovations around which new technology ventures could be built (TBI). This is because of the limited processing capacity and short memory of the mind that necessitates some of the abstractions and models to be converted into visible prototypes which are manipulable (Klemmer et al., 2006; Dew et al., 2014). One would conceive such externalisation of mental processes as “embedment.”

3.4.2. The embodiment thesis

The “embodiment thesis” submits that cognitive processes reside deep in the physical body, especially its sensorimotor capabilities or bodily interactions with the world (Thelen et al., 2001; Robbins & Aydede, 2009; Dew et al., 2014). The basic premise of this thesis is the physical grounding of cognition in context (Barsalou, 2010) is a useful heuristic for understanding the conception and application of entrepreneurship behaviours. This transcends the main criticisms leveled against cognitive theorists that they over-emphasise individual-focused research and downplay the interactions between these individuals and contexts, including the meta-theory which explains these contextualised interactions

(Randolph-Seng et al., 2015). For this thesis, therefore, body postures such as eye contact, momentary gaze, gestures, and linguistic resources such as language, intonations, accent and pronunciations are physical body capabilities that are integral to business communication, successful business proposal writing, entrepreneurship competitions and business incubation pitches. Consistent with the embodiment thesis, previous studies interrogated the role of bodily properties such as genetics in shaping entrepreneurial propensity (Nicolaou et al., 2008), contribution of hormones (e.g., testosterone levels) to commitment to engage entrepreneurially (White et al., 2007) and the value of gestures and metaphors in the derivation of sense of entrepreneurs (Cornelissen et al., 2012).

3.4.3. The distributed cognition thesis

The most complex thesis is the distributed cognition thesis or the "extended mind thesis" (Clark & Chalmers, 1998; Robbins & Aydede, 2009) founded on the conviction that mental operations transcend the frontiers of the individual to incorporate a constellation of networked and interacting elements. Consistent with social cognitive theory, the premise of this thesis is that cognitive thinking, which unfolds in entrepreneurship, is dynamic: situated among individuals operating in multiple, active environments with different degrees of distribution of such thinking across minds and tools (Mitchell et al., 2014; Randolph-Seng, 2015). Therefore, entrepreneurial cognition is not only action-oriented, embodied and situated within and among specific individuals and environments but also distributed across minds and tools (Smith & Semin, 2004; 2013). The individual entrepreneurs' cognition does not only manifest in the organisational structures that they form (e.g., ventures for incubatees) but also in their obsession with concepts (e.g., prototypes), tools (e.g., applications, technologies) and artefacts that they develop. By extension their cognition is continually refined by the interactions between these tools and the mind. Entrepreneurs tend to be intrigued by objects they are creating, creating a market for these products (Cardon et al., 2009), and these relationships often ignite their passion to pursue entrepreneurial decisions such as the decision to be incubated in an TBI. For this thesis, the role of transactive memory and boundary objects (Star & Griesemer, 1989; Wegner, 1987; Dew et al., 2014) in explaining entrepreneurial behaviours and actions is often a reference point for a logical construction of entrepreneurial cognition. Therefore, cognition is situated in the social actors themselves as much as it is extended in their interactions, which are fundamental to entrepreneurial actions. Some of the studies that emphasise the distributed nature of cognition include Zheng's (2012) study on the influence of transactive memory on venture teams and Breugst et al.'s (2012) study on how employees' perceptions of entrepreneurial passion shape their commitment to ventures.

3.5. OPERATIONALISATION OF ENTREPRENEURIAL COGNITION

Although cognitive processes may be conceived to precede conscious and intended behaviours such as decisions to form a venture (Sánchez, 2013), each phase of the entrepreneurial process necessitates certain cognitive qualities (Kickul, Gundry, Barbosa & Whitcanack, 2009). Since entrepreneurial cognition denotes those mental processes and models that entrepreneurs use to process information (i.e., transform, store, recover and use), the different ways through which entrepreneurs gather, organise and use information as they interact with other individuals need to be grasped and operationalised (Mitchell et al., 2002). Therefore, entrepreneurial cognition can be operationalised, assessed and measured using intuitive thinking (Barrow, 2009), cognitive scripts (Sánchez, 2013) and heuristics (Busenitz, 1992) or heuristic-based logic (Wright et al., 2000; Alvarez & Busenitz, 2001).

This chapter concentrates on three types of entrepreneurial cognition namely, intuitive thinking, heuristics and expert scripts. The focus on these entrepreneurial cognition types was informed by the reality that there is a growing body of literature that considers them as critical foundations for the realisation of venture creation and entrepreneurship (Busenitz & Barney, 1997; Mitchell et al., 2002; Baron & Ensley, 2006; Smith, Mitchell & Mitchell, 2009; Marlow & McAdam, 2015; Liu, Schøtt & Zhang, 2019). These cognitive resources can be advanced independently as fundamental to realising entrepreneurship. For instance, intuitive decision style is credited with enhancing technology-based entrepreneurial teams' mental states and facilitating team performance (Organ & O'Flaherty, 2016). Heuristics are deemed to facilitate logical thinking during complex decision making on ventures, which arise from conditions of uncertainty (Urban, 2015). Similarly, entrepreneurial expert scripts are considered instrumental to the formation of an entrepreneurial mindset at the individual level of analysis (Smith et al., 2009). Similarly, entrepreneurial cognition is a key determinant of the learning process by which entrepreneurs cognitively acquire and transform entrepreneurial knowledge (Cope & Down, 2010). The next section discusses intuitive thinking.

3.5.1. Intuitive thinking

Despite the heated controversy around the meaning of intuition (Duggan, 2007; Hodgkinson & Healey, 2008, Dörfler & Ackermann, 2012), Dane and Pratt's (2007) definition has gained currency in contemporary psychology literature as a more germane and legitimate characterisation of the term. They define intuition as "an involuntary, difficult to articulate, affect laden recognition or judgement based on prior knowledge, which is arrived at rapidly, through holistic associations and without deliberate or conscious rational thought" (Dane & Pratt, 2007: 40). This definition suggests a single type of intuition called expert intuition (Walsh, 2017) in which individuals employ involuntary cognitive reflexes based on prior knowledge to make judgements about their environment. Expert intuition can be distinguished from entrepreneurial intuition, which involves involuntary judgements which support exploration of new ideas, novel connections, emergent relationships and is required for innovation and change (Crossan et al., 1999). While expert intuition is concerned with an experienced person making some unconscious judgements about some phenomenon based on associations between that phenomenon and their prior knowledge without recourse to rational thought, entrepreneurial cognition is predominantly focused on the deployment of similar judgements but with specific reference to identification, validation and exploitation of new entrepreneurial opportunities. Instinct, therefore, involves fast, unconscious reflexive responses to particular situations and insight, and is a sudden realisation of a solution following an impasse and a period of subconscious deliberation (Duggan, 2007; Hodgkinson & Healey, 2008).

3.5.2. Origins of intuitive thinking

Intuitive thinking has its origin in the dual process theory, which postulates that mental operations in the brain are segmented, with the left half of the brain specialising in analytical tasks while the right half concentrates on intuitive and creative processes (Sloman, 1996; Kahneman & Frederick, 2005; Walsh, 2017). The theory emphasises the co-existence of different modes of thought: a quick, automatic, associative, and affective-based type of reasoning, which can be contrasted with a slow, thoughtful, deliberative process (Epstein & Pacini, 1999; Evans, 2006). As such, the functioning of the mind is explained in terms of dualities that co-exist and complement each other. These dichotomies include associative vs. rule-based thinking (Sloman, 1996), and fast vs. slow thinking (Kahneman, 2011), intuition vs. deliberation (Sloman, 2014), a quick, effortless, associative and experience-based, fast thinking involving affective processes (Epstein, 1994; Sloman, 2014) vs slow thinking requiring application of effort and cognitive resources, founded on symbolic and manipulation of abstract rules (Gronchi & Giovannelli, 2018).

This dualistic presentation of thinking has also permeated management thinking, where planning has been conceived as a left-brain activity while managing is construed as a right brain operation (Mintzberg, Raisinghani & Theoret, 1976) due to the different processes required to activate them. Therefore, dual process theory distinguishes subconscious and conscious (i.e., rational) processes that occur simultaneously in the brain and demonstrates that while thought processes are attributed to one system than the other generally, both are employed to an extent in most thought processes (Hodgkinson, Sadler-Smith, Burke, Claxton, & Sparrow, 2009; Kahneman, 2011).

However, recent research has questioned the formulation of these two forms of thinking in terms of dualities and conceive them as hybrid thinking modalities. For instance, the argument is that these thinking patterns happen simultaneously allowing for the resolution of conflict (Gronchi & Giovannelli, 2018). The Default-interventionist (DI) model claims that fast thinking generates intuitive default responses where subsequent slow thinking processing may or may not serially intervene depending on availability of adequate resources (Evans & Stanovich, 2013). Therefore, intuitive and deliberate thinking cannot be reduced to rational and irrational thinking processes as there is continual mediation between them. This is because it is plausible through introspection to be conscious of either form of thinking (Sloman, 2014).

3.5.3. Application of intuitive thinking in entrepreneurship

Since intuitions constitute involuntary "affectively charged judgements that arise through rapid non-conscious and holistic associations" (Dane & Pratt, 2007: 40), they find expression in hunches or gut feelings in the business arena. The success of business ventures is attributed to 'instinct' (Mehta, 2013), 'hunch' (Barrow, 2009), or 'gut feeling' (Welch & Byrne, 2001; Sadler-Smith, 2015) raising critical questions about the extent to which intuitive thinking is integral to the recognition, evaluation and exploitation of business opportunities. From an entrepreneurial thinking perspective, intuition involves an involuntary, rapid, non-conscious, associative mental processing that may facilitate the recognition and evaluation of a business venturing opportunity (Sadler-Smith, 2015). To the extent that gut feelings are domain-relevant expressions of expertise, they are acquired through prolonged periods of training, learning, socialisation and experience. However, to claim that intuitions are products of experience does not necessarily mean that nascent technology entrepreneurs do not make intuitive judgements but rather, they may not have sufficiently interacted with complex business environments and relevant knowledge domains necessary to have developed advanced intuitive thinking skills.

While consciousness in business decision making suggests that decisions can be arrived at intuitively or analytically, there is a lack of consensus on how intuition affects entrepreneurial decision making such as venture creation and business incubation. For instance, Sanker (2016) reports that neither an individual's intuitive nor radical (i.e., logical and analytical) thinking causes a preference in causational decision-making. To the contrary, Olson (1985) suggests that intuitive individuals tend to discover opportunities by observing cues or signals inherent in unfamiliar, unstructured information processed in a synthetic and holistic manner. As such, the intuitive cognitive style is fundamental to the opportunity identification phase of the new venture creation process (Kickul, Gundry, Barbosa & Whitcanack, 2009). Other researchers have suggested that both intuitive and analytical thinking styles are necessary in venture creation even though they are demanded at different venture creation stages. For instance, since the analytical cognitive style relies on linear and sequential information processes in evaluating venture opportunities, it may be relevant to latter stages of the venture creation process (Olson, 1985; Kickul et al., 2009) such as the opportunity evaluation and exploitation stages of business creation rather than at the opportunity identification stage. This is because opportunity identification requires the sifting and processing of diverse and disparate information from multiple sources, for which cues may be critical.

3.5.4. Cognitive scripts

The attitudes, behaviours and intentions to engage entrepreneurially have their roots in knowledge structures, and cognitive science researchers often employ methods such as cognitive scripts, causal maps and schemes to understand these structures. Cognitive scripts denote “a cognitive mechanism that comprises the key elements in a situation decision and the likely ordering of events” (Krueger, 2003: 128-129). In terms of content, however, a script is knowledge structure that fits predictable, conventional, or frequently encountered situations – they are schemas for understanding events and behaviours (Gioia & Poole, 1984). From an entrepreneurial perspective, scripts would comprise the thought structures and processes employed to organise knowledge relating to the identification of entrepreneurial opportunities, the mobilisation of resources and their effective exploitation in the incubation of businesses. Scripts have also been conceived as “highly developed, sequentially ordered knowledge” that forms “an action-based knowledge structure” (Mitchell, Smith, Seawright, & Morse, 2000: 975). This implies that entrepreneurial processes that give rise to business incubation do not rely on harp hazard unconscious thought structures but rather draw on deliberate, highly structured and carefully orchestrated knowledge (e.g., of perceived feasibility, perceived desirability of opportunities, funding models, perceived markets) that entrepreneurs employ to organise their actions and activities in pursuit of venture creation and incubation.

As experts in processing (i.e., acquiring, storing, transforming, using) of entrepreneurial knowledge, entrepreneurs (e.g., venture creators and incubatees) employ entrepreneurship and incubation information differently than non-entrepreneurs (Sánchez, 2013). Knowledge scripts can either be sufficiently developed (expert scripts) or not sufficiently developed (novice scripts) and hence the prevalence of information-based thinking errors (Urban, 2011). The three prominently discussed forms of scripts are arrangement, ability and willingness scripts, which are considered fundamental to the entrepreneur’s performance (Mitchell et al., 2000; Smith, Mitchell & Mitchell, 2009) and these are discussed in the section after scripts origins. Although scripts are documented as antecedents to the venture creation decision, little is known about analysing how these scripts affect entrepreneurial success (Mitchell, Mitchell & Mitchell, 2009; Sanchez, 2013), and hence the need to explore them further in this thesis.

3.5.5. Origins of scripts

Jean Piaget is widely celebrated in cognitive psychology as a pioneer scholar of cognitive development of mental schema, including scripts. Piaget's (1936) theory of cognitive development describes how children develop their mental models and make sense of their external world. He conceives biological maturation and interaction with the physical and social environment as the main processes through which cognitive development unfolds. He employed observational studies to develop a stage theory of cognitive development that explains how mental structures are developed upon further learning (McLeod, 2018). He argues that while some mental structures are genetically inherited, some are learnt through children’s engagement with the environment and progressive reorganisation of schemas, leading to the development of discrete stages of cognitive development.

For Piaget (1952), schemas are the fundamental building blocks for the development of cognitive models and allow humans to develop mental representation of the world. Piaget (1952: 7) defined a schema as "a cohesive, repeatable, sequence possessing component actions that are tightly interconnected and governed by a core meaning." This implies that mental schemas which facilitate cognitive processing are a consequence of repeatable cognitive processes and actions. Schema, which are mental representations of the world, constitute increases in the complexity of schemata that one has learned and stored in their memory that are re-enacted in response to situations (McLeod, 2018). Therefore, a script is a stored pattern of behaviour, which is enacted in response of a specific situation, as is the case with ordering food in a restaurant – where perusing the menu, ordering food, eating and paying the bill (Piaget 1952; McLeod, 2018) are the sequential stages in the model of behaviours. Therefore, as individuals experience the world, their units of knowledge (schemata) specifically needed for specific activities are qualitatively increased and reorganised and are subsequently re-enacted very time that situation happens.

By the 1980s, scripts had received considerable attention as fundamental elements in cognitive processing (Tversky & Kahneman, 1980; Nisbett & Ross, 1980; Taylor & Crocker, 1981). Largely, they were conceived as a cognitive framework that individuals employ to impose structure upon, and assign meaning to, social information or social situations to facilitate understanding (Gioia & Poole, 1984). The imposition of a structure is relevant to cognitive processes because without a coherent structure, situations lose their meaning and cloud an individual’s understanding, sense making and the development of coherent judgements of them. As such, a script is a procedural event schema (Hastie, 1981; Taylor & Crocker, 1981), which retains context-specific knowledge of common or conventional behaviour and event sequences (e.g., role-based interactions, task performance) (Gioia & Manz, 1985), to provide a mechanism of making sense of situations and prescribe behaviour relevant to these situations. Therefore, scripts provide informational cues that describe the behaviour and actions relevant to specific events such as an investment meeting or a conference call.

Since scripts were conceived as schemas that render a knowledge base that guides the interpretation of information, actions, and expectations (Graesser, Woll, Kowalski, & Smith, 1980), the study of scripts has led to the proliferation of schema-based approaches to organisational behavior (Phillips & Lord, 1982; Lord & Smith, 1983; Daft & Weick, 1984) such as cognitive mapping to explain causal relationships and perceiver's prototypes of leadership categorisations. This is because it was largely believed that since individuals working in organisations have potential to create large repertoires of organisationally relevant knowledge structures, an examination of these schema in organisational settings would aid understanding of organisational behaviour (Shrivastava & Mitroff, 1984; Gioia & Poole, 1984).

Gioia and Poole (1984) render a more comprehensive discussion of scripts in organisational behaviour. They contend that scripts serve a dual role for employees of enabling the understanding of on-going organisational events and providing a guide to appropriate behaviour (the performance of which is termed *script processing*). They elaborate that scripts are held prototypically – i.e. a person's knowledge of behaviours and behavioural sequences appropriate for given situations is held categorically with a "prototypic" or generic script representing each category of situations. It can be inferred that there is a script for the behaviours expected and another for the sequences of such behaviours in any given situation. Gioia and Poole (1984) further contend that scripted organisational behaviour is often performed unconsciously (*automatic script processing*), although active cognition (*controlled script processing*) is involved during the process of script development and when encountering unconventional situations. They further argue that scripts exhibit a metaphorical nature that enables organisation members to understand expected behaviours in terms of the required "performances" in specific situations.

3.5.6. Classifications of scripts

With the accumulation of knowledge relating to descriptions of scripts as schema held in the memory that describes events or behaviour (or sequence of events or behaviours) appropriate to a particular context (Abelson, 1981; Graesser, Gordon & Sawyer, 1979), literature has also progressed to develop some classifications and distinguish the traits of scripts. For instance, Abelson (1981) categorises scripts into weak and strong scripts. He articulates that weak scripts resemble other forms of cognitive structures such as personal prototypes (e.g., extroverts) that organise behaviours and expectations about the attitudes of oneself or other people but do not specify the exact sequence of these behaviours. This implies that while weak scripts allow an individual to predict what would happen in specific situations, they do not allow them to forecast the sequence of events. Weak scripts can be differentiated from strong scripts that contain both the expectations for the occurrence of events and for the progressive sequence of such events (Abelson, 1981). For Gioia and Poole (1984), strong scripts are perceivably reserved for stereotypical and ritualistic occasions, such as a selection interview where one forecasts what will happen and the sequence in which it happens.

Abelson (1976) further proposes that the development of scripted behaviour can progress through three evolutionary levels, which he termed *episodic, categorical*, and *hypothetical* scripts. An episodic script is of an elemental nature and is retained as a context-specific remembrance of a single experience (Gioia & Manz, 1985). When an individual experiences several similar episodes in similar types of situations, the amalgamation of episodic scripts develops into a *categorical script* - a script that is deemed appropriate for a relatively narrow class of situations. Finally, when enough experience or learning is acquired and generalised across multiple contexts, a *hypothetical* or *generalised* script is abstracted and serves as a "metascript" to guide behaviour in a range of related situations. Generalised scripts imply the organisation of behavioural knowledge into some meaningful structure (Abelson, 1976; Gioia & Manz, 1985).

Other studies have developed process perspectives of characterising scripts. In their Four Is (Intuiting-Interpreting-Integrating-Institutionalising) model, Crossan et al. (1999) present entrepreneurial intuition as the first stage of organisational learning. As a pre-verbal stage, this involves the application of sub-conscious thought. The interpreting stage involves the appropriation of language in the development of cognitive maps while the integration stage includes the deployment of interaction and conversations to develop a shared understanding in groups. The institutionalising stage entails the adoption of routines and procedures at organisational level to ensure that learning becomes ingrained in organisations (Crossan et al., 1999; Walsh, 2017). Since scripts are founded on episodic and semantic views of learning and memory retention (Schank, 1975; Schank & Abelson, 1977), scripting and script processing constitute the core components of the vicarious learning process (Gioia & Manz, 1985).

3.5.7. Types of scripts: An overview

Scripts are acquired through social interactions even though they are subject to replication and revision depending on social situations (Chiasson & Saunders, 2005). Mitchell et al. (2000) draw on expert information processing theory to clarify three different ways (scripts) through which entrepreneurs employ cognition to transform, store, recover and re-use information and to improve their venture performance compared to non-experts. These three levels of information processing are *arrangement, willingness* and *ability scripts* (Yamockul; Pichyangkura, & Chandrachai, 2019). These scripts influence behaviours through which entrepreneurs search and perceive, interpret, acquire and control resources respectively (Pryor et al., 2016). These three scripts are elaborated in subsequent sections.

3.5.7.1. Arrangements scripts

For Sánchez (2013), arrangements scripts describe knowledge structures which entrepreneurs possess regarding contacts, relationships, resources, and assets fundamental to the formation new economic relationships. For nascent technology entrepreneurs, arrangement scripts may shape how they source and perceive information about physical spaces (e.g., incubation office space, shared spaces, laboratories), acquisition of financial capital and engagement in social networks and building of business relationships. The four arrangement scripts relevant to entrepreneurship and incubation literature include 1. *Idea protection* – knowledge of protecting ideas such as patents, copyrights, franchise agreements, contracts which are integral to preventing imitation of ideas by competitors, 2. *Appropriate networks* – having knowledge of accessing essential contacts, 3. *Access to business resources* – cognitive processes on accessing and regulating access to physical, human and financial capital, integral to the formation of transactions, and 4. *Specific skills* – possession of specific capabilities that maximise the firms' competitive advantage (Sánchez, 2013).

3.5.7.2. Willingness scripts

These are knowledge structures that underlie the entrepreneur's commitment to develop a new venture and receptivity in resuming economic relationships (Sánchez, 2013). Willingness scripts comprise how entrepreneurs interpret their commitment to understanding the essence of information and the quality of social interactions with their social networks (i.e., social capital). The knowledge structures of such scripts undergird practical thoughts on: 1. *Opportunity seeking*, concerned with openness to experiment with new ideas and seeking new possibilities, 2) *Commitment tolerance*, which involves taking risks and responsibility for economic transactions, and 3) *Opportunity pursuit,* concerned with executing of decisions and being content with experimenting with failure (Sánchez, 2013). Possession of willingness scripts is critical to the entrepreneur's intentions to incubate businesses because entrepreneurship and business incubation are considered fundamental to the self-enhancement, financial security, social influence and autonomy of the entrepreneur (Richard et al., 2009; Dej et al., 2010).

3.5.7.3. Ability scripts

These relate to knowledge structures entrepreneurs possess regarding capabilities, norms and attitudes necessary for incubating new ventures. The possession and deployment of ability scripts could determine how these entrepreneurs appropriate and acquire intellectual capital such as entrepreneurial knowledge, "intellectual property management" such as patent registration, technology licensing, technology transfer and commercialisation (Mian, 1996; Isabelle, 2013). Ability scripts range from 1. *Diagnostic scripts,* which concern the entrepreneurs' ability to assess the potential of new businesses and comprehend the components required in their creation, 2. *Situational knowledge scripts,* which encapsulate the ability to learn lessons derived from ventures and apply them to specific contexts, and 3 *Opportunity recognition scripts,* which denote the capacity of the entrepreneur to conceive customer and venture value that could be forged by integrating products, services and people (Sánchez, 2013). In fact, the identification and recognition of opportunities are among the most critical metrics for determining the success of an entrepreneur (Ardichivili et al., 2003; Pauli, 2014) and the success of the business incubation process as entrepreneurs must fulfil vital market needs and demands. Value creation is particularly critical to entrepreneurship and business incubation because apart from profit generation and optimisation (Kuratko, Ireland & Hornsby, 2001; Baah, 2019), nascent entrepreneurs also value the maintenance of cordial relations with customers and employees for social recognition and for business continuity (Gorgievski, Ascalon & Stephan, 2010).

3.5.8. Heuristics

The term heuristics denotes simplifying strategies which entrepreneurs use in making judgement-based decisions (Randolph-Seng et al., 2015). The work on heuristics can be traced back to the scientific work of Kahneman and Tversky (1972), who identified commonly employed shortcuts in recognition of the inherent limitation of the cognitive mind. Tversky and Kahneman (1974) contend that when confronted with the need to make decisions under uncertain conditions, individuals use heuristics (short cuts) such as *representativeness*, *availability*, and *adjustment* and *anchoring*, to subjectively assess probabilities. However, representativeness may be a consequence of insensitivity bias to sample size and prior probabilities, availability can be associated with biases of retrievability, imaginability, or illusory correlation; and adjustment and anchoring may arise from biases of insufficient adjustment, evaluation, and subjective probability distributions (Tversky & Kahneman, 1974).

Later, the management scientist, Hebert Simon's (1977) views on bounded rationality expanded the notion of heuristics to decision making in organisations. Simon (1977) argues that in theory, rational decision making should ideally comprise the following stages: *Intelligence*: finding occasions for making a decision; *design*: inventing, developing and analysing possible courses of action; *choice*: selecting a particular course of action from those available; and *review*: assessing past choices (Simon 1977; Turpin & Marais, 2004). However, rational decision making is not always guaranteed due to limited organisational memory, the existence of sunk costs and lack of perfect information on all possible alternatives to arrive at the best decision. In fact, arriving at the best optimal decision is challenging due to the decision maker's limited knowledge of (1) all possible alternatives; (2) the consequences of implementing each alternative; (3) a well organised set of preferences for these consequences and (4) lack of computational ability to compare consequences and to determine which consequence is preferred (Operations Research Society of South Africa, 2002). Due to these intellectual and contextual limitations, a "satisficing," process-oriented view was developed, one in which Simon (1979) argues that since the decision maker does not always have complete information, and that optimal choices are not always feasible, the decision maker' rationality is bound by the constraints listed above. Therefore, Simon's (1979) concept of bounded rationality is premised on the activities of searching and satisficing (i.e., choosing an option that is satisfactory and sufficing) rather than securing the ideal option. In this model, alternatives are searched for and evaluated sequentially and if an alternative satisfies certain implicitly or explicitly stated minimum criteria, it is said to "satisfice" and the search is terminated (Turpin & Marais, 2004). Therefore, the "satisficing" approach is based on entrepreneurs' use of heuristics (or shortcuts) to decision making in which they rely on a limited set of alternatives to solve entrepreneurial problems rather than searching for all alternatives as a basis for ideal decision making.

3.5.9. Heuristics and entrepreneurial decision-making

To the extent that entrepreneurs operate in complex environments characterised by information overload, high uncertainty, high novelty, strong emotions, time pressure and fatigue (Baron, 1998), they are susceptible to employing heuristics in making sense of and dealing with such complex environments during venture creation and in incubation processes. Cognitive heuristics enables entrepreneurs to engage in fast decision making and diminishes their perception of risk, which explains entrepreneurs' pursuit of risk ideas and ventures (Busenitz & Barney, 1997; Simon, Houghton & Aquino, 2000; Barbosa et al., 2007; Ndofirepi, 2020). This does not mean that cognition makes entrepreneurs reckless individuals but rather enables them to make strategic and calculative entrepreneurial decisions that downplay risks in conditions of uncertainty. Therefore, Busenitz and Barney (1997) contend that compared to business managers, entrepreneurs employ heuristics to accelerate the pace of their decisions.

Given the pace at which windows of entrepreneurial opportunities open and close, heuristics (shortcuts) are instrumental in preventing entrepreneurs from missing these important opportunities (Shepherd &

Patzelt, 2018). However, the use of such heuristics can contribute to entrepreneurs making errors when making decisions relating to representativity, illusion of control (Busenitz & Barney, 1997), confirmation bias (McGrath, 1999) and cognitive bias such as sunk cost bias (Baron, 2004). Representativity relates to the perceived pervasiveness of the impact of their decisions – an entrepreneur may assume massive uptake of a product or service without prior market research. Illusion of control relates to the leverage entrepreneurs may perceive to have over the consequences of their actions such as those relating to the pricing and how much they may supply in terms of goods and services. In fact, the possession of a stock of knowledge and experience implies that entrepreneurs may pay special attention to the most critical components of the information as a basis for the identification of new opportunities and more effective decision making (Shepherd & Patzelt, 2018) as well as ignore others.

3.5.10. Perceptions

The term perception denotes the act or faculty of apprehending through senses or the mind (Bayon, Vaillant & Lafuente, 2015). Since perceptions unfold in mental faculties, Johnson-Laird (1983) argues that they often trigger the development of mental models, the causal inferences developed by individuals to represent real, imaginary or hypothetical situations. Therefore, perceptions may lead to the mental representations of reality such as the intentions to pursue an entrepreneurship activity. Perceptions are also instrumental in the development of mental models about entrepreneurship. Even through these mental models are fundamental in guiding an individual's understanding of reality when new information/data from the external source is received (Mitchell et al., 2011), mere possession of perceptions and activation of mental models do not necessarily induce certain types of behaviours. This is because the information cues that guide behaviour need to be complemented by the existence of the appropriate individual traits such as capabilities and competences.

3.5.10.1. Entrepreneurial perceptions

Since perceptions rely on sensory input and cogitative processes, entrepreneurial literature conceives entrepreneurial perception as mental representation of entrepreneurship or what individuals think about entrepreneurship (Palich & Bagby, 1995; Liñán et al., 2011). Given that entrepreneurial processes are concerned with discovery of economic opportunities, assessment and development of risk-adjusted strategies for exploiting these opportunities, and the marshalling of physical, social and intellectual resources to exploit these opportunities, one's cognitive constructions of these entrepreneurial processes (i.e., opportunity discovery, risk assessment, opportunity exploitation) can be conceived as entrepreneurial perceptions. Literature considers opportunity discovery involving entrepreneurs' increased alertness of arbitrage situations for generating profit (Kirzner, 1979; Sarasvathy et al., 2005), and the framing of information on associated risks in ways that reduce their magnitude (Douglas, 2006; Bayon et al., 2015) as typical expressions of entrepreneurial perceptions. While the possession of entrepreneurial perception is a desirable antecedent to the manifestation of entrepreneurship behaviour, engagement in venture creation activities is not necessarily an automatic experience. This is because entrepreneurs must exhibit and apply cognitive and navigation capabilities to explore existing business opportunities in the market and capitalise on these opportunities (Ndofirepi & Rambe, 2016).

According to the theory of entrepreneurial event, entrepreneurs engage in ventures where they perceive such venture creation activities feasible and desirable compared to other scenarios (Shapero & Sokol, 1982). Perceived feasibility is the perception regarding an individual's own capacity to carry out a specific behaviour such as becoming an entrepreneur (Liñán & Santos, 2007). Perceived desirability is the degree of attraction an individual perceives towards a specific behaviour such as becoming an entrepreneur (Liñán & Santos, 2007). The attraction to become an entrepreneur can be steered by one's perception of their capacity to engage in such behaviour and the social legitimacy of establishing and sustaining an entrepreneurial career. Since entrepreneurs may overstate the feasibility (e.g., by over valuing small probabilities) (Urban, 2011:7), and the perception of desirability of their decisions (Krueger & Dickson, 1994, Krueger, 2005), TBIs are created to overcome the fallacies often inherent in perceived feasibility and perceived desirability – the fact that certain business decisions are feasible and desirable do not necessarily guarantee their success. As such, TBIs provision of diverse resources serve as hedges that cushion incubatees from external shocks that contribute to startup failures, despite their feasibility and desirability.

3.5.10.2. Entrepreneurial capability

To appreciate entrepreneurial capability, the term capability must be defined. For Day (1994:38) capabilities are "complex bundles of skills and accumulated knowledge, exercised through firm processes that enable firms to coordinate activities and make use of their assets." Although this definition discusses capabilities in the context of firm practices, it is the individual who accumulates and deploys capabilities until they are embedded as components of the firm's organisational processes. From an individual perspective, therefore, entrepreneurial capability describes as distinct set of capabilities and skills including actions, practices, and routines that serve to explore, integrate, and exploit untapped business opportunities within an instituted market context (Alijani, 2013). Precisely, it refers to an entrepreneur's ability to identify and seize market opportunities (Zao & Liu, 2006). At the core of entrepreneurial capability at individual level is entrepreneurs' ability to be sensitive to and discover opportunities through the spirit of adventure, innovation, taking risks and through strategic decision making (Cao, Kang & Lim, 2017). However, one could expand this view to include the ability to make sense, validate and exploit these opportunities through venture development and expansion. As such, Oyedele et al. (2020) perceive entrepreneurial capability as the internal ability of an entrepreneur required to start and operate a successful enterprise often expressed through entrepreneurial orientation and entrepreneurial self-efficacy.

At the organisational level, entrepreneurial capabilities have focused on entrepreneurs working as a team or corporate entities (Karra, Phillips & Tracey, 2007). Abdelgawad et al. (2013) define entrepreneurial capability as a firm's capacity to sense, select, and shape opportunities, and synchronise their strategic moves and resources in pursuit of these opportunities. The focus is on the ability of firms to harness resources within their reach in exploiting opportunities. For Zhang et al. (2009), entrepreneurial capability denotes a firm level ability to leverage resources via an amalgam of innovative, proactive, and risk-seeking activities to discover, enact, evaluate, and exploit business opportunities. In short, entrepreneurial orientation is the vehicle through which opportunities are discovered, validated and exploited. Since entrepreneurial processes are concerned with discovery of economic opportunities, assessment and development of risk-adjusted strategies for exploiting these opportunities, and the marshalling of physical, social and intellectual resources to exploit these entrepreneurial opportunities can be conceived as entrepreneurial capability.

3.5.10.3. Perceived entrepreneurial capabilities

The term perceived entrepreneurial capabilities (PEC) (also called perceived entrepreneurial ability [PEA]) is an amalgam of perceptions and entrepreneurship capabilities (Tardiu, 2004) or entrepreneurial perceptions and capability (Kor, Mahoney & Michael, 2007; Edelman & Yli-Renko, 2010) or perceived capability and entrepreneurship (Tsai, Chang & Peng, 2016). Due to space and scope limitations, these variants are beyond the focus of this investigation even though the current study identifies with the view of combining perceptions with entrepreneurship capabilities. This approach is consistent with the current study's preoccupation with clarifying capabilities of engaging in entrepreneurship processes as imagined and perceived from the entrepreneur's lens. The study adopts PEC and not PEA employed by Bayon, Vaillant and Lafuente (2015) because capabilities capture a broader range of action-oriented attributes such as skills, abilities, actions and activities and not just abilities and capabilities being assessed at the level of the individual as well as the organisation. Simply, PEC denotes an entrepreneur's own evaluation of their capacity to engage in the entrepreneurship process successfully. Luong (2015:11) defines PEC as the perception of one's "…knowledge, skills and experience to start a business." This is the definition of adopted in this study.

3.5.11. Origin of PEC

The first concerted effort at understanding capabilities such as PEC lies in Human capital theory. Human capital theory conceives human capital investments in education and training to render prior private information critical to the development of capabilities and perceptions (Becker 1964, 1993; Nanda & Sorensen, 2010). Becker (1993) contends that human capital (which he defines as knowledge, skills and experience of individuals), is acquired through education and formal on-the-job training. He elaborates that human capital increases one's cognitive ability through increasing access to information, which increases the acquisition of generalised and specialised skills. To the extent that access to education and training increase the acquisition of entrepreneurial knowledge as well as access to experiential learning, it is logical to expect human capital to increase the capacity of entrepreneurs to discover, validate and legitimise and exploit business opportunities – capabilities deemed fundamental to entrepreneurial action. While Becker (1964) concentrated on the capacity of human capital to increase economic growth, Schultz (1971) applied human capital to entrepreneurship development by highlighting the potential of entrepreneurs to correct disequilibrium in the economy through rational and efficient reallocation of resources to ensure equilibrium.

The second contribution to PEC lies in organisational capabilities founded on the resource based view (RBV). Un and Montoro-Sanchez (2010) define an organisational capability as a firm's ability to mobilise knowledge, combine and convert individual knowledge embedded in different disciplines for the creation of new knowledge that results in innovation in products and/or processes. From an RBV perspective, organisational capabilities denote "an organisation's ability to combine different types of resources, especially firm-specific knowledge embodied in their employees, in order to create new resources that enable firms to achieve and sustain their competitive advantage" (Un & Montoro-Sanchez, 2010: 414). RBV postulates that a firm comprises a bundle of heterogeneous resources and capabilities, which must be coordinated to support competitive advantage, and these resources and capabilities explain the variance in performance across companies (Un & Montoro-Sanchez, 2010). Consistent with the RBV, those firms with organisational capabilities that are superior tend to perform better and become more competitive than those without such capabilities

The examples of organisational capabilities that are associated with firms are organisational innovation, organisational change, research and development, organisational culture, managerial talent and entrepreneurial capability (Barney, 1991; Hall, 1992). These capabilities are considered critical to the marshalling of existing knowledge and the creation of new knowledge. The growing body of literature that makes reference to organisational capabilities (Nelson & Winter, 1982; Prahalad & Hamel, 1992; Hamel, 1994; Un & Montoro-Sanchez, 2010) focus exclusively on the capacity to mobilise firm-specific knowledge and personnel skills of firms especially their tacit knowledge (Nonaka, 1994; Spencer, 1996) as potential sources of firm competitiveness. Tacit knowledge denotes the knowledge that is hard to express verbally, gained through practical experience. Similarly, other research studies consider capabilities to be dependent on the firm's ability to mobilise and combine individual knowledge and skills across boundaries of the firm to create new resources, i.e., innovation (Prahalad & Hamel, 1990). Others have focused on dynamic capabilities as sources of competitive advantage (Teece, Pisano, & Shuen, 1997; Madhani, 2009). Dynamic capability denotes the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments (Teece et al., 1997).

3.5.12. Conceptualisation of PEC: Terminological confusion

The various terms used with reference to PEC in the RBV have created terminological confusion. The RBV has been criticised for being imbued with "terminological soup" for capabilities, with various resource-based theorists employing concepts such as "resources," "competencies," "capabilities," and "assets," to capture what is essentially the same concept (Foss, 1997: 346). Part of this confusion arises from whether capabilities are exclusively an organisational variable (i.e., can be applied to firm level exclusively) or whether they can also be analysed at the individual level or both (Penrose, 1959; Wernerfelt, 1984; Peteraf, 1993; Teece, Pisano, & Shuen, 1997) in the RBV. The indecisiveness in use of terms and the lack of conceptual and analytical coherence is a consequence of a weak theoretical foundation upon which capabilities are derived. This terminological confusion continues to manifest in studies that have been conducted with reference to entrepreneurial capability which employ the terms entrepreneurial capabilities and entrepreneurial competences interchangeably (Lv et al., 2011).

3.5.13. Dimensions of PEC

The dimensions of PEC are just as contested as its definitions. For Luong (2015:11), the dimensions of PEC are knowledge, skills and experience of entrepreneurs. Arguing from an organisational perspective, Zahra, Abdelgawad and Tsang (2011) presents sensing, selecting, shaping, and synchronising as the main dimensions, while Zhang et al. (2009) place emphasis on experience, marketing capability, learning capability, networking capability, innovative and risk-taking capability as PEC dimensions. For this study, however, Luong's (2015) conceptual dimensions are employed as the study postulates that entrepreneurs bring a combination of knowledge, skills and experience to their encounter with entrepreneurial opportunities including their exploitation of resources to develop their ventures. The next section discusses knowledge as a dimension of PEC.

3.5.13.1. Knowledge

Knowledge comprises the cognitive and mental structures that shape how individuals perceive and integrate new information (Fiske & Taylor 1984) and renders a framework to interpret and comprehend (i.e., give meaning to) new information (Frese & Gielnik, 2014). Entrepreneurs access and assimilate knowledge from the social environment and use it to make sense of venture creation opportunities that arise in their entrepreneurial environments. The next section briefly discusses the origins of knowledge.

3.5.13.2. Origins of knowledge

The conception of knowledge as a source of economic activity can be tracked to Gary Becker. For Becker (1964), knowledge is a consequence of human capital investments such as education and work experience. Therefore, the acquisition of knowledge is attributed to the years of schooling, quality of the curriculum and overall quality of education offered at academic and professional training institutions. The argument is that educational institutions offer various programmes and reflective experiences (e.g., apprenticeships, internships, vocational training, tuition, case studies and simulations) that facilitate the assimilation and acquisition of academic knowledge that may be relevant to the pursuit of entrepreneurship. For instance, educational institutions engender *reflective orientation* (i.e., premised on understanding the meaning of ideas and situations that facilitate the transfer of concrete experience into new information and knowledge) (Kolb, 1984) and *metacognitive activities* (i.e., activities to control one's cognitions) (Ford et al., 1998), which are catalytic to the transformation of experience into knowledge (Unger, Rauch, Frese & Rosenbusch, 2011).

3.5.13.3. Knowledge and its application to entrepreneurship

The possession of prior knowledge is fundamental to the way new knowledge about business is acquired and interpreted (Shane, 2000). As such, prior entrepreneurial knowledge provides a cognitive frame of reference and informational cues against which new knowledge is received, interpreted and comprehended. Consequently, the possession of knowledge shapes and informs individuals' ways of reasoning, comprehension and interpretation, which determines their capacity to make sense of their surrounding environment including entrepreneurial opportunities that arise in that environment.

From an entrepreneurial perspective, knowledge comprises thoughts, expertise and mindsets relevant to venture creation (Ndofirepi & Rambe, 2018) such as those relating to opportunity discovery, financial planning, resource management and complex decision making. Knowledge can be categorised into cognitive, affective and psychomotor domains, which enable entrepreneurs to deal with numerous business complexities (Sönmez, 2017). The *cognitive domain* renders cogitative skills of comprehension, application, analysis, synthesis and evaluation (Bloom, 1956), which increase one's capacity to respond to and adapt to the contingencies and complexities of the business world. In entrepreneurship, the interpretation and comprehension of new information are central to discovering new business opportunities (Mitchell et al., 2007). It is not surprising that this domain constitutes one of the foci of this study. The *affective domain* of knowledge encapsulates feelings, values, appreciation, enthusiasm, motivations, and attitudes (Bloom, Krathwohl & Masia, 1973; Rumbaugh, 2014), which inform the dispositions of entrepreneurs to manage complex social relationships and diversity. The current study continually refers to entrepreneurial attitudes as fundamental to both the entrepreneurship, venture creation and business incubation process - even though this is not the focus of this investigation. The *psychomotor domain*, which include includes physical movement, coordination, and use of the motor-skill areas (Ntshangase, 2020), enable entrepreneurs to convert physical objects, symbols and artefacts into prototypes and concepts that ultimately culminate in products and services. Again, while psycho-motor skills are also not the prime focus of this study, they are embedded in the business incubation process, which predominantly deals with business strategies, norms, activities, actions and behaviors that give rise to new ventures. Overall, the possession of specific knowledge areas related to entrepreneurial tasks (e.g., industry and managerial experience) and expertise are critical for entrepreneurial success than general knowledge is (Baron & Ensley 2006; Unger et al. 2011).

Despite knowledge being a key determinant of entrepreneurial success and TBI, knowledge is not infallible. Prior knowledge can also undermine receptivity to new information, which becomes a disservice to the entrepreneurial processes. It is argued that highly experienced individuals may infer too much from little information, leading to their contentment with the familiar and culminating in their incapacity to think beyond what is known (Westhead et al., 2009). Similarly, Gielnik, Krämer, Kappel, and Frese (2014) contend that prior knowledge founded on previous experience may contribute to cognitive fixation, which undermines the integration of new information and constrain the identification of new business opportunities. One can infer that too much knowledge can constitute a proverbial poisoned chalice that inhibits the generation of insights from new information and clogs the innovation process. More knowledgeable and experienced entrepreneurs' discounting of new information that is inconsistent with their preconceptions and past experiences (Parker, 2006) contributes to the generation of negative outcomes such as cognitive entrenchment and stereotyped thinking (Frese & Gielnik, 2014) which are an anathema to creativity and innovative decision making.

3.5.14.1. Skills

A skill captures one's ability and understanding of the appropriate procedures, processes and dynamics of accomplishing a task or activity successfully. To the extent that skills entail one's ability to accomplish a task or procedure, it has some resonance with technical know-how and constitutes a component of an individual's competence. It is for this reason that definitions of competencies often include skills as key components. For instance, competences are "observable and applied knowledge, skills, and behaviour that create a competitive advantage for an [an individual or] organisation" (Jauhari, 2006: 123). Therefore, skills are one of the defining and demonstrable traits that distinguish experienced persons from non-experienced ones because by virtue of having mastered them, experienced persons are more capable of executing particular tasks and procedures more proficiently than their counterparts.

3.5.14.2. Skills and their application to entrepreneurship

Kutzhanova et al. (2009) identified four types of skills which are relevant to the development of an entrepreneurship system namely entrepreneurial, technical, managerial, and personal maturity skills. They elaborated that while *entrepreneurial skills* revolved around discovering economic opportunities and executing them effectively, technical skills are those critical to the production of products or services of firms. However, Cooney (2012) considered entrepreneurial skills to include innovation, persistence, internal discipline and orientation to change while technical skills encapsulate industry specific operations, communications, design, research and development and environmental observation. One can infer than while entrepreneurial skills are associated with the entrepreneurial and venture creation processes, technical skills deal with procedural and technical aspects such as product development, knowledge of business specifications and technological applications. It can be deciphered that while entrepreneurship skills emphasise opportunity recognition, evaluation and exploitation for effective engagement in venture creation, technical skills deal with the mechanisms and dynamics of firm production processes, which grant the firm its unique corporate identity and image.

Kutzhanova et al. (2009) elaborated that while *managerial skills* are essential to routine management and administration of firms, *personal maturity skills* include traits such as self-awareness, accountability, emotional skills and creative skills. The management skills encapsulate planning, decision-making, motivation, marketing, finance and selling (Cooney, 2012). One can deduce that while managerial skills emphasise daily operations of firms that guarantee their continued existence, personal maturity skills appeal to the cognitive and affective dispositions of the individuals, which when tapped optimally into can leverage the firm's competitiveness.

3.5.15.1. Experience

Experience denotes those capabilities acquired from one's exposure to and practical involvement in a particular firm or industry. Some of the commonly discussed forms of experience in entrepreneurship literature are entrepreneur-specific experience and industry-specific experience (Eggers & Song, 2013; Ntshangase, 2020). Entrepreneur-specific experience denotes that practice-based knowledge and abilities gained through entrepreneurs' previous exposure to, ownership or management of specific operations of firms (Eggers & Song, 2013). This can be contrasted with industry-specific experience, which entails knowledge and abilities derived from an entrepreneur's direct exposure to a specific group of inter-related businesses (i.e., an industry) (Eggers & Song, 2013). The argument is that knowledge and abilities gained from a cluster of related businesses may not necessarily be transferable to other industries due to the differences in nature and operations of different industries. This is notwithstanding the reality that exposure to a specific industry is ideally critical to developing knowledge and expertise in that particular industry.

3.5.15.2. Experience and its application to entrepreneurship

Since PEC encapsulates the entrepreneur's knowledge, skills and experience required to start and run a business successfully (Bayon, Vaillant & Lafuente, 2015; Ibrahim & Schøtt, 2018), experience and resources are at the vortex of the entrepreneurial process. For instance, there is evidence to suggest that an entrepreneur's experience and resources significantly affect venture startup and growth (Chandler & Hanks, 1998; Westhead, 1995; Edelman & Yli-Renko, 2010) as much as the difference between entrepreneurs and non-entrepreneurs is often attributed to their experience (Edelman &Yli-Renko, 2010). Prior experience comes in different forms such as (1) Specific knowledge about the industry; (2) Multidisciplinary foundation; (3) Technology and R&D experience; (4) Marketing experience; (5) Accounting experience; (6) Manufacturing experience; and (7) General management experience (Lv, Lai, & Liu, 2011).

3.5.16. PEC and entrepreneurship intentions

PEC is widely reported as an antecedent and predictor of entrepreneurs' intentions to engage in venture creation (Ebrahim & Schott, 2011; Walker et al., 2013; Tsai, Chang & Peng, 2016). These studies breached the research gap on previous studies' failure to examine why perceived capability affects entrepreneurial intention, especially the routes linking perceived capability and entrepreneurial intentions (Tsai, Chang & Peng, 2016). While the studies cited above provide useful insights into the nexus between perceived capabilities and entrepreneurial intentions (e.g., those aimed at supporting venture creation), they do not examine how PEC affect incubation processes and incubation outcomes. It is critical to acknowledge that while venture creation unfolds at the volition of the individual entrepreneur, incubation often unfold within the geographical location, practices, incubation models, support and guidance of the TBI, which changes the dynamics of venture creation processes. Previous research concentrated on investigating the direct effects of perceived capability, perceived opportunity, and fear of failure on entrepreneurial intention (Noguera et al., 2013; Walker et al., 2013). Other studies have explored how perceived capability positively affects entrepreneurial intention through perceived opportunity – alluding to variations of such mediation across specific countries (Tsai et al., 2016). Nevertheless, these studies are less insightful for understanding the dynamics of business incubation and incubation outcomes – given the institutional mediation of incubation processes by TBI, universities and technology transfer offices. Moreover, the limitations of prior research exploring the relationships between PEC and entrepreneurial intentions are that entrepreneurial intentions are a reasonable but uncompelling proxy for venture creation and business incubation because their exhibition do not guarantee venture creation due to yawning gap between intentions and the realisation of their outcomes (Ndofirepi & Rambe, 2016). The current study, therefore, examines the relationship between PEC, business incubation processes and technology entrepreneurship.

The realisation of entrepreneurial intentions is conceived through the lens of feasibility and desirability of a career in entrepreneurship (Krueger et al., 2000) depending on one's PEC. Shapero's Entrepreneurial Event Model suggests that the intention to engage in entrepreneurship is a function of *perceived desirability*, *perceived feasibility* and *propensity to act* (Shapero, 1975). Perceived desirability, which describes the degree to which an individual feels enticed to pursue an entrepreneurial career, could be dependent on the extent to which they are persuaded by the encouragement of significant others (e.g., family, spouses and friends). Perceived feasibility is conceived as the extent to which the individual considers herself personally capable of executing a certain behaviour (Shapero, 1975, Nguyen, 2018) and could be a function of the person' perceptions of the effectiveness of their capabilities. As such, perceived feasibility is often employed as a synonym of perceived behavioural control as the latter captures one's belief in the plausibility of specific behaviours. Propensity to act denotes one's belief in her own capacity to influence the behavioural outcomes (Shapero, 1975; Rambe & Ntshangase, 2020). Therefore, entrepreneurial intentions can be a consequence of perceived feasibility, perceived desirability and propensity to act entrepreneurially.

3.5.17. PEC and the entrepreneurial process

Since PEC constitutes an entrepreneurial perception associated with the mental representation of entrepreneurship i.e., what individuals think about entrepreneurship (Palich & Bagby, 1995; Liñán et al., 2011), it is logical to expect this mental representation to be associated with various aspects of the entrepreneurial process (Bayon et al., 2015). Whether business opportunities are discovered through venture creation and business incubation or created by social actors in the environment (Penrose, 1959; Weick, 1995; Alvarez & Barney, 2007; Edelman & Yli-Renko, 2010), perceptions of one's capability to successfully engage in entrepreneurship remain deeply embedded in the discovery or social construction of opportunities in situated contexts, as is the case with university-incubated firms. The discovery of opportunities through alertness to complex situations is considered fundamental to making profit (Kirzner, 1979; Sarasvathy et al., 2005) and such discovery can also be facilitated by one's perception for their capacity to filter value-creating information where ordinary people conceive some constraints.

PEC allows entrepreneurs to recognise and be sensitive to opportunities in the environment and propel them to act on these opportunities in fulfilment of the entrepreneurial process. With reference to business opportunity development and profit making, an entrepreneur is conceived as a knowledge mediator who identifies differences in information relating to two opportunities located in different geographical locations and then exploits this to optimise profit (Kirzner, 1973, Tardieu, 2004). PEC manifests in the conversion of differentials in market information (e.g., on product price) among market participants (e.g., entrepreneurs and non-entrepreneurs) and the conversion of such differentials into a business opportunity by intending and creating a business venture. The entrepreneur exudes entrepreneurial action by exploiting observed market price differentials through the coordination of resources and rendering knowledge to market participants through her actions (Tardieu, 2004).

However, the characterisation of capabilities to engage in entrepreneurship and venture creation from the perspective of entrepreneurial alertness as envisioned by Kirzner (1973) is useful but incomplete for understanding the complexity of the entrepreneurial process and venture creation. This postulation is useful to the extent that entrepreneurial processes commence with opportunity identification but is insufficient to capturing the heterogeneity of entrepreneurial knowledge. While market knowledge is fundamental to determining the needs and knowledge of market participants, it must be complemented by the knowledge on the exploitation of the market opportunity (Tardieu, 2004; Ndofirepi, 2016). Therefore, for incubatees, the exploitation of market opportunities undergirds the identification of motivations for performing certain business actions and how they must be performed (Ardichvili, Cardozo & Ray, 2003) to optimise incubation outcomes such as technology entrepreneurship.

3.5.18. PEC and venture creation

With reference to the development of organisational ventures and spin-offs, three capabilities are critical: *opening new paths of action, balancing organisation and commercial interests, and integrating new resources* (Afzal, Mansur & Sulong 2017). Opening new paths of action may find expression in the entrepreneurs’ search for new business ideas in the entrepreneurship eco-system for instance, through patenting and licensing of a new discovery. Balancing organisation and commercial interests could undergird the legitimation of organisational and commercial activities in incubation processes. Integrating new resources is a function of the entrepreneur’s networking capabilities and identification and exploitation of entrepreneurship opportunities (Munshi, Siddiqui & Dutta, 2018).

Opportunity identification is considered a critical capability of entrepreneurial firms which are skilled at aligning available resources (inside or outside of the firm) and market needs (Miller, 1983) by applying a new means-end relation framework unknown or unavailable to other actors (Ardichvili, et al., 2003). The use of modern technologies, applications and tools in delivering services of value to the market could be instrumental in changing the market dynamics and creating value for incubatees. The incubatees that survive the entrepreneurial and incubation environment must be adept at combining complementary resources and creating new information channels between the organisation and its external environment (Shane & Venkataraman, 2000).

Opportunity identification is followed by opportunity exploitation, which involves the integration of new knowledge into existing knowledge, products and services. From a business incubation perspective, the process may involve validating ideas empirically by soliciting the feedback of social networks created by the entrepreneurs to gain legitimacy of the idea or new opportunity (Floyd & Wooldridge, 1999); as well as aligning the idea, organisational goals, activities and strategies (Guth & Ginsberg, 1990). Gaining legitimacy may manifest in entrepreneurs performing entrepreneurial pitches and challenges with investors, experimenting with ideas in launch labs and securing finance from venture capitalists and commercial banks. Aligning idea, organisational goals, activities and strategies could entail developing the business models and aligning them with economic, social, ethical and environmental sustainability imperatives, establishing the value proposition, the competitive position and the viable business product. In short, PEC in its various forms allows incubatees to optimally realise TBI.

3.6. INSIDE THE BLACK BOX: UNPACKING THE TBI PROCESSES AND DYNAMICS

While TBIs generally contributes to proving ideas, developing teams, and de-risking ventures (Dee et al, 2015: 10), there is a lack of clarity on what must happen inside these “black boxes” as that is functionally dependent on the clientele sought, funding model proposed, role of partners (e.g., TTOs and university academics). The absence of "one-size-fits-all" TBIs has been attributed to the diversity of incubator offerings, tenant needs, business environments, and the national and local culture across industries, regions, and countries (Maital, Ravid, Seshadri & Dumanis, 2008) leading to various speculation and presumptions on the desirable missions and qualities of TBIs. However, it suffices to note that different incubation processes take the form of incubation and accelerator programmes, co-working spaces, social venture academies and learning programmes, competitions and enterprising work of very early-stage investors (Dee et al., 2015).

For the sake of simplicity, this study considers TBI processes to encompasses selection criteria (such as selection strategies, approaches and models), intellectual property and patenting issues and managerial competencies of incubation managers and incubation norms and procedures. For the sake of developing a coherent and clear structure, each of these TBI processes are discussed in subsequent sections.

3.6.1. Incubation selection criteria

Since incubation selection criteria were discussed as one of the dimensions of the TBI process in Chapter 2 (See section 2.9), this section concentrates on approaches to the selection of incubation tenants. As already indicated in Chapter 2, selection describes decisions that incubators make concerning which ventures to accept for entry and which to reject and can be categorised based on quality of the idea and of the entrepreneur (Bergek & Norrman, 2008). The incubatee selection approaches are individually discussed in the next sections.

3.6.1.1. Selection approaches

Generally, there are four main approaches employed when incubators select incubatees for participation in incubation processes. These are the idea-focused approach, the entrepreneur-focused approach, picking-the-winners approach and survival-of-the-fittest approach. The first section of subsequent sections discusses the idea-focused approach, followed by the entrepreneur-focused approach.

3.6.1.1.1. Idea-focused approach vs the entrepreneur-focused approach

There are two main approaches to selection of incubatees for inclusion into incubators and these are the *idea-focused approach* and the *entrepreneur-focused approach*. In the idea-focused approach, incubation managers and teams emphasise the viability of the business idea, product/service and the nature of the market (Hackett & Dilts, 2004) as their selection criteria. Other researchers have added to the idea-focused approach the innovation and feasibility of the business idea, arguing that the pursuit of a great idea targeting a large market and innovativeness are fundamental to incubation performance (Maital et al., 2008). Since the selection criteria under the idea-focused approach emphasise the viability of the idea, incubator managers can concentrate on characteristics of the product/service and markets the incubatee is targeting or the venture is aiming at including the expected profit potential of the venture (Hackett & Dilts, 2004). Product or service characteristics include uniqueness, durability and aesthetic qualities of the product while market characteristics can include whether the market is a monopoly, niche market or differentiated.

When an entrepreneur-focused approach is considered, incubatee managers' judgements concentrate on entrepreneurs' personality, their knowledge of the business development process and compares them with the capabilities (knowledge, experience, expertise and skills) generally required of the industry in which the entrepreneurs wish to establish themselves (Bergek & Norrman, 2008; Wachira, Ngugi & Otieno, 2017). It is generally assumed that the weaknesses of the business plan can be compensated by evaluating the personality of the entrepreneur (Wulung et al., 2014). As such, the selection criteria under the entrepreneur-focused approach are anchored on the entrepreneur or venture team's prior employment experience, technical expertise and entrepreneurial traits (e.g., resilience, affect, tenacity, creativity and resourcefulness). The pre-occupation with the entrepreneur's traits assumes that these traits may predict incubation performance outcomes. For instance, Ciavarella et al. (2004) attribute venture's survivability to an entrepreneur's personal attributes of extroversion, emotional stability, agreeableness, conscientiousness, and openness to experiences. By extension, Maital et al. (2008) concurs that great innovative ideas must be complemented by strong entrepreneurial personality, managerial capabilities and skills as well as cohesive and strong management teams. As such, great innovative ideas and great market opportunities are a critical but insufficient condition for the success of incubation.

3.6.1.1.2. Picking-the-winners approach vs survival-of-the-fittest approach

When the idea-focused and entrepreneur-focused approaches are not considered, incubator managers and teams can also choose a "picking-the-winners approach" or a survival-of-the-fittest approach. When a "picking-the-winners approach" is adopted, those firms demonstrating logical prospects of success are chosen and when this approach is inflexibly adopted it approximates a venture capital approach (Bergek & Norrman, 2008). Venture capitalists are individuals who invest their equity into firms exhibiting prospects of high profit margins and high returns in revenue. Therefore, following this definition, when picking-the-winners approach is inflexibly adopted, only those firms with the highest chances of success and lowest risk of failure are selected for business incubation – the same way venture capitalists and business angels select their ventures for financial support. Venture capitalists are often skeptical about investing in new and small ventures due to their lack of audited financial statements, information symmetry and credit rationing challenges (Kumar & Rao, 2015; Mpiti, 2016). Therefore, venture capital approach only considers high-growth oriented firms with over 80% chances of success to ensure that profit margins can recoup their initial cost of investment.

The "survival-of-the-fittest approach" is a more flexible approach where a large contingent of new ventures are invited, and mechanics of the market become the vital tool for distinguishing winners from losers (Fritsch & Mueller, 2004; Bergek & Norrman, 2008). Since the natural selection approach from biology is drawn upon in executing this strategy, firms with moderate and greater chances of successes are expected to operate and concepts such as the minimum viable product (the amount of the product needed for the business to function at break-even), the nature and level of competition in the market and the competitive strategies of rivals would be considered over the duration of the selection process. The assumption here is that the market dynamics would naturally eliminate weaker competitors (i.e., incubatees) progressively until a few strong competitors are left – the proverbial "last man/woman standing." The assumption is that weak incubatees naturally leave the incubator, fold operations or may pursue other funding opportunities outside incubation circles.

3.6.1.2: Selection strategies

While selection approaches deal with the broader choices that incubation managers make when selecting incubatees, selection strategies entail what combination of approaches can be integrated to maximise the incubation performance of incubatees. Put differently, strategies can be conceived as the different "recipes" infused to make incubation processes more competitive, effective and efficient in generating the intended outputs and outcomes. Therefore, incubation managers and teams can employ a complex selection strategy involving a combination of either the idea-focused approach or the entrepreneur focused approach, combined with either picking-the-winners approach or survival-of-the-fittest approach. The result strategy would be an integration of two different selection approaches (i.e., picking-the-winners approach and survival-of-the-fittest approach) with two other approaches (i.e., idea focused approach or the entrepreneur focused approach) to develop a quadrant comprising four selection strategies (see Figure 3.2). When the idea-focused and entrepreneur-focused approaches are mapped against these other two strategies, four "selection strategies" emerge namely:

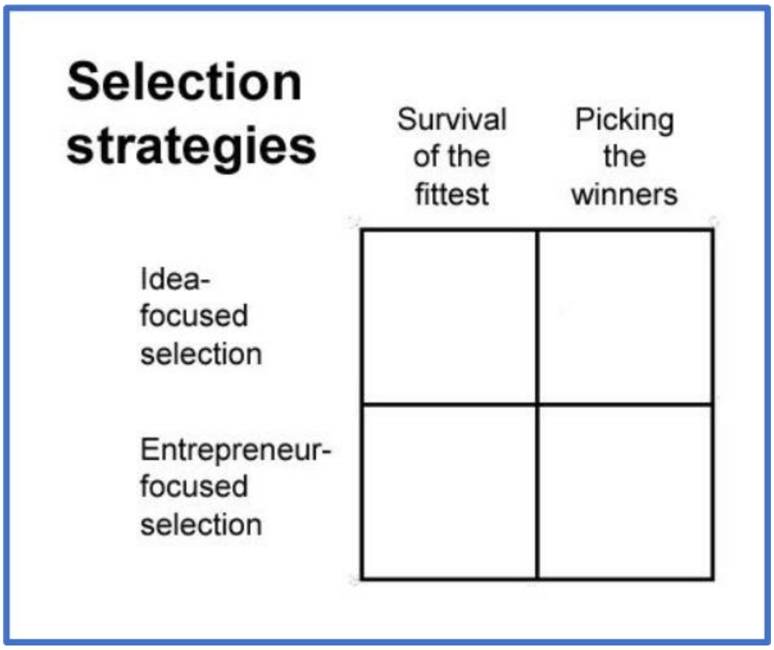

Figure 3.2: Selection strategies for incubatees (Source: Bergek & Norrman, 2008: 29).

- *Survival-of-the-fittest & idea.* The incubation portfolio would comprise many upcoming entrepreneurs (i.e., owners of ideas) with immature ideas related to diverse fields.

- *Survival-of-the-fittest & entrepreneur*. A resultant incubation is a diversified portfolio comprising entrepreneurs/teams with strong drive representing diverse ventures.

- *Picking-the-winners & idea*. A consequence of a highly niched portfolio comprising carefully screened ideas in a narrow technological area resulting from highly ranked universities research.

- *Picking-the-winners & entrepreneur*. The portfolio comprises few handpicked and carefully evaluated entrepreneurs, with ideas coupled to a nearby university's research (Bergek & Norrman, 2008).

3.6.1.3: Selection model categories

To apply and validate the aforementioned selection strategies in context, Bergek and Norrman (2008) further considered each of the selection strategies, the type of business support and mediation process associated with it and the typical examples of business incubators that fitted each description. This process culminated in the development of incubator model categories - model categories that described the selection strategy, support structure and mediation processes of typical incubators. Five incubator model categories emerged as illustrated in Table 3.1.

Table 3.1: Incubator model categories

Model categories	Selection	Business support	Mediation	Incubators
Category 1	Idea & picking-the-winners	Major involvement (shares and/or participation in management/board)	Technological innovation system	*Incubation at Chalmers, Karolinska Innovation Systems, GU Holding, (Teknikdalen[b])*
Category 2a	Idea/entrepreneur & picking-the-winners	Program-based, incubator-initiated	Regional innovation system	*Stockholm Business Incubator, Kista Innovation Growth, Science Park Jönköping*
Category 2b	Entrepreneur & picking-the-winners	Program-based, incubator-initiated	Regional innovation system	*Gothia Business Incubator, Uppsala Innovation Centre, Growlink Incubator*
Category 3	Entrepreneur & picking-the-winners	Loose/on demand, entrepreneur-initiated	Regional innovation system	*Aurorum Business Incubator, Ideon Innovation, Minc, (Teknikbyns Företagsgenerator[c])*
Category 4	Idea & picking-the-winners	Program-based	Cluster	*Inova, Umeå Innovation*
Category 5[a]	Idea & survival-of-the-fittest	Loose, entrepreneur-initiated	Local	*As described above, many incubators (and universities) provide a pre-incubation process.*

(Source: Bergek & Norrman, 2008: 30).

[a]Applies to idea hatchers. [b]The incubator, Teknikdalen, has a selection criteria and business support strategy that fits this category. However, it has a regional mediation focus and has university colleges and government agencies as its main sources of research ideas. [c]Teknikbyns Företagsgenerator has a similar approach to business support and mediation but has a survival-of-the-fittest approach to selection.

Since the university-based TBI is an evolving merging phenomenon in South Africa, robust incubation approaches, strategies and model categories are yet to emerge. Nevertheless, what is known is that it often takes the form of academic entrepreneurship (ventures initiated by students, academics and support staff), *guest-based incubation* (involving TBIs that invite tenants from outside universities to participate in university incubation processes), government-sponsored/ promoted incubation (e.g., SEDA's publicly supported centres) and privately funded incubation.

Having discussed incubation selection criteria focusing on approaches, strategies and model categories, the subsequent discussion turns attention to the next TBI process, namely intellectual property and patenting.

3.6.2. Intellectual property and patenting

Having defined intellectual property and patents under the dimensions of technology business incubation in Chapter 2 (see Section 2.9.2), this section concentrates on the economic benefits of IP and patents, their articulation as measures of innovation success and incubation performance, and their contribution to incubation outcomes especially TE. In its various forms IP can contribute to technology development, prototypes, products, inventions and discoveries that contributes to multiple benefits for the new startups. These economic benefits of optimal deployment of technology, prototypes, products, effective interpretation of new information (Cohen & Levinthal, 1990) and establishment of optimal product designs (Rosenberg, 1994; Van Stijn, Van Rijnsoever & Van Veelen, 2018) are job creation, skills development, industry knowledge spillovers, national economic growth and regional development. At university level, IP is fundamental to the university's protection, wider rollout and commercialisation of technical knowledge from academic research (Van Stijn et al., 2018). IP and patenting are the backbone for technological breakthroughs for new startups because: (1) Protected knowledge serves as the foundation for opportunity recognition and business startups, (2). Universities can invest in the founding entrepreneurs/academics' prototype and service development (financial capital) for spin-offs and to facilitate the commercialisation of the licensed technology and (3). Patents constitute an effective source of credibility to startups as they demonstrate the novelty of a technology (Van Stijn et al., 2018).

Patenting and intellectual property rights are common measures of innovation success and incubation performance of incubation tenants. Rothaermel and Thursby's (2005) compared two mechanisms of technology transfer – licensing to a university, and backward citations from incubator firm patents to university patents or publications. Their study reported that firms with licenses had higher survival rates than those without, even though the absorptive capacity of the firms was more evidenced and calibrated by backward citations. Literature suggests that the number of patents applications filed and registered is another distinguishing measure of the impact of TBIs over and above the number of graduating firms and their survival rates (Özdemir & Şehitoğlu, 2013). As such, the level of innovation and incubation outcomes is assessed using the *number of approved intellectual property rights* (AIPs) granted by industrial professional associations to firms operating in TBIs (e.g., for product designs, software copyrights, printed circuit boards, or a new type of plant) (Xiao & North, 2018). However, it critical to understand that products for which intellectual property may be granted may not always be patentable (i.e., be amenable to filing for a patent) as they may not involve inventions - even though they represent innovative adjustments of practical value to ventures' competitiveness.

Despite the economic and social benefits already identified, licensing has its own fair share of challenges. For instance, the development of licensing procedures can be costly for firms as it involves a competitive and exorbitant cost of registration, validation of licenses as well as experienced staff. Moreover, universities' use of licensing and patentable technologies as an intervention to address economic sustainability challenges can undermine local economic development impact as most licensees often operate in different jurisdictions from the universities (Maxwell & Lévesque, 2011; Mian, 2011).

3.6.3. Incubator manager competence

The next section concentrates on the knowledge expected of incubator managers and incubatees, followed by skills and then behaviours expected of entrepreneurs.

3.6.3.1. Incubatee manager and incubatee's knowledge

Having articulated the types of knowledge relevant to TBI in general under the dimensions of TBI process in Chapter 2 (see Section 2.9.3.1), this section concentrates on the knowledge that incubator management must have, including the knowledge expected of incubatees. For new ventures, incubation managers with expert knowledge and talent are regarded as critical resources needed for the commercialisation of cutting-edge technologies (Powers & McDougall 2005; van Stijn et al., 2018). However, different types of industries and firms may require different types and combinations of managerial knowledge, which incubation managers might not always possess. Van Roy and Nepelski (2017) contend that high-tech industries' reliance on complex economic activities that depend on advanced and cutting-edge technologies means that they require more sophisticated and specialised (managerial) knowledge and skills as compared to low-tech industries employing traditional and mechanical technologies.

Despite the demands for specialised knowledge, research suggests that TBI managers are instrumental in identifying entrepreneurs who meet certain qualities. For instance, TBI managers have categorised some entrepreneurs into these architypes: team formers, proposition seekers, consumer hunters, model clarifiers and scalers (Miller & Stacey, 2014). Team formers are entrepreneurs seeking co-founders who complement their knowledge gaps. The assumption here is that no entrepreneur can possess a universe of solid knowledge relevant to all aspects of business creation and development processes ranging from financial, human resources, technology, entrepreneurial and technical knowledge. As such, entrepreneurs need to partner with other entrepreneurs to complement their knowledge gaps.

Proposition seekers are entrepreneurs seeking knowledge on the conversion of their ideas into well-developed venture propositions (Miller & Stacey, 2014). The premise of proposition seekers is that different forms of technical and networked knowledge may be required at different stages in the venture creation process. For instance, at idea generation and mind mapping stages, design thinking and networked knowledge is critical to the collation of ideas; at concept development stage, technical skills would be relevant; while at prototype development stage, design thinking and manufacturing knowledge would be important. Customer hunters strive for the formation of contacts with first customers (Miller & Stacey, 2014). The development of minimum viable product to satisfy the needs of the identified market necessitates the knowledge of the size of the market, marketing knowledge on strategies of approaching, attracting and retaining existing customers and business networking skills to retain loyal customers.

Lastly, model clarifiers and scalers are those entrepreneurs interested in testing their business growth models and those who have established their growth models but want to overcome scaling challenges such as new business relations (Miller & Stacey, 2014). One would anticipate both model clarifiers and scalers to require some business economics and marketing knowledge to appreciate concepts of minimum viable product, marginal utility and laws of diminishing returns, and the complexity of the market respectively, even though skills required of different archetypes tend to complement each other. For instance, both customer hunters and model clarifiers need fundamental knowledge on the size and dynamics of the market to launch their products and scale the reach of their products.

3.6.3.2. Skills

Skills are related to the performance of a craft, trade or job that requires manual dexterity or specialised training in a domain where an individual has experience and competence (Mmako, 2019). In his seminal work, Robert Katz considered three skills deemed fundamental to the performance of entrepreneurial processes, namely technical skills, conceptual skills and interpersonal skills (Katz, 1974). A technical skill describes practically oriented knowhow and ability of an entrepreneur to perform a specific task based on their training or experience. For an entrepreneur, this can involve scanning the environment to grasp and act on economic opportunities, knowledge of accounting principles to effect efficient record keeping and negotiate deals that bring optimal financial benefits to the venture. Conceptual skills are abstract thinking abilities required of entrepreneurs such as analysis of ideas, processes and predictive abilities (Mmako, 2019). This can involve abstraction, complex problem solving and critical analysis of issues such as interpreting financial information, developing strategic direction of the firm and unpacking the details of moving into complex markets. Interpersonal skills involve abilities for addressing human relations matters such as engaging with various stakeholders within and outside the organisation (Mmako, 2019). Good communication and negotiating skills are critical to engaging with stakeholders from diverse backgrounds and with competing interests in the venture.

3.6.3.3. Behaviours

Behaviours describe goal-oriented patterns of actions, inclinations and mannerisms that individuals exhibit in their environments. Therefore, entrepreneurial behaviour entails concrete and observable actions that are required to start and grow new organisations (Gruber & MacMillan 2017). It involves actions that demonstrate the capacity of individuals to identify opportunities in the market and turning them into profitable businesses (França, Frankenbach, Vereb, Vilares & Moreira, 2021). The behaviours central to entrepreneurial pursuit range from opportunity scanning, risk taking, creativity, innovation, resource mobilization and new business formation. Entrepreneurial behaviour, therefore, is central to understanding how entrepreneurs create, develop, maintain and grow new organisations (McAdam & Cunningham, 2019) and these behaviours are not exclusive to business formation but can be extended to behaviours displayed pre-idea conception to those evident in post-venture creation stages. In its entirety, entrepreneurial behaviour covers a collection of values of beliefs, intrinsic motivation, and self-determination to engage in entrepreneurial activities (Kirkley, 2016).

3.6.4. Incubation norms and procedures

Incubation norms and procedures can take different forms ranging from strategic objectives, methods of incubatee selection, funders' philosophy, focus of support and period of evolution (Subrahimanya & Krishna, 2021). The strategic objectives of TBI may range from identification of ventures with great potential for success that are constrained by resources, creating innovative and competitive firms that overcome the liability of newness and smallness (Salvador & Rolfo, 2011), commercialisation of research and technology through creating fully fledged firms (Sithole & Rugimbana, 2014) and fostering cross cutting technologies (e.g., nano technologies, biotechnologies) that have multiple industrial applications (OCED, 2010). From a funders' philosophy viewpoint, government funding institutions create TBI to generate employment, support regional economic development and support regional innovation ecosystems while private investors may foster the development of incubation ecosystems to fulfil their needs for profit generation. Tavoletti (2013) contends that the main goal regional policy makers such as government institutions in supporting TBI is promoting sustainable ecosystems and generating employment through the creation of innovative and technology-based ventures. The funding philosophy which includes funding strategies and models can range from rental fees, grants, loans, tax incentives and direct payments including the cycles of payments and repayment structures and periods for loans. The procedures of incubation may take the form of how, when and at which stages in the incubation life cycle can incubatees be admitted into incubation and at what stage the provision of support to incubatees must cease.

3.7. INDIVIDUAL ENTREPRENEUR LEVEL OUTCOMES OF TBI

While TBIs are often credited with generating broad social economic goals such as fostering employment opportunities, creating wealth, industry cluster development, enhancing links between multiple stakeholders, they also contribute to micro-level outcomes such as supporting individuals pursuing technology innovations, transferring technology and pursuing high growth potential for their firms (Davies, 2009; Startup Promotion for Entrepreneurial Resilience, 2015). Therefore, at individual entrepreneur level, TBIs support the expansion of the pool of talent, accelerating technology transfer, scaling-up capital availability and increasing managerial, technical and business knowledge (Bulsara, et al., 2009). TBIs can also support individual entrepreneurs' interactions with the external environment by increasing their networking capabilities, access to social capital and increasing the legitimacy of their venture founding activities (Amezcau et al., 2013).

3.8. PARALLEL STUDIES ON TBI AND THEIR TE CONSEQUENCES

While studies of TBIs abound, it is hard to separate real outcomes of TBI from best practices approach because TBIs either mask their failures in a bid to continually secure funding from partners (e.g., venture capitalists, government), or their association with universities may mean that they are shielded from external risks for the sake of protecting the university's reputation. For this study, "best practice" means the most efficient (least amount of effort) and effective (best results) way of accomplishing a task, based on repeatable procedures that have proven themselves over time for large numbers of people (Yamockul et al., 2019). TBI best practices are essential in improving university-based incubation performance as they serve as reference points for effective and acceptable entrepreneurial behaviours. The following section provides a summary of TBI studies on best university-based TBIs, their activities and outcomes.

Table 3.2: Summary of the world's best university-based TBIs with world class best practices of business incubation

University-based TBI name	Partners	Activities	Outcomes	Source
Selected US-Based TBIs				
Los Angeles Cleantech	University of California, University of	▪ Renders flexible office space,	▪ Development of cleantech startups	http://laincubatororg/

Incubator (LACI) -	Southern California, California State University in Northridge, California Institute of Technology and Otis College of Art & Design	▪ CEO coaching and mentoring, ▪ Access to capital and network experts, ▪ Locates and develops local talent, facilitates access to market.	▪ Increased job opportunities ▪ Bigger green economy in Los Angeles.	SUPER – StartUp Promotion for Entrepreneurial Resilience, 2015
1871 Programme	Northwestern University, University of Chicago, University of Illinois, Loyola University, Illinois Institute of Technology and DeVry University	▪ Renders programming, access to mentors, educational resources, and potential investors and entrepreneurial community to Chicago startups.	▪ Successful businesses & ▪ Entrepreneurial hub for digital startups.	http://www.1871.com/
StartX's Accelerator Programme, Stanford University	Works with venture partners such as Greylock Partners, Andreessen Horowitz, and Founders Fund	▪ Provides community, mentorship, education and partners to Stanford's top entrepreneurs, ▪ Covers multiple industries- consumer and enterprise IT, medical and hardware, ▪ Mentorship from over 200 serial entrepreneurs, experts, angels and VCs.	▪ Promote development of Stanford's top entrepreneurs. ▪ Raising over $700M with a $3M+ average per company funding rate from leading investors. ▪ Cloud computing and storage credits, developer platforms.	http://startx.com/
Harvard Innovation Lab (i-lab), Harvard University		▪ Multi-disciplinary venture incubation programme for Harvard students interested in entrepreneurship. ▪ Provides mentoring, workshops and community for entrepreneurial team teams.	Support entrepreneurship and innovation. Successful teams move to Launch Lab, a prototype co-working space and are supported through funded-alumni ventures.	https://i-lab.harvard.edu/
		Selected Canadian TBIs		
DMZ at Ryerson University		One of the top ranked TBIs in North America that: ▪ connect customers, advisors, influencers and other entrepreneurs, ▪ resolves economic /social problems, ▪ supports innovative deployment of technology.	▪ Prototype development, successful launching and fast-track venture growth through developing connections and programming.	https://dmz.ryerson.ca/about/dmz-model/
Innovate Calgary – University of Calgary	Research Services and the Office of the Vice-President (Research)	▪ Develops connections for stakeholders, ▪ Provides incubation programmes and services. ▪ Connects discovery to sustainable innovation	▪ Technology-transfer and business-incubation	http://www.innovatecalgary.com
		United Kingdom TBI		

SETsquared Partnership in the UK	University of Bath, University of Bristol, University of Exeter, University of Southampton and University of Surrey	▪ Develop student entrepreneurial talents. ▪ Assist academics realise the commercial impact of their research.	▪ Developing enterprise activities and create new hi-tech ventures for university partners.	http://www.setsquared.co.uk/
Imperial Innovations – Imperial College London	Cambridge, Oxford and London partners	A technology commercialisation company focusing on ▪ technology transfer, intellectual property licensing and protection, company incubation and investment. ▪ Runs seminars and events focusing on entrepreneurs and inventors.	▪ Building an entrepreneurial community that shares experiences of developing technology businesses. ▪ Commercialising promising innovation from therapeutics, med-tech, engineering and materials, and ICT fields.	http://www.imperialinnovations.co.uk/
Taiwan-based UBI				
Innovation Incubation Centre, Chaoyang University of Technology, in Taiwan	Chaoyang University of Technology	▪ Brings together academic research, R&D, and human resources of the university. ▪ Provides skills in advanced management and innovation to industrial entrepreneurs.	▪ Advancing industry-academic cooperation. ▪ Upgrading industries.	http://www.cyut.edu.tw/~incubatr/ushtml/1_1.php
Saudi-based TBI				
BADIR for Technology Incubation Programme, Saudi Arabia	King Saud University, King Abdulaziz University, King Fahd University of Petroleum & Minerals, Princess Nora Bint, Abdul Rahman University, Taibah University, Al-Baha University, Al-Qassim University and Al-Dammam University	▪ Fosters innovative ideas generated by Saudi techno-entrepreneurs. ▪ Facilitates scaling-up of their technology for industrialisation and commercialisation.	▪ Supports non-oil-based industry economic growth. ▪ Fosters knowledge growth and innovation-based startups.	Khorsheed et al., 2014
		Indian-based TBI		
Centre for Innovation, Incubation and Entrepreneurship (CIIE), at Indian Institute of Management, Ahmedabad	Department of Science and Technology, Government of India.	*Infrastructure support*, ▪ Promotes networks for technology, finance, mentoring and consultancy. *Information dissemination* ▪ Supports international networking. *Entrepreneurship Development* ▪ Facilitates the development of business plans, consultancy, case studies, dissemination of information, training programmes	▪ Supports technology-based innovations and use enterprises to commercialise them. ▪ Supports research and training on innovations and viable enterprises. ▪ Disseminates research findings on innovation management and incubation.	Bulsara, Gandhi & Porey, 2009

		▪ Apart from research, engages in training and consultancy, interactive workshops, and seminars.		
Nigerian-based TBIs				
Federal Ministry of Science and Technology (FMST) supported TBIs in Agege, Kano and Aba	National Office for Technology Acquisition and Promotion (NOTAP), National Technology Incubation Board	▪ Promote SMME linkages with corporations by acting as local suppliers. ▪ Commercialisation of R&D results. *Challenges* ▪ Limited national impact of incubation. ▪ Only 7% of the products emanating from incubation centres comes from the research system.	▪ Develop the national industrial base through commercialisation. ▪ Application of indigenous technologies. ▪ Create new innovative business engaged in value-added and low, medium and high-technology-related activities. ▪ Promote linkage between research and industry.	Adelowo, Olaopa & Siyanbola, 2012
South African Based TBIs				
LaunchLab, an initiative of Innovus, an industry interaction and innovation company of Stellenbosch University	Stellenbosch University, Nedbank, Santam, FinTech, AgriTech	▪ Facilitate valuable connections between startups & strategic industry partners. ▪ Facilitate the de-risking of startups and entrepreneurs' business ideas. ▪ Create their capacity to secure funding.	▪ Run incubation programmes, provide expert advice, ▪ Provide mentorship, access to corporate partners, ▪ Provide access to funding, along with office space and facilities across a network of university campuses.	https://launchlab.co.za/about/ https://launchlab.co.za/industry-engagements/
Wits Enterprise	Wits Enterprise's Innovation Support Unit	▪ Facilitates the research-to-products journey. ▪ Facilitates the development of new innovations (e.g., spinouts/incubation, negotiating commercial deals, intellectual property protection strategies) for commercial or social benefit.	▪ Identify promising innovations by our Outreach Scouts. ▪ Training on the "how to" of innovation, networking and partnerships. ▪ Getting the best intellectual property deals for researchers.	https://wits-enterprise.co.za/innovation-support

(Source: Adelowo, Bulsara, Gandhi & Porey, 2009; Olaopa & Siyanbola, 2012; Khorsheed et al., 2014; SUPER – StartUp Promotion for Entrepreneurial Resilience, 2015; LaunchLab, Wits Enterprise)

It is clear from Table 3.2. that the outcomes of technology entrepreneurship can be categorised into individual-level (entrepreneurs' technological expertise; individual technological innovations, use of indigenous technologies), firm-level (knowledge transfer, commercialisation of innovation, ventures' innovation capabilities), industry level (ventures' linkages with strategic partners) and national-level outcomes (employment creation, national economic growth). That said, university-based TBIs are often concerned more with knowledge spillovers, linking new ventures to venture capital, commercialisation of technological innovations and protection of IP than with economic growth and creating jobs and expanding the high-tech industrial base – which is the domain of science parks and innovation centres.

3.9. ENTREPRENEURIAL COGNITION AND TBI

Although the researcher could not find literature that makes direct links between entrepreneurial cognition and TBI, there is literature that makes some cursory reference to the interaction between cognition, venture creation and entrepreneurial intentions. For instance, since business incubation and venture creation are cognitive-intensive activities that demand the entrepreneurs to develop strategies for engaging with the external environment (e.g., market conditions, financiers, customers and employees), research suggests that each entrepreneurial phase demands a different set of cognitive abilities (Kickul et al., 2009). These views can be expanded by arguing that possession of entrepreneurial cognition is not an exclusive preserve of the entrepreneurs but rather of TBI managers as well because incubation selection strategies (for example those proposed by Bergek & Norrman, 2008) demand knowledge of the individual entrepreneur' cognitive traits, the incubatee' value proposition and knowledge of the market dynamics in relation to the sale of technology products and services.

Mirjana, Ana and Marjana (2018) explored whether innovative cognitive style is a significant determinant of entrepreneurial intentions of undergraduate students at a university in Slovenia and reported that innovative cognitive style was significant in creating one's intention to become an entrepreneur. Similarly, Liñán, Rodríguez-Cohard, Rueda-Cantuche and Martínez (2005) examined the relationships between perceived feasibility, personal attitude and entrepreneurial knowledge as cognitive variables for engagement in entrepreneurial behaviour. Evidence demonstrates that while perceived feasibility and personal attitude towards entrepreneurship significantly shape entrepreneurial intentions, entrepreneurial knowledge has no direct effect on intention but has an indirect effect on perceived feasibility.

3.10. ENTREPRENEURIAL COGNITION AND TECHNOLOGY ENTREPRENEURSHIP

Most literature on entrepreneurial cognition-technology entrepreneurship relationship is complex because: first, although it has explored many relevant variables, research on entrepreneurship cognition has failed to fully articulate key conceptual features of the cognitive perspective (Grégoire, Corbett & McMullen, 2011). For instance, some cognitive concepts straddle entrepreneurial personality and cognitive domains such as emotions, affect and passion – thereby complicating the delineation of purely cogitative from personality concepts. Second, this literature discusses the effects of entrepreneurship cognition on entrepreneurship and not necessarily technology entrepreneurship per se. For instance, Hird's (2012) exploration of the impact of entrepreneurial cognition on the founding of new ventures revealed that awareness of the cognitive style of an entrepreneur is instrumental to incubators and funders who support and advise nascent entrepreneurs. Moreover, such awareness facilitates individual entrepreneurs' recognition of their strengths and weaknesses when developing appropriate strategies for successfully launching their business.

Entrepreneurship literature suggests that possession of entrepreneurial cognition is fundamental to the recognition and exploitation of technological opportunities (i.e., technology entrepreneurship) by individuals and by private or public organisations (Urban, 2015). Mao (2015) explored the effect of entrepreneurial cognitive factors on new product innovation (itself a dimension of technology entrepreneurship) in 37 countries. His study established that technology entrepreneurship is a consequence of cognitive factors that technology entrepreneurs deal with such as perception of risk and knowledge acquisition. He argues that to transform their ideas into business models and to commercialise these ideas, technology entrepreneurs must reduce the perception of risk for investors, continually update their technical knowledge and incorporate customer's perceptions and feedback during new product development (Mao, 2015).

Eesley and Roberts's (2012) study explores the role of cognitive resources such as innate talent and entrepreneurial experience in the entrepreneurial performance of new technological ventures. Their findings show the context-dependent nature of the bi-directional relationships – acknowledging that in situations where the technology or the market is familiar, experience tended to exert more influence on entrepreneurial performance of these technology ventures and vice versa. When the conditions are unfamiliar, entrepreneurs need to tap into their talents such as innovation and creativity to transform the market conditions in ways that advance technology entrepreneurship. Cho and Linderman (2019) explore the role of metacognition (i.e., the higher-order process controlling existing knowledge structure or [cognition]) in process improvement practices (a component of commercialising innovations) of United States based firms. The results establish a positive association between managerial metacognition and adaptive process improvement practices. The study further reports that managerial metacognition and implementation of process improvement practices positively impacted the performance of firms.

3.11. PERCEIVED ENTREPRENEURIAL CAPABILITIES AND TBI

Although TBI is conceived as fundamental to the commercialisation of ideas, such TBI is fueled by PEC. For instance, the possession of entrepreneurial capability is essential to the success of incubation process areas such as protection of intellectual property rights (IPR), prototyping activities, market research, product development, technology venture creation, writing business plans, licensing and royalty agreements (Hannon, 2003; Khalid et al., 2010). Similarly, TBI managers are expected to demonstrate various forms of entrepreneurial capabilities such as financial capability, analytical capability, business function capability, interpersonal capability, and networking capability if they are to effectively provide TBI professional services (Khalid, Gilbert & Huq, 2010). As such, PEC is perceived as a strong predictor of TBI in literature.

The possession of PEC is critical to the identification and exploitation of business opportunities by entrepreneurs who operate in incubation centres. Literature recognises entrepreneurial capacity, which drives opportunity identification, as a critical identity of entrepreneurial firms – those that are adept at identifying potential for aligning internal and external resources to market needs (Miller, 1983; Sathe, 2003). As such, entrepreneurial perceptions of demand (latent and real) for products and services in the market and resources needed to fulfil such demand are fundamental to the realisation of productive opportunity (Lockett, Hayton, Ucbasaran, Mole & Hodgkinson, 2013), which makes business incubation possible. By extension, the capability to recognise and exploit specialised and complementary technological and financial resources that create value for the firm and products and services for the market are the fundamental essence of TBI. This gels well with literature that emphasises the centrality of PEC in enabling enterprising firms to recognise business opportunities in markets and effectively co-ordinate economic resources in realising these opportunities (Rae 2014; Ndofirepi & Rambe, 2016) through entrepreneurship and incubation processes.

3.12. PERCEIVED ENTREPRENEURIAL CAPABILITIES AND TECHNOLOGY ENTREPRENEURSHIP

There is consensus that PEC is fundamental to the realisation of technology entrepreneurship (Krueger, 2000; Karra, Philips & Tracey, 2008; Nacu & Avasilcai, 2013). The realisation of venture creation and technology entrepreneurship is a consequence of the identification and exploitation of entrepreneurship in the environment through the harnessing of PEC (Krueger, 2000). One could infer from Krueger (2000) that opportunity identification and exploitation mediates the relationship between PEC and technology entrepreneurship – hence the relationship between PEC and TE is not direct. However, technology entrepreneurship may not happen if entrepreneurs do not have the cognitive navigation skills for the identification and exploitation of these opportunities. As such, prospective entrepreneurs must have PEC if they are to successfully incubate new ventures (Hechavarria, Renko & Matthews, 2012) and guarantee technology entrepreneurship. This gels well with evidence on the capacity of PEC to shape entrepreneurship intentions (Tsai, Chang & Peng, 2016), which are considered integral to venture creation and technology entrepreneurship (Ndofirepi, 2016; Ibrahim & Schøtt, 2018). However other researchers consider PEC as a mediator of environmental conditions-venture creation relationship (Edelman & Yli-Renko, 2010), which is critical to the realisation of technology entrepreneurship.

3.13. CHAPTER SUMMARY

This chapter rendered a comprehensive conceptual account of the individual antecedents of university-based TBI and its outcomes. The chapter unravelled the concept of university-based TBI and acknowledged the murkiness of the concept. At the coalface of TBI, however, was the centrality of the integration of technology, talent, capital resources and knowhow notwithstanding the diverse variants relating to this complex concept. The chapter then proceeded to provide an overview of the support regime rendered by university-based TBIs, appreciating the fact that these entities could be designed to offer single-purpose, dual purpose or multi-purposes.

The chapter examined individual factors affecting TBI and its outcomes, emphasising the predominance of entrepreneurial literature that unpacks factors affecting venture creation, entrepreneurial intentions and entrepreneurship in general and not TBI in particular. While recognising the diversity of factors affecting of university-based TBI, the chapter concentrated on EC and PEC as main antecedents, unpacking their dimensions and attendant perspectives, and operationalising them. Since EC was often confused with many concepts from cognitive science, cognitive psychology and meta-cognition, attention was devoted to making the distinctions from its close psychological variants and associates and clarifying its relationships with several concepts. To the extent that PEC is also a muddied concept, a similar approach was also adopted in which the concept was discussed in relation to its associates (e.g., other forms of capabilities, entrepreneurial self-efficacy), its relations with TBI and incubation outcomes especially TE. Since business incubation predominantly underscores venture creation and the entrepreneurship process, these concepts were factored into this discussion to ensure that TBI was understood in context.

The next chapter shifts its focus to institutional level factors affecting TBIs and their relationships with TBI and incubation outcomes

CHAPTER FOUR
INSTITUTIONAL FACTORS AFFECTING UNIVERSITY-BASED TECHNOLOGY BUSINESS INCUBATION AND THEIR OUTCOMES

4.1. INTRODUCTION

The previous chapter examined individual level factors affecting university-based technology business incubation (TBI), assessed the complex TBI processes and dynamics at play inside the incubator and individual level (i.e., at incubatee and individual entrepreneur levels) outcomes of TBI. The chapter also evaluated parallel studies on TBI and its consequences, several relationships relating to individual level antecedents of business incubation and incubation outcomes. This synthesised literature was critical to understanding the reality that the cognitive disposition (especially entrepreneurial cognition) of the entrepreneurs and their individual capabilities (especially perceived entrepreneurial capabilities) are fundamental to the realisation of technology business incubation and technology entrepreneurship (TE) in university contexts.

Appreciating that individual determinants of business incubation do not unfold in a vacuum but are facilitated and disrupted by institutional systems, resources, procedures and constraints, the current chapter builds on this understanding and focuses on the institutional factors that are at the heart of TBI and the realisation of effective TBI outcomes, especially TE. The chapter discusses the incubation incentive and support regimes of university-based technology business incubators (TBIs) and incubatees, which comprises different forms of capital, and their relationships with TBI processes and incubation outcomes. Structurally, the chapter is designed to deal with the conceptualisation and the application sections. The conceptualisation section discusses the history of different forms of capital, classifications of capital forms, dimensions of capital, types of capital, benefits and challenges of exploiting each capital form. The application section interrogates the relationships between (a) incubator incentive and support regimes (i.e., various capital forms) and TBI and (b) incubator incentive and support regimes and TE. However, since the technology business incubation-technology entrepreneurship relationship was explored in the previous chapter, it is excluded from this chapter to avoid repetition. Ultimately, the chapter engages with the postulated relationships that unfold at institutional levels captured in the conceptual model in the conceptual chapter (see Figure 6.1. in Chapter 6).

4.2. SUPPORT REGIME OF UNIVERSITY-BASED TBI- AN OVERVIEW

The support regime describes the range of support such as real estate resources and financial resources (Hausberg & Korreck, 2018), social and business networks support for incubation tenants to network with peers and external actors (Bruneel et al., 2012) and intellectual support such as training and coaching programmes (Patton & Marlow, 2011) that an incubator provides to its incubatees to facilitate successful

TBI. The incubators' provision of services and resources, such as a physical infrastructure, business services, specialised technological knowledge, and a comprehensive support network (Bruneel et al., 2012; Theodorakopoulos et al., 2014) provides multiple benefits as elaborated in the sections that follow.

4.2.1. Availing inaccessible and expensive physical resources

The provision of physical capital (e.g., shared offices, co-working spaces and laboratories and facilities such as equipment) by incubators is credited with availing inaccessible and expensive resources and increasing the economies of scale for technology startups (Bergek & Norrman, 2008; van Weele, Rijnsoever & Nauta, 2017). In the same vein, the rendering of seed investment capital (short- or long-term) is critical to overcoming credibility challenges of technology ventures (World Bank, 2014b) such as lack of collateral, unreliable credit history and lack of financial management history. Since technology startups require large sums of money for research and development at the pre-sales stage (Westhead & Storey, 1997), financial institutions perceive technology startups as high-risk investments because of the novelty and complexity of their technology innovations (Carpenter & Petersen, 2002). Therefore, incubators may either serve as guarantors when external funding is provided or may increase credibility of tenants when funding proposals are submitted to investors, private and public funding agencies.

4.2.2. Boosting incubatees' networks

Provision of social networks enables access to resources owned by other stakeholders which can substitute or complement those that incubation tenants own (Borgatti & Foster, 2003; van Weele, Rijnsoever & Nauta, 2017). As such, by providing business and social networks, TBIs facilitate the convergence of entrepreneurs, investors, volunteers, and service providers, thereby adding value to incubation tenant activities (World Bank, 2014b). Since technology startups may not have established stable and trustworthy networks (Stinchcombe, 1965; Hughes et al., 2007) due to the tragedy of smallness and newness, drawing on incubators' established networks renders significant benefits of linking technology incubatees with external stakeholders (Bergek & Norrman, 2008; Soetanto & Jack, 2016).

4.2.3. Availing intangible intellectual resources

While technology startups may possess technical and technological knowledge to facilitate the founding of their businesses, literature suggests that they often lack managerial and entrepreneurial experience and business knowledge of venture creation (Sullivan & Marvel, 2011). The provision of training, mentoring and coaching services in marketing, finance management, business model development and general administration to incubatees narrows their knowledge and expertise gaps in exploiting market opportunities. At best, such intangible resources that incubators make available contribute to incubatees' experience in their business domains (Rice, 2002; van Weele et al., 2017).

4.3. INCENTIVE REGIME OF UNIVERSITY-BASED TBI: AN OVERVIEW

Incentive regimes are predominantly intangible resources and services which government departments and other public institutions render to newly established businesses to thrive. These may take the form of fiscal incentives such as corporate tax breaks, customs and excise incentives for importing and exporting particular goods, and incentives for investing in certain economic and industrial sectors. With reference to Chinese TBIs, common incentives include elimination of legislative barriers on new firms through TBI's liaison with local government, the facilitation of incubatees' bidding processes and winning of contracts, provision of training on policy matters and providing accommodation and entertainment to business founders and their staff (Xiao & North, 2018). For instance, technology and management guidance incentives from Taiwanese government subsidise 60% of total costs of consulting activities of technology-based firms in the country. The high-technology industries co-located in the Hsinchu Science Based Industrial Park also receive diverse tax incentives, low interest loans, R&D and manpower training grants, and are permitted to import equipment and materials duty free (Conceicão, Gibson, Heitor & Shariq, 2000). While the use of incubator incentives may not directly impact innovation activity, they generate a conducive environment for implementing new ideas, facilitating the development and commercialisation of these innovations (Xiao & North, 2018).

Lalkaka (2006) documents the range of incentives that incubators and governments could provide to incubatees to ease their settling into incubation processes. These include provision of government properties as premises, facilitating accounting standards, promoting of a banking culture among incubatees, providing advice on taxation, stock markets, foreign investment, prevention of bankruptcy, and resolving disputes. During the Covid-19 pandemic in South Africa, the government provided various relief funds to existing and newly incubated businesses. The South African Reserve Bank also served as guarantor of funds lent by commercial banks to small businesses. However, the uptake of these schemes by commercial banks was low due to the strict lending conditions imposed by the government. For instance, the government would abrogate its guarantor responsibility if lending by banks violated certain conditionalities (e.g., the need for borrowing firms to have a physical address, audited statements, and proof of banking account).

4.4. SUPPORT REGIME OF UNIVERSITY-BASED TBI

When the support and incentive regimes of university-based TBIs are disaggregated, their dimensions can be grouped into physical capital (Le Van, Nguyen & Nguyen, 2014; Levy, 2017), social capital (Fine, 2010; Ramorena, 2016) and intellectual capital (Calza, Dezi, Schiavone, & Simoni, 2014; Barreira, 2015). In classical economic thinking, physical capital represents a collection of personal holdings and trade investments of capitalists (Marshall, 1961; Farr, 2004), comprising physical objects (Putnam, 2000) such as finance, land, buildings, machinery, laboratories, shared spaces and equipment. While the physicality and tangible nature of physical capital is uncontested, focusing on tangibility of capital creates problems in classification as there are some capital forms that carry existential properties but no material form such as Wi-Fi networks, economic and environmental capital - making physical capital definitionally chaotic. As such, the tendency to refer to any resource as physical "capital" has precipitated a "plethora of capitals' (Baron & Hannon, 1994), and has been dubbed the syndrome of capitalising (Fine, 2010).

Social capital denotes "the sum of the resources, actual or virtual, that accrue to an individual or a group by virtue of possessing a durable network of more or less institutionalised relationships of mutual acquaintance and recognition" (Bourdieu & Wacquant, 1992: 119). This definition projects social capital as resources that inhere in individuals by virtue of their affinity to and engagement in relationships of social value in institutional networks. Therefore, the generation and sustenance of social networks necessitates the participation of individuals in relationships of reciprocity and social exchange. For Putnam (2000: 19), social capital denotes "connections among individuals - social networks and the norms of reciprocity and trustworthiness that arise from them." When conceived operationally and instrumentally as resources that reside in a social network accessible and exploitable by members of a network, social capital exhibits two properties. First, social capital constitutes those resources inherent in social relationships rather than individuals. Second, the access and exploitation of those resources is exclusively the preserve of members of that network (Lin, 2001a; Andriani, 2013). Compared to other capital forms (e.g., physical, human and financial capital), which are fundamental to the allocation of resources, optimisation of efficiency and generating equilibrium in the market, social capital captures those resources that are not private (i.e., individually possessed) and tangible, which are integral to economic performance (Fine, 2010). The argument is that while physical, human and financial capital can be privately owned and possessed, social capital falls outside the realm of the private market and economic framing of resources.

Intellectual capital is a property of individuals and finds expression in capabilities, knowledge, abilities and expertise. For instance, Barreira (2015) conceives it as comprising individual attributes such as cognitive complexity and capacity to learn, tacit and explicit knowledge, as well as skills and expertise that an individual builds over time. However, this private property-based definition of intellectual capital is not without contestation as other authors embrace collectivist perceptions of the concept. In these divergent perceptions, intellectual capital is defined as the knowledge and knowing capability of a social collectivity, such as an organisation, intellectual community or a professional community of practice (Nahapiet & Ghoshal, 1998). If social collectivities such as organisations and institutions are macrocosms of microcosms, it can be argued that although intellectual capital often manifests as an organisational property in firms, its origins lie in individual mental properties. That said, intellectual capital contributes directly to organisational outcomes such as their acquisition of intangible assets, launching subsidiaries in international markets and overcoming competition by incubated firms (Calza et al., 2014).

4.5. CLASSIFICATION OF PHYSICAL CAPITAL

Broadly conceived, physical capital can be divided into fixed and working capital. These are elaborated in sections below.

4.5.1. Physical capital

Physical capital describes the stock of physical structures such as buildings (e.g., laboratories, shared spaces and factories) and infrastructure (e.g., roads, water, sewers) (Green & Haines, 2008), employed in the production process. It constitutes real estate and other physical material properties that are employed by entrepreneurs as factors of production. These production factors include tools, machines and buildings that are durable and do not get exhausted abruptly (Topper Learning, 2017).

4.5.2. Working capital

Working capital constitutes the share of financial assets that a firm has and comprises the firm’s short-term current assets and liabilities (Hall & Kruiniker, 1995). In accounting terms, working capital such as liquidity (i.e., cash available for use) and raw materials are easily consumed in the process of production and are transitory in nature (Topper Learning, 2017). Current assets include financial assets namely cash, account receivable and inventories that are easily convertible into cash, while current liabilities include accounts payable and short-term debts (Hall & Kruiniker, 1995). Since working capital constitutes a critical resource to the routine operations and viability of the firm, it is a good indicator of the firm’s liquidity.

Yet the classification of money as a form of physical capital is problematic as finance is often considered as another form of capital on its own (i.e., financial capital). Sharafeddine (2016) argues that financial capital can be distinguished from physical capital and these capital forms possess different types of factor prices. Moreover, unlike physical capital, in Islamic banking, Sharia law forbids financial capital from earning interest. By extension, there are other classifications of physical capital that are not necessarily money or real estate such as economic capital. As such, these nuances complicate the grasp of types of physical capital.

4.6. CLASSIFICATION OF SOCIAL CAPITAL

Two distinct classifications of social capital are evident in literature. The first classification organises social capital in terms of structural, relational and cognitive social capital (Castro & Roldan, 2013; Sanchez-Famoso, Akhter, Iturralde, Chirico & Maseda, 2015), while the second classification structures social capital from three dimensions: bonding, bridging and linking social capital (Kim et al., 2013; Tundui & Tundui, 2013). Although both classifications are ways of understanding the constitution of social capital, neither of them is better than the other and their adoption in scholarly works is a matter of preference and relevance to context. Janine Nahapiet and Sumantra Ghoshal developed the first classification, which is more popular and widely adopted in entrepreneurship literature (Nahapiet & Ghoshal, 1998; Alvani, Nategh & Farahi, 2007). The second classification was developed by Mark Granovetter in his discussion of strong and weak ties (Granovetter, 1973) and expanded by Robert Putnam who made a distinction between internal and external social capital (Putnam, 2000). Since the two approaches are ways classifying of social capital based on its dimensions, these individual dimensions are elaborated under the section on social capital dimensions to avoid repetition.

4.7. CLASSIFICATION OF INTELLECTUAL CAPITAL

The classification of intellectual capital is messy and heavily contested. For example, whether intellectual capital is classified as a component of human capital or whether human capital is conceived as one of the dimensions of intellectual capital remains a grey area (Gratton & Ghosal, 2003; Calza et al., 2014; Ntshangase, 2020). Following, Gratton and Ghosal's (2003) classification, the types of human capital are social capital, intellectual capital and emotional capital. Social capital captures the structure and quality of network relationships, sociability and trustworthiness, while intellectual capital comprises tacit and explicit knowledge, specialised skills and expertise including cognitive complexity (Barreira, 2015). Emotional capital covers the psycho-affective components of the mind such as self-awareness, resilience, integrity and courage (Barreira, 2015). Gratton and Ghosal's (2003) classification differs from Calza et al.'s (2014) as discussed under dimensions of IC.

In contrast to Gratton and Ghosal's (2003) classification, if no specific reference were made to intellectual capital but rather is imputed under the generic concept of human capital, then human capital can be broadly classified into two types namely *general human capital* and *specific human capital*. General human capital captures general education and practical experience while specific human capital relates to education and practical experience applied in a specific context or scope of application (Gimeno et et al., 1997). Barreira (2015) elaborates that general human capital entails education, entrepreneurial business knowledge, entrepreneurial training, entrepreneurial experience and other forms of human capital accumulation such as opportunity recognition, personal traits and information acquisition.

The most celebrated classification of intellectual capital is that of Thomas A. Stewart (1991) who classifies intellectual capital into three main components namely: *human capital*, *organisational capital* (also called structural capital) and *relational capital*. Suffice to say, human capital encapsulates the competencies (i.e., knowledge, skills and abilities), education, training, experience, and value orientation of an organisation's workforce embodied in the psychology of individuals (Virkus, 2014). Structural capital represents "the codified knowledge bases that do not exist within the minds of employees (but exist in databases, filing cabinets and organisational routines)" (Bontis & Fitz-Enz, 2002: 225). Relational capital are those resources deployed to the relationships between organisations and their stakeholders (i.e., customers, investors and suppliers) including the knowledge embedded in these external relations (Gioacasi, 2014). It covers both internal and external relations of value to the organisation. Since this classification is often also discussed as dimensions of intellectual capital (Calza et al., 2014), these three components of intellectual capital are discussed under dimensions of intellectual capital to prevent repetition.

4.8. DIMENSIONS OF CAPITAL FORMS

Having discussed some classifications of physical, social and intellectual capital to identify their underlying elements, it is critical to turn attention to the dimensions of each of these capital forms so that their constituent elements can be fully appreciated. The subsequent sections, therefore, articulate the dimensions of physical capital, social capital and intellectual capital.

4.8.1. Physical capital dimensions

Kataria, Curtiss and Balmann (2012) argue that in economic theory, there are three factors of production that summarise capital forms, which are physical, human (labour) and land (natural resources) capital. Physical capital denotes an asset that is used in production and which is manufactured by humans (Johnson & Quance, 1972). It comprises machinery, vehicles, equipment, buildings, shared offices, and technological gadgets as its main dimensions. In short, physical capital (also called fixed capital) comprises all assets employed in the production process, which are reproducible and whose depreciation spans over a longer period of time.

In terms of its main characteristics, physical capital can be described in terms of its tangibility, durability, mobility and reproducibility (Kataria, Curtiss & Balmann, 2012: 2) (see Table 4.1). Tangibility denotes the capacity of the asset to have a physical and material form. In TBI, some assets are tangible (finance, buildings, offices, shared spaces, equipment and technological gadgets). Durability encapsulates the potential of the asset to be deployed in the production process over an extended period. Office complexes, computers, printers, and equipment have different life spans and they are integral to the incubation of businesses. Mobility describes whether the asset can be shifted across different geographical locations while reproducibility deals with whether the asset can be replicated. Although laboratories and offices are immovable assets, makerspaces can be reconfigured in support of the development of business prototypes and products.

Table 4.1 illustrates dimensions of physical capital and their properties. Since the development and survival of TB firms is tied to the exploitation of different forms of physical capital in the production processes, incubator tenants must be privy to the range of physical capital that they need and their associated properties to ensure their efficient and effective deployment in the realisation of business goals.

Table 4.1: Categorisation and dimensions of physical assets used in production

Categorization	Definition	Examples relevant for agricultural production	Assets in this category can be (but are not necessarily) labelled as physical capital according to its standard definition[+]
Tangibility[++]			
Tangible	An asset whose value depends on certain physical properties. It has a physical form.	Buildings, machinery, different types of facilities and equipment used in agricultural production	Yes
Intangible	An asset that do not have a physical form.	Human capital, managerial skills	No
Durability[+++]			
Durable (fixed)	An asset used repeatedly over several production periods	Buildings, machinery, different types of facilities and equipment used in agricultural production	Yes
Non-durable (variable)	An asset used within the current production period	Seed, fertilizers, pesticides	Yes
Mobility			
Mobile	An asset that does not have a fixed localization (can be moved).	Machinery, equipment	Yes
Immobile	An asset that has a fixed localization (cannot easily be moved).	Land, buildings, facilities that cannot (easily) be moved	Yes
Reproducibility[++++]			
Reproducible	A tangible asset that can be matched or duplicated	Buildings, machinery, equipment, different types of facilities and equipment used in agricultural production	Yes
Non-reproducible	A tangible asset that cannot be reproduced (i.e. it is unique)	Land	No

(Source: Kataria, Curtiss & Balmann, 2012:3)

4.8.2. Social capital dimensions

Theorists such as Pierre Bourdieu, James Coleman and Robert Putnam laid the foundation for a comprehensive understanding of dimensions of social capital. Arguing from an individual perspective, Bourdieu (1986) articulates two dimensions of social capital namely *group membership* and *social networks*. He argues that the amount of social capital an agent possesses is a function of the network of connections s/he has. Membership in groups including involvement in social networks arising from such membership can be deployed to elevate one's position in such networks (Siisiainen, 2003). James Coleman shifted attention from individual analysis of social capital to social structures. Coleman's (1988) dimensions of capital include ways of creating social capital (such as *reciprocity expectations* and group enforcement of *social norms*); outcomes of social capital (e.g., privileged access to information); as well as social organisation. Arguing from a societal perspective, Putnam (2000) distinguishes social network as comprising norms, networks and trust. These social capital dimensions improve the efficiency of society by facilitating coordinated actions among citizens (Putnam et al., 1993). Despite the firm foundation on different dimensions of social capital these theorists laid, the most used dimensions in entrepreneurial literature are those of Nahapiet and Ghoshal and Granovetter. These dimensions are elaborated in subsequent paragraphs.

4.8.2.1. Nahapiet and Ghoshal's classification

Nahapiet & Ghoshal (1998) classified social capital according to its dimensions: structural, relational and cognitive. These dimensions are elaborated in sections below.

4.8.2.1.1. Structural capital

The structural dimension involves mutual relations of network condensation, which refers to the proportion of individuals in relation to actual number which people may possess - when real relations are closer to the total value of relations, the network is condensed (Kai, Jingyin, & Jie, 2009). Structural dimension concerns the properties of the social system and of the network of relations in their entirety (Nahapiet & Ghoshal, 1998). It covers network components and facets such as the presence or absence of ties between parties, the structure of a network, the density of relationships, structural holes in networks, formality and informality of networks, and the connectivity in networks (Muniady et al., 2015). The structural dimension examines how the social network is configured including how such configuration enables or hinders access. Tsai and Ghoshal (1998:465) emphasise the significance of an actor' location in a social structure of interactions and its capacity to serve as a conduit for accessing job opportunities, information and resources. Therefore, by examining a TBI tenant's location in a configuration of social and business relations, their proximity to these networks, their potential access to various social resources could be established.

4.8.2.1.2. Relational capital

Relational capital concerns the characteristics and quality of personal relationships individuals develop with others through a series of interactions (Nahapiet & Ghoshal, 1998) such as such as shared history, trust, respect, and friendship (Muniady et al., 2015). It focuses on norms, expectations and trust levels generated via repeated interactions within the network (Ramorena, 2016). Obligation, social norms and sanctions are all embodied in the relational dimension (Nahapiet & Ghoshal, 1998). The fulfilment of an obligation to develop a business plan by an incubatee can create an expectation that the TBI would inevitably avail funding and technical support to the incubatee.

4.8.2.1.3. Cognitive capital

Cognitive capital refers to resources that provide shared representations, interpretations, and systems of meaning among parties (Nahapiet & Ghoshal, 1998). It captures the shared norms, systems of meanings and values developed through relationships and this form of capital has been the least studied of the three (Muniady et al., 2015). The *cognitive dimension* of social capital encapsulates interpretive schemes, codes and languages which agents belonging to the same network share and make reference to when making sense of their actions, behaviours and when interacting in the environment (Nahapiet & Ghoshal, 1998). The assumption is that stakeholders belonging to the same incubation community would have common interpretive schema and repertoires for interpreting behaviour (e.g., bidding processes, prototyping and value proposition) and rules for regulating their engagement (e.g., evaluating grant proposals). Yet these implicit schema may not be commonly understood as stakeholders may display different levels of maturity and engagement depending on their duration of initiation into the incubation community and their level of entrepreneurial expertise.

4.8.2.2. Granovetter and Putnam's classification

Mark Granovetter popularised two dimensions of social capital by integrating the embedment of resources and networks, namely weak (i.e., bridging ties) and strong ties (bonding ties). Putnam (2000) in his discussion of civic action in the United States added linking capital. These dimensions are elaborated in the next sections.

4.8.2.2.1. Bonding capital

In *The Strength of the Weak Ties*, Granovetter (1973) argues that individuals who belong to close circles of affinities and ascriptions such as family, friends and colleagues often share similar information by virtue of belonging to the same network (i.e., *bonding capital*). While the bonding view of social capital is credited with explaining social cohesiveness that supports the realisation of collective intentions (Putnam, 1995; Bhandari & Yasunobu, 2009), it is insufficient for elucidating relations that unfold outside one's close affinities or common identity. In short, bonding capital captures the internal structure of relations among actors within a collectivity identified by affinity or ethnic belonging (Adler & Kwon, 2002).

4.8.2.2.2. Bridging capital

When individuals need different resources and information, they naturally explore other networks outside their closed network to access these resources and information (i.e., *bridging capital*) (Adler & Kwon, 2002). Bridging capital denotes external relations between actors and other actors belonging to other networks (Adler & Kwon, 2002). Although the bridging view illuminates understanding of the actions of persons or collectivities enabled by direct and indirect networking with other actors belonging to external networks (Burt, 2007; Acquaah, 2008; Ramorena, 2016), it fails to account sufficiently for resources shared within identity-based networks.

4.8.2.2.3. Linking capital

Apart from bridging and bonding capital, the other type is linking capital. It describes the interactions and relations between people of different social standing. Linking capital is a vertical linkage to the extent that it is founded on connections among individuals possessing differential levels of power or social status such as those that unfold between politicians and citizens or among persons belonging to different social classes (Woolcock 2001; Bayat, 2005). Since firms are incubated and operated in communities, their entrepreneurs may constantly interact with government officials, technical experts, sponsors and financiers in order to access linking and institutional capital, specialised expertise and secure funding respectively, which have the potential to increase survival and sustainability of these firms.

4.8.3. Intellectual capital dimensions

Another concept whose definition and dimensions defy precision is intellectual capital (IC). To the extent that IC is often conceived as a productive resource that is the property of collectivities and organisations, this characterisation fails to sufficiently capture the role of individual workers in its creation. This is because the knowledge, capabilities and skills that ultimately accumulate and coalesce as organisational assets often originate and develop as individually owned properties of individual workers who externalise and expend them for the realisation of organisational goals.

The controversy around IC dimensions rose to prominence as intellectual capital progressively overtook finance as the most critical resource of contemporary firms. Entrepreneurial firms such as those operating in consultancy, investment banking and IT services have realised that knowledge rather than money differentiates the competitiveness of firms (Barreira, 2015). Gratton and Ghosal (2003) conceive IC as comprising knowledge, skills and expertise of individuals, and constitutes one element of human capital over and above social and emotional capital. Calza et al. (2014) contest this classification of IC as a component of human capital and rather postulate human capital as the most critical dimension of IC. The subsequent sections discuss their characterisation of IC.

4.8.3.1. Human capital

Following Calza et al.'s (2014) discussion of IC dimensions lands us on three constructs underpinning IC namely, human capital, structural capital and relational capital. Human capital is defined as "knowledge, talent and experience of employees" (Bontis & Fitz-Enz, 2002, p. 225). Pursuant of this definition, it is possible to consider entrepreneurial human capital, which describes the knowledge, skills and abilities required to start and operate a firm successfully (Barreira, 2015), as a dimension of human capital. As such, knowledge relating to opportunity identification, validation and exploitation as well as skills in navigating the business' domestic and foreign markets, are encapsulated in entrepreneurial human capital, a component of human capital. Human capital derives from the resource-based view of the firm (Peteraf, 1993) because human capital variables (e.g., education, experience and tacit knowledge) constitute reasonable proxies for scarce skill (or skills costly to acquire) that drive superior firm performance (Zarutskie, 2008; Barreira, 2015). In a TBI context, numbers of staff in incubator management team, proportion of bachelor's degree employees to total number of employees, proportion of employees with more than three years of experience to total staff, the total number of experts, motivation index, competencies of employees and number of staff who received training, all constitute measures of human capital (Hongli & Lingfang, 2011). The number of employees whose products and documents have patents and intellectual property rights respectively in portion to total staff complement can be added to that list of human capital indicators. In South Africa, the number of academics and researchers with National Research Foundation rating, number of South African Research Chairs Initiative (SARCHI), Centres of Excellence in research, capacity of researchers and academics to attract national and international funding are all dimensions of human capital at research-focused universities, which often house technology-based incubators. Please note that since relational and structural capital have been covered under the dimensions of social capital, these two dimensions are excluded from the dimensions of intellectual capital. Therefore, this study will concentrate on human capital alone as a dimension of intellectual capital to avoid repetition.

4.9. THE BENEFITS AND CHALLENGES OF CAPITAL

As already indicated in previous sections, while generalisations about capital are plausible, they are not useful in ascertaining the real value of capital as the identification and analysis of capital necessitates one to specify the type of capital in question. In view of this observation, each type of capital needs further scrutiny to determine the benefits accrued and the challenges often associated with its use. The following section discusses the benefits of physical capital followed by an articulation of its challenges.

4.9.1. Benefits of physical capital

Kataria, Curtiss and Balmann (2012) argue that forms of physical capital (e.g., land and buildings) tend to complement access to other capital firms as an individual's access to agricultural land will increase access to other investments such as access to finance. Since commercial banks often demand collateral as a pre-requisite for the disbursal of funds, ownership of and access to agricultural land and buildings increases access to lending opportunities for businesses. Investment in physical capital triggers production of goods, which are instrumental in the creation of other goods (Hassett, 2008). The complementary forms of physical capital also find expression in the law of diminishing returns. Consistent with this law, literature suggests physical capital's contribution decreases with increases in levels of economic development of economies (Li, Wang, Westlund & Liu, 2015), a clear demonstration that other capital forms like human capital take over as economic advancement increases. For example, advanced economies have long transitioned from relying on physical infrastructure to dependence on a combination of other capital sources such as intellectual capital and human capital.

4.9.2. Challenges of physical capital

The durable traits of physical capital, especially immovable factors, constitute their virtue as well as their vice. To the extent that factors of production factors (e.g., buildings, land, location and fixed equipment) are immovable, they are constrained by asset specificity and non-reproducibility (Kataria et al., 2012). Asset specificity implies that certain assets are developed to serve a specific purpose of production and therefore, would have a low or non-existent value if resold. While some factors of production such as building are reproducible, some such as land are non-reproducible (Kataria, et al., 2012). Effectively, this means that these assets cannot be physically re-located nor can their size be magnified as a basis for increasing their output. Moreover, the law of diminishing returns applies to the usage of inputs on a piece of land – increases in inputs (e.g., fertilizer) per hectare will contribute to a proportional increase in agricultural output beyond which such increases in fertilizer will decrease output (e.g., due to increases in soil acidity or alkalinity). Moreover, agricultural production investments are often irreversible and characterised by huge sunk costs because agricultural buildings often do not have markets for their resale (Kataria, et al., 2012). Hurlburt (1958) argues that the multi-dimensionality of land implies that its value is complex as it is attached to not just quantity but also its quality such as climatic conditions in the area. The next sections examine the benefits and challenges of social capital.

4.9.3. Benefits of social capital

Social capital exhibits multiple benefits. Consistent with the structural holes research, Burt (1992) postulates that bridging ties avail more resources to individuals belonging to different networks that essentially facilitate the flow of information and resources within networks. Therefore, individuals' exploitation of structural holes enables them to secure status in their networks and deploy it to their social advantage (Growiec, Growiec & Kaminski, 2017). Therefore, incubation tenants with well-developed external social networks stand a better chance of accessing financial, technical and technological resources compared to their counterparts with fewer or no external networks at all. Moreover, literature reports that networks with structural holes are positively associated with creativity, social trust and improved economic performance (Burt, 2005). Similarly, the centrality of networks in organisations is credited with facilitating increased economic performance of individuals (Granovetter, 2005; Kadushin, 2012) as they share expertise and specialised knowledge. Moreover, bridging capital's capacity to enable individuals to engage and share social ties with individuals from other groups enables access to new information, which makes creativity and improved performance possible. Myeong and Seo (2016) argue that since individual and group actions are shaped by their links to other social network actors, social capital is instrumental in explaining varying successes of individuals and corporations when confronted with competitive rivalry.

A study conducted by Lee et al. (2011) on the effects of bonding social capital and bridging social capital on regionalism in South Korea revealed that while bonding capital sustains regionalism, bridging social capital is critical to alleviating regionalism. Whether regionalism is critical or detrimental to incubation success depends on how much it can be exploited by participants in an incubation community to support resource pooling and obstruct other players from accessing and exploiting resources in the incubation environment. It can be argued that while using bonding capital can contribute to resource pooling by groups sharing kinship ties in support of incubation activities, such ties can also promote resource concentration by limiting access to these resources by external participants from other incubation communities. Hawkins and Maurer's (2010) study examined the value and manifestations of social capital during Hurricane Katrina in New Orleans in the United States. Their study established that while bonding capital facilitated the immediate provision of humanitarian support, linking and bridging social capital supported the long survival of neighborhoods and revitalised communities.

4.9.4. Challenges of social capital

Evidence suggests that the absence of social capital can have detrimental effects as much as different social capital types have their limitations. The next section discusses challenges of social capital on entrepreneurial growth, social trust and social control.

4.9.4.1. Entrepreneurial growth

Lukeš, Longo & Zouhar (2019) examined the effects of incubators (i.e., as structures that avail social capital resources to incubatees) on entrepreneurial growth especially sales growth, job creation and investment in public spending. The results revealed that although incubation activities (e.g., provision of social capital) sped up the growth of sales revenue in the long run, having tenants in incubators tended to negatively impact startups' sales revenue in the short-term. Moreover, incubator tenancy did not have a significant effect on startups' job creation and evidence to justify public spending on business incubators could not be found (Lukeš et al., 2019).

4.9.4.2. Social trust and social control

While dense networks that form among people sharing similar traits (e.g., bonding ties) facilitate conformity to norms (Festinger, Schachter, & Back, 1948), they are less desirable for developing social trust because they are founded on reputation formation and social control, which are functional substitutes of social trust (Dasgupta, 1988; Growiec, Growiec & Kaminski, 2017). In communities where "multiplexity" (i.e., overlapping social networks where the same people are linked together across different roles) relations persist (Diviák, Dijkstra & Snijders, 2019), social control levels are conceived to be too strong, leading to restrictions on personal freedom of independent minded individuals (Portes, 1998). One can argue that the emasculation of personal freedom in closed incubation communities bounded by bonding ties can be an anathema to creativity and innovation, qualities that often thrive where open and democratic communication flourish. Moreover, dense networks tend to be exclusionary to those from other networks. Waldinger (1995) documented the tight control imposed by white descendants of Italian, Irish, and Polish immigrants bounded by bonding social capital in construction, fire and police unions trades respectively in New York. Similarly, excessive control was reported in the produce business operated by Korean immigrants in several East Coast cities and in the Jewish merchants' diamond trade in New York (Portes, 1998).

Conversely, sparse networks founded on bridging capital tend to convey limited information on status and reputation of individuals belonging to other networks and hence are ineffective in enacting social control (Growiec, Growiec & Kaminski, 2017). Such networks founded on bridges existing among disparate cliques (that contain multiple structural holes) are problematic in enforcing social conformity, which can be fundamental to building trust within networks. The last segment of the conceptualisation of capital focusses on the benefits and challenges of intellectual capital.

4.9.5. Benefits of intellectual capital

Since intellectual capital allows the conversion of invisible properties and mental resources of an organisation into valuable goods and services (Ayar, Bakhnoo, Abdoullahi & Mahmoodi, 2016), there is growing literature pointing to its capacity to generate dividends for individuals, firms and society. For instance, human capital (i.e., intellectual capital as it was called before the coining of the term in 1969), which manifests in education, accumulated experience and skills is deemed fundamental to increasing employees' productivity (Stiglitz et al., 2007). Therefore, one can infer that the accumulation of expertise and skills unlocks potential for innovation that unleashes the productive potential of firms. Similarly, Paprock (2006) contends that the accumulation of intellectual capital in terms of knowledge and skills contributes to increased employee productivity and earnings and accentuates societal wellbeing.

At the firm level, the investment in and development of intellectual capital contribute to the growth, competitive advantage and performance of enterprises. Roos, Bainbridge and Jacobsen (2001) highlight that firms' intellectual capital expenditures accentuate firm growth, their economic wealth and competitive advantage in the market. Identifying with this reasoning, one can argue that the synergy between varying forms of intellectual capital (e.g., education, expertise, experience, mental propositions and values) unlocks personal initiative, creativity and innovativeness, which are critical to increasing the productive capabilities, enabling the growth of firms and overcoming the dominance of rival firms. As such, human capital development constitutes a vital investment fundamental to the viability and success of economic enterprises (Crook et al., 2011). Literature highlights that intangible assets such as intellectual capital embody values that facilitate the transformation of productive resources into value added products and services that increase the performance of firms (Hall, 1992, Gioacasi, 2014). Therefore, intangible assets that fall under intellectual capital such as trademarks, patents, copyrights permit the reconfiguration and transformation of production processes that enable improved performance of firms to happen.

Chen et al. (2005) reports that the combination of intellectual capital, R&D and expenditure on advertising positively impact on firms' return on assets. Therefore, incubatees (especially those external to the university) that are affiliated to resourceful incubators with a broad range of intellectual resources (e.g., patents, copyrights, brand names, trademarks) employed in value propositions and value exploitation have potential to scale their return on investment and expand their asset base than those incubatees with a limited supply of these intellectual resources. However, there is growing consensus that incubatees can also be creations of academic entrepreneurs who have already experimented with and succeeded in developing innovations in universities or research institutes before they are selected to operate in incubators (Mian, 1996; Dee et al., 2011; Xiao & North, 2018). Therefore, it is not coincidental that access to knowledge and entrepreneurial skills (forms of intellectual capital) in university-based incubators is deemed fundamental to incubatees' commercialisation of technological developments and assessments of their commercial prospects (Meyer, 2003; Xiao & North, 2018).

4.9.6. Challenges of intellectual capital

Criticism has been levelled against intellectual capital. The human capital component of intellectual capital, which is possessed by individual workers in an organisation, can be lost if these individuals exit organisations (Calza et al., 2014, Mbeo, 2019). To the extent that human capital is largely a property of individuals in organisations, it is susceptible to loss if these individuals leave the organisation and therefore, is hard to document, curate and retain as an organisational asset. Moreover, the acquisition of material forms of intellectual capital such as technology, data bases and intellectual property can be costly to the organisation even though such resources can also become obsolete over time. Therefore, organisations are under intense pressure to continually transform these intellectual assets to keep them abreast with international standards and to ensure that these resources remain relevant to organisational survival and sustainability. For instance, although Kodak used to be a world class technological giant for capturing and printing photographs, the introduction of digital devices (e.g., laptops, tablets and smartphones) that perform similar functions as cameras that Kodak used, as well as the integration of printing capabilities in social media applications such as Instagram and Facebook, have rendered the monopoly and competitive advantage Kodak used to enjoy obsolete.

Having discussed the conceptualisation and theoretical development of incubation incentive and support regime of incubators, which has been summarised as physical, social and intellectual capital, the second segment of this chapter is devoted to unpacking the relationships between capital forms (as dimensions of the incubation incentive and support regime) and TBI, and these capital forms and incubation outcomes especially technology entrepreneurship.

4.10. INCUBATOR INCENTIVE AND SUPPORT REGIME AND TECHNOLOGY BUSINESS INCUBATION: AN OVERVIEW

While the provision of incentives such as tax breaks, tax rebates and other commissions are critical to the preservation of income and availability of cash flow by incubatees, literature (Campbell & Allen, 1987;

Chan & Lau 2005; Kumar & Ravindran, 2012; Obaji et al, 2018) also demonstrates that provision of such incentives together with suitable services is fundamental to the success of incubation programmes. Similarly, the provision of tangible resources (e.g., physical infrastructure and financial capital) and intangible resources (intellectual capital such as knowledge, social capital and legitimacy) is also fundamental to improving incubation performance (Mian, 1997, Van Weele, et al., 2016). The next section discusses the relationship between physical capital and TBI.

4.10.1. Physical capital and technology business incubation

Despite the different characterisation of technology business incubation, its enduring trait is the creation of newer institutional arrangements that support technology venturing (Bulsara et al., 2009). At national level, technology venturing emphasises creative and innovative strategies for aligning public sector initiatives and private sector resources within and across regional and national boundaries for promoting economic growth (Bulsara et al., 2009). At the core of TBI is the development of entrepreneurial ecosystems for technology-based startups (Hillemane, Satyanarayana & Chandrashekar, 2019), the development of local innovative firms through technology transfer and diffusion of innovations (EU, 2010; Hillemane, et al., 2019).

Although claims about ownership and control of resources may not ideally fit the description of emerging tenant firms accommodated in TBIs that remain externally resource dependent, the physical capital of such firms range from tangible to intangible resources. Van Weele, van Rijnsoever, Groen & Moors (2019) distinguish between tangible physical capital resources and intangible physical resources and contend that while tangible resources are assets that are physical in nature, such as cash, land, buildings, or equipment, intangible assets are non-physical in nature. Such intangible physical capital resources include internet networks, Wi-Fi, bonds, securities and electronic payments.

While it is difficult to attribute the success of a firm exclusively to one factor, there is consensus that the availability of physical and shared spaces for business incubation (Hillemane et al., 2019; Van Weele et al, 2019) is just as important as the provision of financial resources for venture creation, research and development, production of new products and their delivery to the new market (Daramola, 2012). As such, office space, shared spaces and other forms of physical capital (machinery, equipment and shared laboratories) are critical to physical development of a new venture. To the extent that incubators render a constellation of physical resources and support services to technology startups (Bøllingtoft & Ulhøi 2005; Pauwels et al., 2016), they constitute prominent instruments for facilitating the development, survival and growth of innovative startups (Bergek & Norrman, 2008; Ahmad & Ingle 2013).

Although the contribution of physical capital to TBI is perceptible through incubators lens, what remains unclear is whether technology business tenants are enticed by heterogeneity of capital forms or are enamored by specific capital types. One school of thought claims that most incubation tenants are attracted to tangible resources that incubators offer (McAdam & McAdam, 2008; Soetanto & Jack 2013; Van Weele et al., 2017) and therefore, often downplay the contribution of intangible resources initially (Van Weele et al., 2019). Considering tangible resources as synonymous with physical capital, it can be inferred that physical capital occupies a critical space in TBI performance. To the contrary, another divergent school of thought perceives intangible resources bestowed by incubators especially established business knowledge and networks, as more fundamental to leveraging the competitive advantage of technology startups compared to tangible physical resources (Bruneel et al. 2012; Eveleens et al. 2017; Van Weele et al. 2017).

4.10.2. Physical capital incentives and technology business incubation

One of the most celebrated forms of physical capital is finance resources such as venture capital (Mpiti, 2016; Baah, 2019). The explosive growth of technology-based firms such as Google, Facebook, Instagram in the Silicon Valley is partly attributable to the dispensing of venture capital. For instance, venture capital and loan guarantees are credited with developing stock markets, exhorting financial and development institutions to render funding, technical support and advancing entrepreneurship among new startups (OECD, 1997; Daramola, 2012). Therefore, venture capital has been instrumental to the development of new technology-based firms (NTBFs) (i.e., organisations focused on the creation, development and exploitation of technological innovation with some risk implications of entrepreneurs) (Luggen, 2004) who had limited prior entrepreneurial experience such as the founders of Facebook.com.

Broadly, the provision of venture capital to NTBFs can be public funds-supported or pursued by private companies such as venture capital firms, commercial banks, private financial lenders such as micro-credit. National governments can intervene in the economy by providing directly or indirectly facilitating the creation of new technology-based ventures, rendering direct funding to such firms and increasing the contribution of the private sector through new technology venture creation (Daramola, 2012). Precisely, the government can invest financial resources as equity investment (i.e., government venture capital) or provide loan guarantees in new technology-based firms to support their incubation activities. Table 4.2. provides types of government-supported direct supply of capital and financial incentives that are relevant to and can be harnessed by NTBFs.

Table 4.2: Government supported supply-side policies for financing new technology-based firms

Nature of Supply side policies	Types	Description
DIRECT SUPPLY OF CAPITAL	**Government equity investment**	To make direct investments in venture capital firms or Technology-Based firms(TBFs)
	Government loans	To make low-interest, long-term and/or non-refundable loans to venture capital firms or TBFs
FINANCIAL INCENTIVES	**Tax incentives**	To provide tax incentives, particularly tax credits, to those investing in small firms or venture capital funds
	Loan guarantees	To guarantee a proportion of bank loans to qualified Technology-Based firms
	Equity guarantees	To guarantee a proportion of the losses of high-risk venture capital investment
	Investor regulations	To allow institutions such as pension funds or insurance companies to invest in venture capital

(Source: Adapted from Bank of England (BoE), 1997; Santiso, 2007, Daramola, 2012).

While direct support involves direct injections of venture capital into a NTBF to facilitate its development, financial incentives entail those (predominantly finance-related or non-financial) provisions aimed at easing the burden of operating NTBFs in complex and unfamiliar environments. The success of both financial support and incentives depends on the extent of strictness or laxity of the funding instruments provided for the incubatee, monitoring and evaluation mechanisms and the combinations of support provided to NTBFs. For instance, diversions of funds are common in situations where direct supply of venture capital is done without proper facilitation of how such funds are utilised and where the mechanisms of monitoring incubation outcomes and outputs are weak or fragmented. Alternatively, when institutional investors acquire equity or adopt equity type positions in private companies on behalf of their shareholders (e.g., individuals, pension funds, endowments, foundations and private companies), this is private equity capital (Rubin, 2008). Lastly, when communities take equity or near equity and invest in new technology startups for the purpose of realising noble community goals such as creating jobs for low-income communities, such investment is called Community Development Venture Capital (Rubin, 2008). Therefore, without a large, effective, and competitive credit market availing debt capital with government regulation serving as an enabler, the seizing and exploitation of entrepreneurial opportunities by NTBFs would be inconceivable.

4.10.2.1. Physical capital and incubation criteria

Physical capital such as working space, laboratories and finance available to the incubator can be instrumental in determining the preferred selection criteria, incubation model, the time span of incubation, the exit strategy of incubation tenants adopted and the size of businesses that incubators can accommodate. Incubators with large spaces for incubation absorb and accommodate large tenants (e.g., those in manufacturing and large-scale, technology-intensive businesses) as those in large pioneer incubators. Examples of such abound- such is the case for incubators in Detroit, Batavia and New York. While selection policy of incubators may emphasise identifying weak ventures with great potential, in reality, the selection criteria vary widely (Hackett & Dilts, 2004; Alzaghal & Mukhtar, 2017). The selection criteria depend on size of incubation labs, incubator missions, resource base, management teams and incubator projects pursued, the and the financial base of the incubators – factors which determine the number of incubatees that can be incubated. However, there remains a deep schism between physical capital that incubatees need (technology and finance) and resources provided by incubators upon their selection (Ratinho et al., 2013) suggesting that there might be no direct relationship between physical capital and selection criteria. For instance, physical capital such as increasing cash flow including introduction of new products and determining the market are key strategic issues that are outside incubators' selection criteria and hence tenants may not seek the support of incubators on such issues (Jorgensen, 2014).

4.10.2.2. Physical capital, IP and patenting

IP and patenting issues are intangible resources that are fundamental to the long-term survival and sustainability of new technology-based firms. They constitute a component of the firms' intellectual capital that gives them some competitive advantage when exploited to outwit the firms' rivals. Since incubators render an emporium of physical capital resources such as access to bank loans, loan funds and guarantee programs and access to angel investors or venture capital to support intellectual property management (Knopp, 2007; Bubou & Okrigwe, 2011), it is logical to expect a direct link between financial deployments and the growth of patent and intellectual property development. To the extent that technology business incubatees located at universities often benefit from locational proximity to research and development offices, physical shared spaces, laboratories and research of academics, one would expect the knowledge spillovers emerging from such tenant-academic interactions to facilitate the development, refinement and filing of patents and intellectual property to the benefit of technology business tenants. The knowledge externalities (e.g., those that facilitate patent development) arising from public financial investments in diffusion of knowledge and support for re-engaging in entrepreneurship (Hoetker & Agarwal, 2007; Parker, 2013) via the development of incubation infrastructure such as the development of world class research laboratories suggest some direct links between patent development and investment in physical capital. Therefore, the establishment of physical capital is non-negotiable to the development, registration and filing of patents, even though not all technological inventions during incubation processes necessarily require patent rights.

While acknowledging the incubators' heterogeneity in terms of the resources they provide, one would expect incubators that invest heavily into large infrastructure (e.g., office space, incubation buildings, laboratories) for R&D to have greater prospects of generating IP and patenting than those that do not. Since finance is the most critical component of the physical resources that facilitate the acquisition and development of basic infrastructure (e.g., office space, libraries, furniture, laboratories, physical internet connections and payment of overhead costs) (OCED, 2015b; Engel, 2018), it is a critical antecedent to the success of the development of patents and intellectual property development.

4.10.3. Social capital's contribution to technology business incubation processes: An Overview

Incubation processes can involve a multiplicity of resource sharing encounters and capabilities exchanged through "formal meetings, social relationships, informal get-togethers and other social events" (Burt & Burzynska, 2017). For this study, the incubation selection criteria, IP and patenting, incubation managers' competence and incubation norms and procedures were covered under incubation process. However, the current study concentrated on the first three dimensions of TBI as they relate to social capital as the fourth dimension (norms and procedures) can be inclusive of the incubation selection criteria. Moreover, this fourth dimension covers a broad gamut of issues beyond the scope of this study. Some studies insinuate a combination of structural and relational capital in incubation processes. Hughes, Ireland and Morgan (2007) contend that value creation during incubation arises from combinations of extensive or narrow networking activities (i.e., structural capital) with other firms. They elaborated that during incubation, incubating firms choose whether deliberately or otherwise, to behave in ways that enable them to seize network opportunities and use networked resources and knowledge (i.e., expression of relational capital). The next section discusses social capital as it relates to different aspects of the incubation process.

4.10.3.1. Social capital and incubation selection criteria

During incubation processes such as the selection of incubatees, the assets and resources at the disposal of incubators and incubatees may depend on the degree of relational trust; shared identity as a group; and mutual reciprocity, which are the relational dimensions of social capital (Ebbers, 2014; Zhang & Shih, 2022). In fact, it seems there is a bi-directional relationship between social networks and selection processes. On the one hand, Nair and Blomquist (2019) consider incubators to steer the development of teams of experts (i.e., structural capital) that make informed decisions on selection of suitable startups to accept for incubation from many applicants in their formative stages but often lacking defined technology and market. It can be inferred that since decisions on economic potential of new technology-based firms (NTBFs) are founded on feasibility of their innovative ideas, their capacity to disrupt the market and generate sustainable financial returns from their products/services, a team of experts (comprising incubation managers, venture capitalists, and other investors - itself an expression of structural social capital) may need to draw on their diverse expertise in making incubation selection decisions. As such, social capital influences selection criteria.

On the other hand, the development phase of selected startups often involves TBIs fostering robust business and social networks that secure material and intellectual resources for startups (Cooper, Hamel, & Connaughton, 2012). This implies that the availability of a proper and effective selection criteria is an indispensable linchpin to the identification of structural capital necessary for resource identification, pooling and validation – therefore, selection criteria impact social capital formation. The proper selection of incubatees enables them to overcome the liability of newness by broadening their access to institutional social networks and business coaching teams (i.e., structural capital), which augment their learning opportunities and access to diverse resources and services (Bruneel et al, 2012; Nair & Blomquist, 2019).

4.10.3.2. Social capital and IP and patenting

In his characterisation of Diné entrepreneurship (i.e., indigenous contemporary entrepreneurship of Navajo people, an American Indian tribe in the United States), Clark (2019) conceives social networks as fundamental to entrepreneurship growth as they offer advice, opportunities to collaborate and share resources. For instance, the existence of relational capital such as trust among incubatees cements their identity as a group and fosters reciprocity (Cooper et al., 2012) and when trust, group identity, and reciprocity are formed in relationships, weak ties can evolve into strong ties (Soetanto, 2019) that enable the exchange of vital resources, confidential information (e.g., IP related information), and knowledge (e.g., patentable information) in cooperative activities (Zhang & Shih, 2022). Since information on patents and knowledge of IP of technology products are often shrouded in secrecy before their commercialisation, the development of relational capital (e.g., trust, shared values, reciprocity) among technology entrepreneurs, technology transfer offices, innovators and local and international certification institutions may be critical to the navigation of IP and patent developments stages such as patent pre-validation, development, filing and registration. IP development also depends on the formation of cognitive capital (e.g., shared interpretations, representations, shared meaning) arising from researchers' interaction with libraries, collaboration with national depository system and university ecosystem to ensure that IP is filed.

It can be argued that patenting and IP development processes must be built into the larger innovation ecosystem that transcends the incubation environment to ensure that technology incubation startups have competitive advantage and are sustainable. The ability to initiate, maintain, and utilise social networking (e.g., networking capabilities, formal networks, ties and idiosyncratic networks as expressions of structural capital) is considered integral to developing marketable offerings, the development of knowledge-intensive products (e.g., patents and IP) and improvement of performance of university spinoffs (Walter et al., 2006; Pettersen, Aarstad, Høvig & Tobiassen, 2016). Since patents and IP are critical products of value-creating and value-enhancing firms, it is logical to expect new technology startups to deploy their structural capital for optimising their patent and IP development processes.

Since building social networks shortens and accelerates firms' learning processes (Knight & Cavusgil 1996; Zahra, 2005) and tend to be dynamic in the startups' life cycle, different networks would be necessary at different stages of the patent and IP development process. For instance, at the firms' founding stages where identification with a group of like-minded entrepreneurs may be more critical than other economic considerations, identity-based networks (e.g., relational and bonding capital) may be more critical than calculative networks (e.g., structural, bridging and linking capital), which could be foundational at resource-intensive stages of patent development. Hite and Hesterly (2001) regard identity-based networks (e.g., relational capital), those in which social identity of the ties are more critical than the economic functions, as fundamental to early stages of growth. To the contrary, strategy-oriented (e.g., structural capital) networks, where purpose and functions are more vital than the identity of the ties, only become essential during later stages of the firms' growth cycle (Hite & Hesterly 2001). Therefore, identity-based networks (e.g., relational capital) could be crucial at the foundational stages of firm's growth cycle (e.g., idea validation, prototype development, access to markets) while patent protection and IP development stage, which could form part of the growth stages of firms that are more capital intensive may necessitate strategy-oriented networks (e.g., structural capital). The next section turns attention to social capital and incubation manager competence.

4.10.3.3. Social capital and manager competence

It is not unusual to attribute manager competence to experience. The managerial competencies of founder organisations are often associated with their capacity to secure entry level positions in organisations and followed by their assimilation and learning of the trades of the organisation, which triggers knowledge and competences that enables venture creation (Clark, 2019). Since social capital is positively associated with venture creation (Moyes, Ferri, Henderson & Whittam, 2015), one would expect the development of social capital (e.g., structural capital which emphasise the nature and content of networks) to facilitate resource sharing in firms and the building around expertise, thereby fueling the development of managerial competence. Through establishing networks of exchanges (e.g., relational capital), firms often combine their resources and reduced time to market (Baum et al., 2000) in ways that enhance their innovative and entrepreneurial competencies (Bakman & Oliver, 2013). Conversely, one would expect managers who exhibit solid competencies (e.g., in problem solving, in strategic decision making and resource mobilisation) to have more influence in the development of social networks (e.g., structural capital) within organisations than those without.

4.10.4. Intellectual capital and technology business incubation

Intellectual capital manifests in various forms such as education, know how, expertise, experience, intellectual property and entrepreneurial competence, which serve as assets in production or developing products that can be marketed for higher return (Gomez, 2016). Intellectual capital is critical to the pursuit of entrepreneurship, the development of innovation and the incubation of new ventures as will be discussed in subsequent sections of this chapter.

4.10.4.1. Intellectual capital and incubation selection criteria

Broadly defined, intellectual capital comprises three main components namely: human capital, structural capital (also called organisational capital) and relational capital. Human capital, such as skills, knowledge, education, experience and talents of employees enable them to execute human roles and responsibilities in the organisation (Barreira, 2015). Incubation managers' possession of human capital (e.g., entrepreneurial knowledge, relevant training and skills) is critical to the development of effective selection criteria for tenants as incubators are essentially technology transfer organisations that commercialise undeveloped inventions of research universities and large R&D-intensive firms through spinoffs and startups (Fukugawa, 2018). In an era where enterprising firms are increasingly recognising that knowledge rather than financial capital differentiates competing firms (Barreira, 2015), incubation managers and incubation experts that exhibit diversity and differentiation of human capital (e.g., entrepreneurial and business knowledge, experience and expertise) stand a better chance of developing solid and effective selection criteria for incubation tenants than those lacking such capital.

However, in hi-tech industries such as pharmaceuticals, consumer electronics and electrical machinery where strong balance sheets and diversified asset bases have traditionally contributed to company success (Gratton & Ghoshal, 2003), the development of knowledge reserves (e.g., in the form of structural capital) has been critical in recent years to the development of effective selection criteria for tenants of incubators and accelerators. If structural capital encompasses intellectual assets such as patents, trademarks, trade secrets, copyright designs, licenses and franchises, invention disclosures, property software and publications (EU, 2003), then one would expect incubation managers with the knowledge of these intellectual assets to develop more coherent selection criteria for incubatees than those lacking such knowledge. Since relational capital dimension as it relates to incubation selection criteria has already been discussed under social capital, it is not elaborated in this section.

4.10.4.2. Intellectual capital, IP and patenting issues

Since the previous sections concentrated on knowledge aspects of human capital, the next section discusses experience (another dimension of human capital) as it relates to IP and patenting issues. In subsequent sections, two forms of experience are discussed as they relate to IP and patents, which are industry-specific experience and team-relevant experience.

*4.*10.4.2.1. Industry-specific experience, IP and patenting issues

One of the variants of human capital is industry-specific experience, which describes an entrepreneur's engagements with diverse stakeholders (e.g., buyers, suppliers, distributors, and regulators other stakeholders), which are integral to the production of knowledge about opportunities, threats, competitive conditions, and governmental regulations of particular importance to the industry (Mosakowski, 1993; Kor, Mahoney & Michael, 2007). Given that historical and industry specific experience (e.g. experience of technological developments, knowledge of the regulations, and market dynamics of the industry) are critical to the perception and evaluation of new entrepreneurial opportunities (Kor et al., 2007), technology entrepreneurs with such experience may stand a better chance of deploying infrastructure resources such as R&D facilities, libraries, electronic libraries, networks with technology transfer offices in the development of their patents and IP than those without such experience.

In the same vein, an incubator manager with industry-specific experience (e.g., in technology-intensive firms) may have a solid understanding the mechanics of the technology industry allowing him/her to use TBIs as platforms for resource pooling via previously established networks (Kor et al., 2007; Zehra, 2018). This could facilitate the deployment of such resources in IP and patent development. Since IP and patenting are capital-intensive investments involving registration, establishing the worthiness of inventions, benchmarking and filing of patents, possession of industry-specific experience by incubation managers and incubatees enables patent development and protection of intellectual property, which serve as a form of competitive advantage. This argument gels well with the evidence that entrepreneurs with industry-relevant experience tend to successful in implementing innovative activities of business ventures and incubation processes that those without (Cooper et al., 1994; Kor et al., 2007).

However, having a team of incubation managers with experience from one industry could be detrimental to the advancement of IP and patenting. For instance, rigid commitments to insights from previous industry experience may be counterproductive in dynamic contexts where quick adaptations to changes in economic demand, competition and technological conditions (e.g., IP and patent requirements) are fundamental to sustained entrepreneurial development and renewal (Chandler & Hanks, 1994; Faes & Matthyssens, 2009). In situations where the incubation managers have homogeneous levels of industry experience and exhibit deep connections to historical views of industry dynamics and buyer expectations, their perception of the new entrepreneurial opportunities (e.g., technology commercialisation through IP and patents) may be truncated, if not misguided (Kor et al., 2007). Conversely, where different incubation team managers have varying inter-industry relevant experience concerning technology developments, market and distribution mechanisms, commercialisation of IP and patents may be positively impacted as managers learn from their diverse experiences.

4.10.4.2.2. Team-relevant experience, IP and patenting

Team-relevant experience is integral to the success of incubation processes such as selection criteria, IP and patenting. It includes team managers' experience in collaborative strategic decision making, allowing co-learning from each other's strengths, weaknesses, and idiosyncratic habits (Kor, 2003; Penrose, 1959), in taking risks, commitment to strategic actions under uncertainty, and winning or losing together as a team (Kor & Mahoney, 2000). It can be argued that when incubation management has diverse team relevant experience, the commercialisation of incubation outcomes through patents and IP for different industries will be more smooth and well-coordinated than if the incubation team lacked such experience.

4.10.4.2.3. Intellectual capital and intellectual property

In a study that examined the link between intellectual capital, intellectual property and firm performance, Bollen, Vergauwen and Schnieders (2005) established, using regression analysis, that all dimensions of intellectual capital showed significant relationships with IP. This demonstrates that all dimensions of intellectual capital such as human capital (e.g., knowledge, experience), structural capital (e.g., knowledge infrastructure such as data bases, processes and systems) and relational capital (e.g., social networks) significantly predicted IP development. However, Van Caenegem's (2002) study reported that human capital such as knowledge was marginally impacted by rules of intellectual property law, because to a limited extent can IP law direct employees' effective control over knowledge that they acquired on the job.

4.10.4.2.4. Intellectual capital and manager competence

Prusak (2016) explored the impact of employee competencies management on the implementation of intellectual capital. Evidence suggested a direct link between the possession of an enterprise competency management system and managers' attitude towards intellectual capital development. Moreover, an increase in the role of competence management system in the organisation contributed to increased interest in the management of other intangible assets as part of intellectual property. The study also concluded that the elevation of the competence management system directly impacted the activities that the company implemented to realise of intellectual capital management. In short, one infers a direct correlation between possession of managerial competence and the management of intellectual capital.

4.11. INCUBATOR INCENTIVE AND SUPPORT REGIME AND TECHNOLOGY ENTREPRENEURSHIP

Despite the myriad definitions and conceptualisations (Nichols & Armstrong, 2001; Bulsara et al., 2009; Mosey, Guerrero & Greenman, 2017), technology entrepreneurship (TE) revolves around creation of technically oriented business enterprises and commercialisation of technological solutions to resolve perennial societal problems. Therefore, TE can involve the organisation, management and assumption of risk of a technology-based business enterprise through new product development (i.e., techno-innovation) (Nichols & Armstrong, 2001). Broadly speaking, TE encompasses the marshalling of publicly created or private-generated resources in the development of technology enterprises and the deployment of technological innovations, products and services to breach societal, community and market needs. Practically, Mosey et al. (2017) perceive TE as the interface of entrepreneurship and technological innovation that allows groups within existing private or public organisations and individuals' recognition and exploitation of technological opportunities through new venture creation. As such, the pursuit of TE is distributed between both formal new technology ventures operated by individuals through private funding (entrepreneurship) and run within existing institutions (intrapreneurship).

4.11.1. Physical capital and technology entrepreneurship: An overview

Given that TBIs provide diverse infrastructure as support (such as financial resources) that stimulate technology-based startups, Vedovello and Godinho (2003) affirm that incubators steer firms' competitiveness and economic growth through diversification of productive activities, diffusion of innovation in the economy and promotion of TE. In subsequent sections, the mixed views on the extent to which physical capital promotes a strong growth orientation (a dimension of technology entrepreneurship), are articulated.

4.11.1.1. Physical capital steers strong growth orientation

One form of physical capital that is often discussed with reference to TE dimensions, especially incubatees' growth orientation is access to capital. Access to credit is fundamental to the growth of startups (Asiedu et al., 2013; Bastiéa et al., 2016) including those of incubators. For instance, access to credit positively affects small business' business decisions and sustained financial growth goals (Bastiéa et al., 2016). Moreover, UK technology incubators' provision of diverse support (including financial support) has proven pivotal to new firm growth and commercialisation of science and/or technology-oriented applications (United Kingdom Science Park Association [UKSPA] 1998; Patton, Warren & Bream, 2009). The availability and access to financial support are crucial for technology-oriented business' growth through the provision of cosmetic services, the acquisition of technology such as the purchase of hair dryers, clippers, relaxers, sanitizers, straighteners, hair pieces and the payment of employee salaries (Kitching, Hart and Wilson, 2015). Therefore, the provision of consistent, coherent and timely financial support enables growth and expansion of technology-based firms through mass production of technological products, goods and services.

Other studies have disputed the significance of access to finance in supporting technology entrepreneurship dimensions such as growth and technology acquisition. Research demonstrates that in developing countries, lack of government financial support obstructs the local growth of most technology-based firms (Nwankwo et al., 2013) as such support is often piecemeal and lacking coherence (Mbonyane, 2006; Mpiti & Rambe, 2017). Similarly, access to credit was intimated as non-significant and not contributing to entrepreneurship quality, growth and depth in Africa (Atiase, Mahmood, Wang & Botchie, 2018). Our study demonstrates that public funding exerts a significant negative impact on technology acquisition of technology-based cosmetological firms, perhaps demonstrating the complexities of debt financing and the exorbitant interest rates charged on principal amounts borrowed (Madichie, Mpiti & Rambe, 2018).

Another typical instance of physical capital is the supply of venture capital. Literature reports a positive relationship between the concentration of venture capital and the strength and growth of the high-tech sector in the economy (Kortum & Lerner, 2000; Schwartz & Bar-El, 2006, 2007; Avnimelech, Schwartz & Bar-El; 2007). However, there are also some significant drawbacks arising from the heavy concentration of venture capital in specific areas with implications for transformation of the high-tech sectors. The targeting of venture capital investment for entrepreneurial high-tech activities in specific sectors has been blamed for narrowing the geographical distribution of high-tech activities, culminating in the reduction of high-tech activity in the peripheral areas (Schwartz, 2006; Schwartz & Bar-El, 2006). Moreover, the clustering of venture capital has been associated with restriction of technological diversification - specifically the circumvention of investment in technological areas and activities that require long development periods or those areas with intermittent success record (Gompers & Lerner, 2000; Lerner, 2002).

4.11.1.2. Physical capital drives commercialisation of technology innovations

As one of the dimensions of TE, the commercialisation of technology innovations needs to be examined in relation to physical capital. Physical capital such as venture capital is considered instrumental to the commercialisation of technology innovations facilitated by university business incubators. As early as the 2000s, literature suggested that venture capital occupied a special space in stimulating venture creation processes and driving commercialisation of innovation-based technologies (Lalkaka, 2002). Despite this promise of the diversity of funding formulae to transform technology development, Lalkaka (2002) also observes the misalignment between management of these funds and understanding of the mentality and special needs of the inventor-innovator, which result in unintended technology commercialisation outcomes. The technology transfer and commercialisation strategies that industrial research development institutions in Nigeria are preoccupied with such as licensing agreements, cooperative R&D agreement/contract research, joint ventures, spinout/spin-off, training workshops, technical assistance and consultancy services (Oyedoyin et al., 2013) are enabled and promoted by provision of finance.

Wonglimpiyarat's (2016) research into the operations of university business incubators (UBIs) and technology transfer strategy of Thailand universities demonstrates that the provision of capital serves as an important vehicle for the commercialisation of technology. The Thai Government's Office of the Higher Education Commission and the Ministry of Education's innovation policy that shaped the creation of UBIs have been instrumental in the creation of new ventures. At the coalface of the incubation development has been the exploitation of venture capital funding and supporting linkages between university and industry in advancing technology commercialisation in Thailand. Specifically, the Ministry of Industry via the Office of Small and Medium Enterprises Promotion (OSMEP) spearheaded the commercialisation of technology through providing new business ventures with grants, venture capital financing and business matching programmes (Wonglimpiyarat, 2016). Wonglimpiyarat's (2016) elaborates that the Ministry of Science and Technology via the National Science and Technology Development Agency (NSTDA) and the National Innovation Agency (NIA) provide SMMEs and technology startups with financial programmes, grants, low interest rate loans and venture capital financing programmes to support technology innovation and development. What remains unclear is whether such financial investment into business incubation translates into huge financial output for these new technology startups.

4.11.2. Social capital and technology entrepreneurship

Literature emphasises the resource-based view in comprehending social capital, arguing that the bedrock of social capital is the exchange of resources such as information, knowledge and experiences (Presutti et al., 2007; Patel & Conklin, 2009; Basu & Pruthi, 2018). The alignment between social capital and TE necessitates opportunity recognition, especially alertness to technological opportunities and knowledge of markets and customers (Baron, 2006), which can be enhanced by one's affiliation to social and business networks. Put differently, access to and acquisition of appropriate resources (McGrath & MacMillan, 2000) is a function of access to social capital. This affords the recognition and exploitation of technological opportunities (Roininen & Ylinenpää, 2010; Lechner, Kirschenhofer & Dowling, 2016). In essence, access to social capital affords access to critical resources for exploitation and commercialisation of technological opportunities.

4.11.2.1. Structural social capital's role in technology innovations

Filieri and Alguezaui's (2014) review explored the interaction between structural social capital, knowledge transfer and (technology) innovations. Their finding established the value of exploring different forms of structural capital (structural holes vs dense networks; strong vs weak ties) in shaping knowledge transfer and (technology) innovations. Their study also reported that a balance of different configurations of structural capital capacitate firms or their employees to explore, access, assimilate and combine different knowledge types, which will lead to improved (technology) innovation outcomes. Drawing on the experiences of a science park, Meseguer-Martinez, Ruiz-Ortega and Parra-Requena (2018) explored structural social capital's impact on technology innovation performance including the contribution of absorptive capacity to the process and showed that demand-pull absorptive capacity influenced structural capital's interaction with technology innovation performance. The major inference from these studies is that whether it is direct or mediated, structural social capital exerts a positive impact on the innovations of technology-based firms.

4.11.2.2. Relational social capital's role in technology innovations

A study conducted by Delgado-Verde et al. (2011) suggests that relational capital shaped the implementation of technological innovations by Spanish technology-based industries, placing emphasis on the inter-organisational relationships created among these firms, their customers and suppliers.

However, the link between relational capital and technology transfer practices in Asian contexts relied on close ties which had some paternalistic tendencies. For instance, Grzegorczyk's (2019) study on the effects of culture moderated social capital on technology transfer demonstrated that "guanxi" (a term which emphasises the value of trust, obligations, and reciprocity in Chinese people's social interactions) was widely practiced as part of social capital and sometimes bordered on unethical behaviours. For instance, to facilitate the transfer of technology, TTO directors and managers depended on guanxi to access business partners. They further established links with existing and potential patrons in the government to access market information, scarce resources, and protection when the need arose (Grzegorczyk, 2019). Other dark sides of relational trust encompass over-embeddedness in one's network (Masiello et al., 2015), inertia, blindness to opportunities and resource asymmetry (Hughes & Perrons 2011), which undermine organisations' capacity in locating new knowledge to develop and sustain technology innovations. An inference from these studies is that despite the positive and significant associations between relational social capital and technology innovations, the prevalence of the dark side of relational capital has potential to undermine the significance of technology innovations in emerging contexts.

4.11.2.3. Cognitive social capital's role in technology innovations

In a study that examined the effects of structural, relational and cognitive dimensions of social capital on technology innovations, Bonfim, Segatto, and Takahashi (2017) established that the formation of shared narratives, shared languages and forging common understanding (i.e., cognitive social capital) in cross-sector or cross-industry collaborations was instrumental in realising technology innovation outcomes. With reference to cognitive social capital, Grzegorczyk (2019) examined the contribution of culture-moderated social capital to technology transfer in American and Asian contexts. The results of the study revealed that national culture shaped internal relationships (e.g., shared representations and meaning making) through the behaviour of technology transfer managers and employees, which invariably shaped the transfer of technology in firms. Li, Li and Wang's (2017) investigation into the role of cognitive social capital of incubated forms in improving the innovation performance in incubation networks demonstrated that the accumulation of cognitive social capital through incubation networks positively impacted the acquisition of intangible resources, which greatly improved the innovation performance of startups. One infers that, whether mediated by other factors such as intangible resource acquisition or unmediated, cognitive social capital exerts a positive effect on technology innovations.

4.11.3. Social capital's role in supporting strong growth orientation

The next section discusses different dimensions of social capital as they relate to the growth of the firms.

4.11.3.1. Structural social capital and firm growth

There is consensus on the capacity of structural social capital to positively influence the growth of firms. It has been shown that the number and diversity of existing networking relationships (aspects of structural capital) have a positive influence on the growth of firms (Powell et al., 1996). However, it is critical to note that not all dimensions of structural social capital exert a positive effect on organisational growth. For instance, Kianto and Waajakosk (2010) examined the effects of dimensions of structural social capital (intra-organisational and inter-oganisational structural social capital; external extended structural social capital) on organisation growth (specially personnel and turnover growth). The results suggest that only external extended structural social capital (i.e., the degree to which a key partner relationship rendered the firm access to new partners or customers), is consistently related to organisational growth. Despite only one aspect of structural social capital being positively related to growth, this finding confirms Yli-Renko et al.'s (2002) finding that external extended structural social capital enhances organisational performance (e.g., growth) of firms. This finding demonstrates that, in scenarios where external structural social capital does not impact the growth of firms, researchers may need to explore beyond this capital to identify the resources that extended networks (e.g., extended external structural social capital) could avail to the firms.

4.11.3.2. Relational capital and firm growth

Some literature suggests that relational social capital (i.e., trust and trustfulness between actors) is positively related to growth of entrepreneurial aspirations (Liao & Welsch, 2001; Myint, Vyakarnam & New, 2005). In the same vein, Sunny, Uboegbulam and Frank's (2020) investigation into the effects of relational social capital on the growth of manufacturing firms in Nigeria reported that relational capital exerted a positive influence on business growth and emphasised that managers of such firms must place their emphasis on fostering good relational capital with their diverse stakeholders (e.g., suppliers, customers and the society) to sustain the growth of such firms. However, the interaction between relational social capital and growth of firms may be shaped by moderating factors such as whether a firm has external networks or not. For instance, Kianto and Waajakosk (2010) explored the role of internal and external relational social capital on the growth of Finish firms and established a positive association between relational social capital and growth among firms that had established external networks. This suggests that the extraction of benefits from relational social capital necessitated systematic collaboration arising from possession and exploitation of stable goal driven networks across organisations. Their study also revealed that, for firms without inter-organisational networks, there was a negative association between internal relational social capital and growth. This suggests that in the absence of external organisational networks to drive sustained growth, strong internal ties may culminate in inertia, which prohibits companies from pursuing and exploiting new opportunities for growth in the environment (Kianto & Waajakosk, 2010).

4.11.3.3. Cognitive social capital and firm growth

Even though cognitive capital is the least researched of the three social capital dimensions, the few studies that have explored it suggest that social capital exerts a positive relationship on firm growth. For instance, Lee and Jones (2006) investigated the role of cognitive social capital in supporting entrepreneurial learning among nascent entrepreneurs. Their study demonstrated the importance of interpretive frameworks that enrich language, codes and narratives from face-to-face communication (i.e., cognitive social capital) in greater exploitation of business ideas, which could contribute to the growth of firms. Another study postulated cognitive social capital as providing a valuable explanation for the ability of firms securing knowledge that enhances innovation in geographically proximate contexts (Requena & Villaverde, 2009) in ways that could positively impact the growth of firms. One infers that as embodiments of shared representations and shared meaning, cognitive social capital provides a useful lens for interpreting new information that can contribute to new knowledge generation and new innovations that can sustain the growth of firms.

4.11.4. Intellectual capital and technology entrepreneurship

The relationship between each dimension of intellectual capital and technology entrepreneurship must be unraveled to fully understand its impact. As such, the next section discusses each dimension as it relates to TE.

4.11.4.1. Structural capital and technology entrepreneurship

A study conducted by Miller et al. (2013) revealed that structural dimension of intellectual capital plays a pivotal role in shaping knowledge transfer and sharing and consequently impacts university technology transfer activities, which drive technology commercialisation. Since structural intellectual capital relates more to organisational systems, processes and methods such as databases, filing cabinets and organisational routines that put information at the disposal of employees, one would expect these infrastructural affordances to provide resources for the exploitation of knowledge that support technology innovations. Aramburu, Sáenz and Blanco (2015) explored the effects of structural dimension of intellectual capital and innovation capability on the performance of technology-based Colombian firms. Their study revealed that structural intellectual capital exerts a significant impact on the effectiveness of new idea generation process and the management of innovative technology projects. Their study revealed that while structural intellectual capital impacts innovation capability, successful innovation project management is the only innovation capability dimension that exerts a significant impact on the performance (e.g., growth) of technology firms. One infers that while structural capital could directly influence technology innovations, other dimension of technology entrepreneurship such as growth are impacted via innovation capability.

4.11.4.2. Human capital and technology entrepreneurship

As a dimension of intellectual capital, human capital has potential to shape the realisation of technology entrepreneurship. Steinfield et al. (2010) examined the interaction between human capital, application of technologies such as using online databases for recruitment, the use of intranets to enhance employees' access to information and collaborative tools to connect with off-premises researchers and firm performance. The study reveals that the use of human capital together with the application of these technologies enhanced the performance (e.g., growth of these companies, which is a dimension of TE). Similarly, a study conducted by Cunha et al. (2015) also suggests the importance of human capital (especially business and technical knowledge) in the implementation of technology innovations (i.e., a dimension of TE) such as Information System Development (ISD) projects. They argued that human capital served as a critical resource in technology innovations through processes such as knowledge boundary spanning process (e.g., new knowledge jointly created by interactions between users and developers) employed for grasping the elicited IS requirements.

4.11.4.3. Relational capital and technology entrepreneurship

Ryu, Baek and Yoon (2021) explored the interaction between relational capital, technological innovation capital, and the international performance in SMMEs. Their study demonstrates that relational capital exerts a significant impact on the technological innovation capability of firms, and technological innovation capability has a significant influence on the international performance. Ramírez-Solis, Llonch-Andreub & Malpica-Romero (2022) also explored the effects of relational capital on technology orientation for innovation of Mexican SMMEs and the results pointed to the positive significant effect of relational capital on technology orientation. Their study also provided some relevant insights into the debate on technology as a source of innovation including how relational capital and technology orientation are related to a firm's performance. In short one infers a direct relationship between relational capital and aspects of technology entrepreneurship such as technology orientation as much as the relationship can be mediated by innovation.

4.12. CHAPTER SUMMARY

This chapter was devoted to an examination of institutional factors, especially incubator support and incentive regimes that shape and drive TBI processes (i.e., incubation selection criteria, IP and patenting, incubator managerial competences) and outcomes. Apart from the characterisation of institutional factors into physical capital, social capital and intellection capital, the chapter also distinguished support from incentives structures offered by incubators and public agencies. The chapter acknowledged the value of the provision of physical public and private capital investment including physical, social and intellectual infrastructure to the realisation of technology business incubation processes. The multiple considerations at the heart of the success of the incubation processes - incubator missions, resource base, management teams and incubator projects pursued, the size of incubation labs, were also acknowledged.

The last segment of the chapter was devoted to how institutional factors affect TBI outcomes, especially TE. To better appreciate the relationships between institutional factors and TE, each one of their dimensions was disaggregated and their relationships were investigated. Since the study is pre-occupied with NTBFs which are incubated in TBIs, special attention was devoted to institutional factors as they related to technology-related goods such as patents, trade secrets, copyright and trademarks, which are some of the manifestations of TE. Other TE dimensions such as growth orientation of firms and technology innovations were also considered. The next chapter is devoted to environmental factors that affect TBI and incubation outcomes.

CHAPTER 5
ENVIRONMENTAL FACTORS AFFECTING TECHNOLOGY BUSINESS INCUBATION AND ITS OUTCOMES

5.1. INTRODUCTION

The previous chapter rendered a synopsis of institutional factors implicated in technology business incubation (TBI) and the associated incubation outcomes. The chapter concentrated on the incubation incentive and support regime of governments and incubators, especially different capital forms and how they shaped TBI processes and outcomes especially TE. This chapter builds on the previous one by exploring environmental factors affecting TBI and TE. Specifically, it focuses on incubation ecosystem dynamism and devotes attention to national entrepreneurship policy, regional funding policies for SMMEs, regional innovation culture and the legitimacy of incubation processes as they relate to TBI processes and TE. Given that literature presents entrepreneurship policy (Daramola, 2012; Tang et al., 2013; Rungani & Potgieter, 2018), regional SMME funding (Williams & Tsiteladze, 2016), regional innovation culture (Pinillos & Reyes, 2011) and the legitimacy of incubation processes (Batchelor & Burch, 2011; Messeghem, Sammut & Beylier, 2014) as drivers of TBI processes, it is critical to discuss them with reference to TBI and incubation outcomes especially TE.

The need to examine these environmental factors arose from the critique levelled against entrepreneurial ecosystem studies regarding the lack of compelling evidence on the capacity of these factors to drive entrepreneurial activities. There is actually a gap in understanding the extent to which ecosystem elements exert an impact on creating innovation and the vibrancy of the entrepreneurial environment (Velt, Torkkeli, & Saarenketo, 2018). These scholars elaborate that by concentrating on the relative importance of certain elements and their contribution to the overall structure and its dynamism, these studies could be inherently misleading (Velt et al., 2018). As such, the current chapter takes a different inclination from uni-level approach (that focuses on either individual, institutional or environmental approach) by adding an environmental layer to the individual and institutional level factors explored in previous chapters.

5.2. CONCEPTUALISATION OF NOVEL CONCEPTS

It is necessary to define certain environmental variables upfront to ensure that they are fully grasped in context. Since some concepts such as national entrepreneurship policy and regional SMME funding are deemed clear and straightforward and need no definitions, the next sections discuss regional innovation culture, legitimacy of incubation and incubation ecosystem. The next section is devoted to defining regional innovation culture.

5.2.1. Regional innovation culture

Since culture refers to "collective programming of the mind" (Hofstede, 2001: 1), and this programming shapes certain attitudes, values, norms of behavior and conventions (Alvarez & Urbano, 2012), regional innovation culture, therefore, describes the collective cognitive orientation of individuals residing in a specific region towards the pursuit of novel ideas, activities, behaviours and values. It targets the cognitive dispositions, inclinations and receptivity of individuals living in a specific region to new ideas, processes, products, services and activities including their long-term commitment to their fulfilment. Their level of openness and acceptance of such activities would determine whether such innovation processes and activities could thrive, be dampened or could vanish in the long term.

5.2.2. Legitimacy of incubation

Legitimacy is defined as a "generalised perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman, 1995: 574). It describes the "social judgement of acceptance, appropriateness, and/or desirability" (Zimmerman & Zeitz, 2002) of specific actions and behaviours of specific actors in the incubation environment. Therefore, legitimacy of incubation describes perceptions of desirability, appropriateness and acceptance of incubation by various stakeholders within and beyond the incubation ecosystem.

5.2.3. Incubation ecosystem

To understand an incubation ecosystem, the terms "system" and "ecosystems" must be defined as these two terms merge to form the suffix of the term incubation ecosystem. A system denotes a group of interrelated entities configured in a way that the collective and their interrelationships reduce complexity (Skyttner, 2005). The individual entities in a system work in a general environment in coordinated and integrated ways to achieve specific pre-determined goals and objectives. Moore (1993) views an ecosystem as a collectivity of components in a business environment working in a coordinated way to achieve certain preconceived goals and objectives (e.g., sustenance, self-preservation). The term characterises and explains the co-effect and co-evolution of firms in their external environment.

In the context of startups, various terms have been employed to describe an incubation ecosystem. These include "entrepreneurial system" (Spilling, 1996), "ecosystem for entrepreneurship" or "entrepreneurial ecosystem" or "entrepreneurship ecosystem" (Mason & Brown, 2014; Spigel, 2017) or "startup ecosystem" (Malecki, 2018) and "startup incubation ecosystem" (Novotny et al., 2020). Moore (1993) first employed the term "business ecosystem" to refer to the broader environment of firms. However, the entrepreneurial environment is the most dominant phrase employed in characterising incubation or entrepreneurial ecosystems in literature from the 1970s to 2015, with entrepreneurial ecosystem only emerging in the 2000s, and becoming more dominant from 2016 onwards (Malecki, 2018).

An incubation ecosystem describes the diverse factors [and actors] that interact to provide a nurturing environment suitable for the successful development of startups (Novotny, Rasmussen, Clausen & Wiklund, 2020). For university-based TBI, the actors comprise the incubator, the incubator tenants, spinoff companies, technology licensing institutions, government regulators, business angels, venture capitalists, academics and researchers who render support and specialised expertise to incubatees. Despite the semantics surrounding the application of the term, this study employs the term “incubation ecosystem” as it gels well with the firm’s environment that enables incubatees to generate innovation-driven and technology commercialisation outcomes. To reduce fuzziness in conceptualisation arising from persistent reference to entrepreneurial/entrepreneurship ecosystems even when pure incubation resources (e.g., network, talent, professional support, capital) are discussed (Cohen, 2006; Isenberg, 2010; Macke et al., 2014; Cowell, Lyon-Hill & Tate, 2018), incubation ecosystems and entrepreneurship ecosystems are employed in this study interchangeably as they emphasise the same elements, despite variations in the foci of their application.

5.2.3.1. Towards an inclusive definition: A synthesis of literature

The imprecise definitions of incubation ecosystem are partly attributed to the diverse ways ecosystems are defined, the diversity of ecosystem requirements of entrepreneurs from different markets and different growth aspirations (Cowell, Lyon-Hill and Tate, 2018). Other explanations for the lack of precision include the different scales employed in assessing ecosystems, the diversity of research designs and data employed to establish them (Stam, 2015; Acs et al., 2017; Malecki, 2018). The characterisation of incubation (or entrepreneurial) ecosystems has emphasised individual actors or stakeholders themselves (Erina, Shatrevich, & Gaile-Sarkane, 2017), the interconnectedness of individual components (Isenberg, 2011), and systemic conditions (namely networks of entrepreneurs, leadership, finance, talent, knowledge, and support services) that guarantee the sustenance of the system (Stam, 2015). This body of literature, however, has been criticised for emphasising essential ingredients and neglecting the processes or “recipes” for their combination into a sustainable milieu with entrepreneurial vitality (Stam & Spigel, 2017). Other scholars have exhorted directing attention at understanding the flow of relationships within an entrepreneurial ecosystem, which change over time (Stam, 2007; Spigel, 2017). In view of this confusion of definitions and characterisations, a panoramic perspective on what has been emphasised in the diversity of definitions is required. As such, Table 5.1 provides some commonly cited definitions of incubation/entrepreneurial ecosystems.

Table 5.1: Definitions of startup incubation (or entrepreneurial) ecosystems

Author	Definition
Isenberg (2010)	The entrepreneurship ecosystem consists of a set of individual elements - such as leadership, culture, capital markets, and open-minded customers that combine in complex ways (p. 43).
Mason and Brown (2014)	A set of interconnected entrepreneurial actors (both potential and existing), entrepreneurial organisations (e.g., firms, venture capitalists, business angels, and banks), institutions (universities, public sector agencies, and financial bodies), and entrepreneurial processes (e.g., the business birth rate, numbers of high growth firms, levels of "blockbuster entrepreneurship," number of serial entrepreneurs, and levels of entrepreneurial ambition) which formally and informally coalesce to connect, and govern the performance within the local entrepreneurial environment (p. 9).
Stam 2015	A set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship (p. 1765). The entrepreneurial ecosystem concept emphasises that entrepreneurship takes place in a community of interdependent actors (p. 1761).
Theodoraki and Messeghem (2017)	The entrepreneurial ecosystem is a generic context aiming to foster entrepreneurship within a given territory. Therefore, it consists of a horizontal network (customers and providers) and a vertical network (competitors and complementors). It also includes organisations supporting entrepreneurs: public or private funding agencies (banks, business angels and venture-capital, etc.); support entities (business incubators, consultants, etc.); research organisations (research centres, laboratories, etc.); and businesses' consortiums (active businesses, associations and trade unions, etc.) (p. 56)
Spigel (2017)	Entrepreneurial ecosystems are the union of localised cultural outlooks, social networks, investment capital, universities, and active economic policies that create environments supportive of innovation-based ventures (p. 49). Entrepreneurial ecosystems are combinations of social, political, economic, and cultural elements within a region that support the development and growth of innovative start-ups and encourage nascent entrepreneurs and other actors to take the risks of starting, funding, and otherwise assisting high-risk ventures (p. 50).

(Source: Adapted from Malecki, 2018:6-7)

Five aspects emerge from the evaluation of definitions provided in Table 5.1. First, an incubation ecosystem comprises stakeholders who are committed to collective engagement for the realisation of their common goals such as mutual interests, interdependence, competition, regulation and provision of collective support and benefits. Second, *horizontal and vertical interactions* unfold among participating, competing and complementary actors in ways that enable the emergence, sustenance and evolution of the incubation system. Third, *locale of interactions* can be a specific place, district, region or a clearly defined physical geographical location, aimed at supporting and enhancing innovation and growth of existing, new and future startups and the generation of multiple spillover effects (e.g., jobs, knowledge transfer, technology and skills development). Fourth, a startup incubation ecosystem supports and sustains robust sharing of resources (expertise, leadership, capital, networks and physical inputs) in ways that enable the generation of collectively developed outcomes. Fifth, such a system is *dynami*c as its employs a broad range of interactions as its source of co-evolution, self-preservation and transformation. Drawing on these five elements, the current study conceives a startup incubation ecosystem as:

> A constellation of actors (e.g. incubators, tenants, financiers, universities, spin off companies, licensing companies, community), institutions, organisations, networks and (e.g. economic, social, political and cultural) communities engaged in dynamic horizontal and vertical relationships and co-evolving interactions that afford and restrict the flow of resources (finance, networks, skills and expertise, physical materials) within a bounded environment (i.e. a locale, district or region) in support of the generation of tangible and intangible impact-driven outcomes and commonly shared values (e.g. self-preservation, co-evolution, transformation).

It is essential to acknowledge that resources are shared across the system but the flows of resources out of the system may be restricted to ensure that the system continues to function in fulfilment of its mandate and imperatives. Macke et al. (2014) conceives an incubation ecosystem to employ five C's: *capital* (financial resources), *capability* (skills and competences of entrepreneurs and owners), *connections* (resource and relationship networks), *culture* (the local communities' perception and support of entrepreneurship) and *climate* (regulatory, economic development and policy environment).

With reference to TBIs, resources are shared via interactions between these players through various processes such as cooperation, competition, "connection, mediation, governance" (Mason & Brown, 2014: 9). These manifest in the establishment of industries and sectors, creation of university spin-offs, management of licensing agreements, generating research contracts, providing consultancy services and facilitating the mobility of graduates and researchers between these sectors (Mascarenhas, Marques, Galvão & Santos, 2017) and multi-level research and development, popularly regarded as quadruple helix exchange of knowledge (Sperrer et al., 2016; Miller et al., 2018).

5.2.3.2. Ecosystem dynamism

Having articulated systems, ecosystems and an incubation ecosystem, the next step is to interrogate ecosystem dynamism as the variance of the ecosystem that contributes towards realising both TBI and outcomes, as will be demonstrated when bi-variate relationships are examined later in this chapter. Musawa and Ahmad (2018:2) define dynamism as "the rate of change and the degree of variability of the environment." The dynamism of the ecosystem is often identified with environmental hostility, heterogeneity and resource munificence in literature (Awang et al., 2009; Rambe & Mosweunyane, 2017). Since these terms are unique, they need clarification so that they can be fully appreciated in the context of this study. The next section discusses a dynamic environment with reference to startups.

5.3.1. Dynamic environment

A *dynamic environment* is punctuated by continuous change and instability and may present multiple opportunities (e.g., industry growth, proliferation of technology, customer preferences, and demand for new products) which new startups could exploit (Covin & Slevin, 1991; Aloulou, 2002). Since a dynamic ecosystem involves constant interaction of ecosystem elements (e.g., participants) amongst themselves and with their external environment, Autio and Levie (2015) contend that the survival of an incubation ecosystem is tied to its capacity to support institutionally embedded interaction between entrepreneurial attitudes, ability, and aspirations of individuals. In their dynamic interaction, they steer the allocation of resources through the creation and operation of new ventures.

5.3.1.1. Environmental hostility

Environmental hostility describes an environment characterised as risky, stressful, and dominating industry settings. Quite often, this means a harsh overwhelming business climate that threatens the viability and performance of firms (Kach, Azadegan & Teich, 2019). Such an environment does not only threaten the survival of firms but also exerts different effects on firms depending on geographical regions and market structure (Amoako-Gyampah & Boye, 2001, Kach, et al., 2019). With reference to South Africa, the highly unionised nature of the market marked by multiple legislation (e.g., Minimum Wage Legislation, Labour Relations Act; Occupation Health and Safety regulations) and excessive bureaucracy in company registration (e.g., cost of filing for corporate and VAT, operational by-laws) may be restrictive and unfavourable to new startups.

5.3.1.2. Environmental heterogeneity

Environmental heterogeneity signifies the prevalence of different market segments with varied characteristics and needs served by the firm (Aloulou, 2002). Market structure for example, is one typical example of environmental heterogeneity. Market structure would entail the level of industry and customer concentration, product heterogeneity, and development stage of industry (Iacono & Nagano, 2017). Although the concentration of industries supplying a bundle of products in a specific geographical area would create barriers to entry for new technology startups, they also present opportunities to create niche markets by serving underserving surrounding areas, thus presenting growth opportunities for such firms. Research suggests that while the new technology startups may struggle to grow in concentrated industries culminating in high failure rates (Wagner, 1994), these firms are often receptive to new suppliers as a strategy for regulating the decision-making power of industry leaders (Iacono & Nagano, 2017).

5.3.1.3. Environmental munificence

Environmental munificence denotes the scarcity or abundance of resources available in the market and demanded by firms (Dess, Lumpkin & McFarlin, 2005). From an individual firm's perspective, munificence epitomises the firm's ability to acquire resources from the environment and the ways in which that could drive the performance of the firm (Davis, 2007; Magaji et al., 2017). Environmental munificence, therefore, captures the scarcity or abundance of resources in the environment (Aloulou, 2002) which present multiple opportunities and constraints for the firm to draw on its strategy in fulfillment of its mission and objectives. However, since the turbulence and variability of the environment is often perceived as an expression of its dynamism (Kim & Kim, 2016), environmental munificence becomes a variant of environmental dynamism with implications for the extent of swiftness and stability with which firms respond to external shocks.

5.4. INCUBATION ECOSYSTEM DYNAMISM: PARALLEL STUDIES

The previous sections focused on diverse conceptualisations of ecosystem dynamism in entrepreneurship literature. This section is devoted to a specific type called incubation ecosystem dynamism. The dynamism of the incubation ecosystem denotes the extent to which the incubation ecosystem responds flexibly and effectively to the changes, demands and risks brought to bear upon it by its internal and external actors. Often used interchangeably with entrepreneurship ecosystem dynamism, incubation ecosystem dynamism captures the dynamic process of business services provision by business incubators, often executed in an open innovation context, where many elements from the entrepreneurship ecosystem (EE) interact (Fernández, Jiménez & Roura, 2015). Isenberg (2011) conceives the dynamism of an entrepreneurial ecosystem to comprise the following:

- a conducive culture (e.g., tolerance of risk and mistakes and positive social status of entrepreneur),
- facilitating policies and leadership (e.g., regulatory framework incentives and existence of public research institutes),
- availability of dedicated finance (e.g., business angels, venture capital and micro loans);
- relevant human capital (e.g., skilled and unskilled labour, serial entrepreneurs and entrepreneurship training programmes),
- venture-friendly markets for products (e.g., early adopters for prototypes and reference customers) and

- institutional and infrastructural support (e.g., legal and accounting advisers, telecommunications and transportation infrastructure and entrepreneurship promoting company networks).

Incubation ecosystem dynamism, therefore, permits the shifting of analysis from individual entrepreneurs and their startups' internal operations to the whole environment where these firms are situated. This re-orientation allows an integrated grasp of how clusters of economic activity come into being and mediate firm performance (Cowell et al., 2018). Incubation ecosystem dynamism, therefore, signifies how these multiple actors (e.g., incubators, incubatees, regulators, financiers, university research institutes) interact, co-evolve and co-influence each other in ways that support the development and sustenance of healthy business development outcomes. Some fundamental outcomes of such dynamism are the creation and implementation of new knowledge and transferable behaviours such as resourcing, sourcing of R&D funding, inventions and patents (Mascarenhas et al., 2017). As such, incubation ecosystem dynamism highlights a dynamic and evolving community rather than a static phenomenon, pointing to the significance of adaptation to social and economic changes among actors within the entrepreneurship ecosystem (Pitelis, 2012).

One of the prominent areas of research resonating with incubation ecosystem dynamism is how business incubator models have evolved over time (Bruneel et al., 2012). When characterising business incubation models, business incubators have often been understood as relatively homogenous institutions that have evolved in similar ways, irrespective of context (Mrkajic, 2017). Moreover, studies have often privileged data sourced from advanced economies in the development of the nomenclature of business incubator models (Barbero et al., 2014; Pauwels et al., 2016). Despite the prevalence of TBIs in developed countries, any attempt at characterising incubation models that does not acknowledge the contribution of institutional dynamics from developing economies would be minimalist and imperfect.

The body of literature on ecosystem dynamism tends to focus on environmental dynamism (the favourability and hostility of the market) (Kim & Kim, 2016) rather than incubation ecosystem dynamism. For instance, the moderation of environmental dynamism on the entrepreneurial orientation (EO) – firm performance relationship has contributed to the heterogeneity of this relationship across contexts. Literature demonstrates that the moderating effects of environmental dynamism are studied through external environments, such as market dynamism and market hostility (Lumpkin & Dess 1996; Awang et al., 2009; Ruiz-Ortega, et al., 2013). For instance, Awang et al. (2009) reported perceived environmental factors (munificence, turbulence, competition, market dynamism, and restrictiveness) as moderating the relationship between EO and performance.

The moderating effect of environmental dynamism on the EO-firm performance relationship seems contextual and circumstantial. While some studies allude to positive effects of dynamic and hostile market conditions on the relationship between EO and firm performance (FP) (Covin & Slevin, 1991; Kim & Kim 2016), other studies recognise market dynamism and hostility as exerting an insignificant moderating role (Wiklund & Shepherd 2005; Hameed & Ali, 2011). Frank et al. (2010) could not establish evidence of the moderating role of market dynamism in the EO–FP relationship. Other studies ascribe greater complexity in the nature of the relationships. For instance, Zhai et al.'s (2018) moderated moderation model demonstrates that while absorptive capacity positively moderates the relationship between entrepreneurial orientation and innovation performance, when external environment exhibits high dynamism, the moderating effect of absorptive capacity will be stronger than when the environment exhibits low dynamism. Similarly, Ruiz-Ortega et al.'s (2013) research suggests that while environmental dynamism, technological and marketing capabilities exert a positive effect on EO, technology capabilities moderated the positive effect of environment dynamism on EO. This demonstrates that environmental dynamism can also serve as a predictor rather than a moderating variable as articulated in some studies (Musawa & Ahmad, 2018). In view of these inconsistent results on the contribution of environmental dynamism, more rigorous research must be conducted in the field of business incubation to establish the contribution of environmental factors (especially incubation ecosystem dynamism) to effective technology incubation.

5.5. INCUBATION ECOSYSTEM DYNAMISM-TBI RELATIONSHIP: AN OVERVIEW

The following sections discuss selected dimensions of incubation ecosystem dynamism and their relationships to specific dimensions of technology business incubation (TBI). The dimensions of incubation ecosystem dynamism explored in this study are national entrepreneurship policy, regional SMME funding, regional innovation culture and legitimacy of incubation. As already indicated at the onset of this chapter, these dimensions were selected as they are most discussed in entrepreneurship literature as impacting TBI outcomes. The dimensions of TBI are incubation selection criteria, intellectual property and patenting, incubation manager competence and incubator norms and procedures. Since incubation selection criteria constitutes a component of incubation norms and procedures, the latter are excluded from the examination of relationships to avoid repetition. The following section provides an overview of the relationship between national entrepreneurship policy and the dimensions of these TBI processes. Thereafter, each dimension of TBI is then treated in relation to national entrepreneurship policy.

5.5.1. National entrepreneurship policy- TBI processes relationship: A snapshot

There exist two strands of research on the relationship between national entrepreneurship policy and business incubation processes (e.g., selection criteria, IP and patenting, manager incubation competencies). The first strand places its emphasis on how national entrepreneurship policy affects entrepreneurship pursuits and venture creation (Bergmann, 2009; United Nations Industrial Development Organisation, 2015; Rungani & Potgieter, 2018) in general and not necessarily TBI processes per se. This broad literature emphasises how the creation of a conducive environment for direct investment and SMME development supports the development and growth of new ventures. The second strand of research has examined the contribution of national entrepreneurship and venture capital financing to the development of high growth-oriented technology ventures (Oyewale, 2010; Daramola, 2012; Tang et al., 2013). Nevertheless, since venture creation is an outcome of incubation processes, this chapter considers both strands to provide a more panoramic perspective on the dynamics of TBI processes as they relate to national policy. This is critical – especially given the fact that entrepreneurship propensity of a nation shapes both resource mobilisation and exploitation of venture opportunities by entrepreneurs (e.g., through venture creation and incubation processes). Having articulated the strands of research on the national entrepreneurship policy-TBI relationship, the next sections explore national policy as it relates to each of the dimensions of TBI processes.

5.5.1.1. National entrepreneurship policy and incubation processes

Table 5.2 provides a summary of studies that examined the relationship between national entrepreneurial policies, strategies and programmes and the incubation of small businesses. These studies demonstrate how such policy, strategy and programme infrastructure provide an enabling environment for the incubation of businesses, including an illustration of the constraints associated with such incubation.

Table 5.2: National policies, incubation processes, venture development and challenges

National or regional Policy	Background and/ Policy foci	Main highlights	Challenges	Source	
United Kingdom UK-based accelerator programmes	▪ 6% of fast-growing UK businesses generate the largest share of employment growth in the UK. ▪ Accelerator programmes are modeled around Y-Combinator (founded 2005) or Techstars (founded 2006) principles. ▪ Y-Combinator funds two entrepreneur cohorts a year, the programme runs for three months. ▪ The cohort meets together for weekly speaker dinners and startups have regular office hours with the Y-	▪ Created 34 accelerators in London area. Some are Fintech Innovation Lab, Bethnal Green Ventures, Climate-Knowledge and Innovation Community (KIC) UK and Microsoft Ventures Acc ▪ The programme provides investments in startups in exchange for equity. ▪ Provides curriculum' or 'training programmes' to new ventures, expert workshops and inspiring talks, regular counselling, and shared spaces ▪ Secure funding of around £10,000 from investors, corporates and public authorities. Developed three accelerator architypes based individual or institutional focus as their selection basis: ▪ Investor-led archetype comprising serial	▪ While they bridge equity gap between very early-stage projects and investable businesses, investor-led accelerators tend to generate sector-specific knowledge and expertise. ▪ While matchmakers provide a service for the customer base by 'matching potential customers with startups', they do not offer finance to startups that participate on the programme. ▪ Although the ecosystem architype has a well-developed curriculum for	Clarysse, Wright and Van Hove, (2016)	

	Combinator team and mentors ▪ Techstars also runs for three months. ▪ It offers a structured programme where startups physically move into the accelerator's co-working space for the duration of the programme ▪ Provides a more regular and intensive approach to mentoring.	entrepreneurs and business angels. ▪ Matchmaker archetype comprising internal coaches from corporates and ecosystem archetypes are often led by government agencies aimed at stimulating startup activity, either within a specific region or within a specific technological domain.	incubatees, its value proposition is not always clear. Their systems are often mainly targeted at satisfying government regulations		
Canada's Small Business Branch is a member of International Consortium for Dynamic Entrepreneurship Benchmarking (ICEB) The OECD-Eurostat Entrepreneurship Indicators Programme	To develop more evidence-based data on entrepreneurship. To develop multiple measures of entrepreneurship according to a simplified conceptual framework. Develop instruments focusing on entrepreneurial performance based on	The entrepreneurial and venture creation commitments in these policy instruments are: ▪ Building a robust regulatory framework that reduce barriers to firm entry and growth, product regulation, patent systems and capital taxes. ▪ Creating conducive market conditions by increasing competition, anti-trust laws, improving access to markets and public investment.	2,300 irritants for small business productivity have been identified. These are being addressed to reduce excessive demands for compliance and time and cost of venture creation. Economy-wide nominal cost of compliance grew from $4.3 billion	(Industry Canada 2015, OECD 2013). Statistics Canada (2008). (Statistics Canada 2005, 2008, 2011)	

Canada Business Network	firms, financial and employment perspectives. ▪ At firm level, the instruments examine: Startup rate of firms (business birth rate) and exit rate of firms (business death rate), ▪ From an employment lens, they target proportion of high growth firms. ▪ At the financial level, they measure proportion of high growth firms by revenue firms. Canada Business Network provides diverse information on government services, programmes and regulations through an online portal and a network of service centres across Canada. This reduces the complexity of dealing with multiple layers of government.	▪ Increasing access to finance e.g., through access to debt financing, venture capital, equity and business angels. ▪ Promoting knowledge creation and diffusion through R&D investment, university-industry partnerships, technology diffusion and technology cooperation between firms. ▪ Building entrepreneurship capabilities through offering training and enhancing experience of entrepreneurs, business skills development and building entrepreneur infrastructure. ▪ Promoting entrepreneurship culture though promoting attitudes to business ownership and risk attitudes and entrepreneurship education.	to $5.2 billion between 2005 and 2011. SMEs prepared and submitted about 12 million submissions to government to comply with key federal, provincial and municipal regulations - this translated into over 14 million compliance hours. Annual federal/provincial business income tax filing was burdensome - ranged from $500 and $4,145 per business per year depending on firm size		

	Treasury Board's Red Tape Reduction Action Plan (RTRAP) has sought to reduce businesses' burden of compliance with export and product regulation. It sets guidelines for timely issuance of licences, certifications and permits, and requires regulators to set and publish measurable standards for delivering them.				
Germany *Einfach Anfangen* ("Simply begin") Programme EXIST – Existenzgründungen aus Hochschulen" (university spin-offs)	The high levels of unemployment in East Germany around the 2000s led to the establishment of necessity-driven starts-ups which were heavily supported by the government. The East Germans tended to view their business environment more pessimistically than the West Germans. East Germans conceived fear of failure and risk aversion as impediments to business creation (Bergmann, 2009). The policy seeks to: 1. Sensitise students and research workers to pursue	The growth in self-employed individuals from 7% to 10% in Mecklenburg-Western Pomerania was attributed to: ▪ Massive support for business startups. ▪ The general trend towards self-employment that was emphasised. ▪ 1998 to 2005, 15 regional startup support networks were assisted by EXIST. ▪ Various regional stakeholders supported the development	It cannot be scientifically verified that programmes designed to advance "entrepreneurial culture" or to improve foundation-related attitudes actually lead to the founding of ventures ▪ It is unclear whether EXIST stimulated the durable change	Bergmann (2009) Heger and Metzger (2006). (Bergmann, 2009; Koch, Kautonen & Grünhagen, 2006).	

	entrepreneurial self-employment. 2. Promote the education and professional upgrading of potential business founders. 3. Ensure that concrete business foundation projects are supported through counselling, coaching and infrastructural backup.	and implementation of measures of business incubation. ▪ Much headway has been made with entrepreneurship education and upgrading. ▪ Success of EXIST was attributed to competition in selecting the regions eligible for support and volition in designing individual measures for determining incubation success.	processes and contributed to the creation of sustainable support institutions. ▪ It remains uncertain whether new ventures will continue existing when support payments are discontinued. ▪ It remains to be seen whether the support programme could contribute to increase startup activities with positive impacts on the regional economy.		
China Science and Technology System Reform (1985), Torch Programme (1988)	Seeks to enhance science-industry linkage and develop high-tech firms. At macro-policy level, the Ministry of Science and Technology (MOST) provides general guidelines and rules, such as entry and exit policies and the incubator evaluation framework.	▪ In 2010, 896 TBIs had been created. Of these, 344 were state-level TBIs. ▪ Accumulated venture capital amounts of between US$ 1.5- US$ 250 million were generated. ▪ Total incubator amounts ranged from US$0.7m – US$ 4.2. ▪ Survival of tenants ranged from 85%-95%.	Despite the provision of an evaluation framework (designed by MOST) for state-level incubators in 2007, there is no systematic assessment framework for the performance of high-tech ventures. TBIs themselves craft and implement tenant	Tang et al. (2013)	

	Torch Programme Office under MOST organises, develops, finances, and guides the TBI programmes	▪ Graduate tenants ranged from 5-30.	performance review policy frameworks.		
India National Science & Technology Entrepreneurship Development Board (NSTEDB) under the Department of Science and Technology (DST) launched the TBI programme.	Indian TBIs' selection criteria include: (i) Excellent idea and business plan; (ii) Commitment and integrity of promoters; (iii) Potential for growth; (iv) Willingness to accept and follow mentoring advice; (v) Capacity to meet targets; and (vi) Willingness to pay for the facilities and services. TBIs target: 1. Creating technology-based new enterprises 2. Creating value-added jobs and services; 3. Facilitating transfer of technology; 4. Fostering the entrepreneurial spirit; 5. Speedy commercialisation of R&D output 6. Specialised services to existing SMEs	▪ By 2009, there were approximately 120 TBIs in India. ▪ Of these, 40 were established in the Software Technology Parks (STPs), ▪ Number of incubated firms generated by TBIs ranged from 14 and 356. ▪ Number of granted invention patents per TBI range from 9-156	Indian TBIs find it difficult to match the startups' needs to the available venture capital as venture capital firms do not fund small amounts.	Tang et al. (2013)	
Nigeria	The Act promotes the commercialisation	The Act renders incentives and tax relief to venture capital companies	While the capacity of venture	Daramola (2012), Oyewale (2010)	

Venture Capital (Incentives) Decree No .89 1993 Act Science, Technology & Innovation Policy Draft (2011)	of research findings with high potential, nurtures innovative ideas to fruition and steers the development and growth of indigenous business processes and technologies. Strives to promote investment friendly policies leading to enormous interest by foreigners and entrepreneurial confidence by locals.	that invest in venture capital projects. It validated the formation of Nigeria's first Venture Capital (VC) Company, the National Risk Fund Plc established in 1987 ▪ More VC firms created with increases in deals, ▪ VC Industry development with specialty firms were created, ▪ Emerging privatised companies, telecommunication companies; financial services, oil and gas, infrastructure, technology-based or technology business model companies were created.	capital to support the creation of technology-based firms was acknowledged, the proportion invested directly in TBFs in Nigeria could not be established with great certainty		
South Africa South African National White Paper on Small Business Integrated Strategy on the Promotion of Entrepreneurship and Small Enterprises	Creates multiple measures to foster an enabling environment for SMME development. Fosters an enabling environment for entrepreneurship and SMME development. Targets enhancing access to small business support and information, strengthening small business advocacy, delivering effective service and monitory impact.	▪ Increases financial and non-financial support by streamlining public sector resources and crowd-in private sector resources. ▪ Creates demand for small enterprise products and services through public sector procurement strategy and BEE codes of good practice. ▪ Reduces small enterprise regulatory constraints by creating an enabling environment through establishing a regulatory impact assessment framework and Business Environment monitoring Mechanism	While multiple measures have been instituted, those that target creating an entrepreneurial climate and profile for incubatees are lacking. These challenges include: Lack of easy access to finance for supporting high growth ventures; complexities of dealing with crime; liberalisation of the labour market; need to simplify business registration; need to	National White Paper on Small Business (1995) Department of Trade and Industry, (2007)	

			incentivise entrepreneurship; need to increase government capacity for effective delivery. Limited evidence to demonstrate the impact of entrepreneurship on business and economic development. The cultural norms of South Africa do not support failed entrepreneurs but rather isolates and vilifies them	(Endeavour SA, 2010; Kassim, Soni & Karodia, 2014).	

What is clear from the studies highlighted in Table 5.2 is that while entrepreneurial policies are too broad to provide granular details on incubation selection processes, they do postulate a vital framework within which incubators can develop the necessary selection strategies for incubatees. It is entrepreneurial plans and programmes that provide comprehensive guidelines to inform and direct the development of incubation selection criteria and incubation models, which national entrepreneurial policies often gloss over. Incubation selection criteria denotes the strategies and methods that are employed by a business incubator in identifying, admitting entry, monitoring growth and progress, and selecting incubatee for exiting incubator premises.

With reference to South Africa, White Paper of 1995 and Guidelines for National Strategy and Promotion of Small Businesses serve as instruments for SMME development and provision of funding instruments in the country. These national policies frame the development of SMMEs and investment in business at both national and local levels (Rungani & Potgieter, 2018). This implies that these national policy instruments constitute economic stimuli for the development of frameworks for the incubation of small businesses and the fostering of parameters and processes (e.g., incubation models, selection criteria and graduation criteria) under which such businesses are incubated. Despite the good intentions of these policy instruments, the complexity of transforming SMMEs into large corporations operating regionally and globally has remained a major hurdle (SMME South Africa, 2015).

The National Strategy for the Development and Promotion of Small Business provides a useful mechanism for incentivising the creation of startups, promoting the transfer of resources to disenfranchised communities and addressing economic imbalances in ways that facilitate economic transformation. The policy is also credited with increasing marginalised groups' participation in the economy (e.g., rural entrepreneurs) and promoting socioeconomic transformation by increasing the capacity of these groups to generate income and promote their self-reliance (Department of Trade and Industry, 2007). In spite of these merits, the provision of institutional support via the policy has presented multiple business incubation hurdles. These include uneven distribution of services, limited outreach to new startups, cumbersome administration, discontinuity of programmes and the need for development of trust between incubators, incubatees and regulators (Berry et al., 2002; Solomon & Lind, 2016). Therefore, it could be inferred that the deployment of national policy as a tool for supporting incubation processes must be supported by resource munificence (e.g., provision of SMME management, financial and technical support) and efficient administrative processes if effective incubation selection criteria is to be developed and applied consistently. This would ensure that the national entrepreneurship policy provides a formidable base for incubators' execution of TBI processes such as development of and conformity to incubation selection criteria and implementation of business incubation models for incubatees.

Solomon and Lind (2016) observe that the implementation of the national policy on SMME development at incubation levels suggests the first solid attempt at developing credible institutions and providing support infrastructure for advancing startup development. The provision of incentives further presents opportunities for bridging the resource gaps of startups and incubatees. However, incubators have displayed some shortcomings in identifying the right calibre of incubatees. For instance, despite the institution of policies on business incubation, incubatees continue to demonstrate lack of initiative, a culture of entitlement and expect resources provision to be presented willy-nilly without personal initiative from them. These challenges demonstrate that SMME policy development has not positively affected incubatee selection processes. These issues are indicative of limited co-creation of incubation processes (by ecosystem stakeholders) and entrepreneurial orientation of incubatees, which demonstrates the flawed nature of the incubatee selection process in South Africa (Solomon & Lind, 2016).

5.5.1.2. National policy, IP and patenting

Auerswald (2015) contends that policies designed to protect incumbents (existing dominant firms) tend to create barriers to entry and create an anti-competitive environment. Such policies and regulations may include restrictive patenting and technology licensing requirements, enforcement of competition laws and regulatory complexities that inhibit contracting. A typical example of the prevention of anti-competitive behaviour in the pharmaceutical software production in South Africa is the temporal relief that the South African Competition Tribunal granted to Vexall (a new technology-based startup) against BCX (a subsidiary of Telkom). BCX, which owns the copyright to the computer programme called Unisolv, used by many retail pharmacies in South Africa to dispense medicine, had requested all firms to accede to the purchase of value-added services as a condition for the sale of the software (Moyo, 2020). BCX developed the software almost three decades ago (26 years), which is now regarded as an industry-standard software for use by private retail pharmacies. The new entrant, Vexall, which renders ICT support services to the healthcare industry, interpreted as anti-competitive behaviour the need to purchase of valued-added services as a condition for issuing the software. The Competition Tribunal ruled in favour of Vexall that for six months, BCX would be prohibited from offering or selling a Unisolv licence on condition that a customer purchases value-added services from BCX (Moyo, 2020). Here is an instance where anti-competitive policies in South Africa protected fledgling startups from the large, dominant companies that employ their proprietary and patent rights to discourage competitive behaviour.

In the United States, companies such as Microsoft, Amazon, Apple, Facebook, and Google have risen to corporate prominence due to their innovation capabilities and their capacity to hold proprietary, mission-critical information technology and licenses for software (Wessels, 2018). The argument is that while these firms could be securing benign profits from their investment in IP and patent development, policies that favour large corporations through protection of intellectual property and patents could be creating barriers to entry for new startups in the technology sector that depend on such IP and patents for their growth. The concentration of large firms is attributed to prevalence of anticompetitive forces, whereby dominant firms block actual and potential rivals from entering and expanding their market. The consequence of legislation favouring anti-competitive behaviour is that incumbent firms in airlines wield excessive market power (e.g., Boeing), and pharmaceuticals (e.g., Dischem) and hospitals in ways which are inimical to the entry and success of business rivals (Wessels, 2018), especially new firms. For instance, in the airline industry, most aircraft operators who purchase planes from Boeing would be required by law to purchase spare parts from Boeing or Boeing-mandated dealerships.

5.5.1.3. National entrepreneurship policy and incubation manager competence

The pursuit of venture creation and incubation processes demands devoting attention to the competencies (i.e., knowledge, skills and experience) of incubation managers and those of stakeholders who support and shape the interactions in the incubation processes. The pursuit of entrepreneurship calls into question the examination of key stakeholders and incubation managers whose competencies play an active role in constituting the firm's basic competencies (Cuervo, Ribeiro & Roig, 2007; Hyseni, 2016). The relationship between national entrepreneurship policy and incubation manager competence can be convoluted due to the multiple dimensions of entrepreneurship policy. Belitski, Caiazza and Lehmann (2019) affirm the multi-layered nature of entrepreneurship policy, which manifests at the individual level, regional level, industry level and even at international levels. At the individual level of analysis, the development of germane entrepreneurship policies is credited with facilitating entrepreneurs' investment in knowledge within the firm's boundaries (e.g., through knowledge and skills development, in-house R&D, entrepreneurial and on-the-job training) as well as empowering entrepreneurs to purchase external knowledge from ecosystem holders of resources within proximity (Acs et al., 2018; Stam 2018). Therefore, in view of Schumpeter's Mark 1 arguments about small technology startups being operated by highly spirited entrepreneurs with exceptional innovation capabilities (Schumpeter, 1934; Chipunza, 2019), one would assume that such entrepreneurs would have entrepreneurial competencies to identify and exploit the knowledge opportunities availed by good entrepreneurship policies, allowing them to render unique products and services in ways that disrupt the market. As such, entrepreneurship policy has the potential to enhance managerial competencies of new startups or incubation managers through broadening their knowledge of entrepreneurship, policy legislation and incubation frameworks.

At the individual firm level, entrepreneurship policies facilitate the birth of new ventures that steer development of new ideas by commercialising knowledge that would under normal circumstances be ignored within their firms and across firm boundaries (Acs et al., 2013). The argument is that since small firms tend to internally exploit knowledge better than large firms, startup managers are better positioned to draw on knowledge availed by good national entrepreneurial policy and transform it into consumable goods and services. Compared to larger firms that accumulate substantial knowledge by investing internally in R&D and human capital development (Audretsch & Feldman 1996; Belitski, Caiazza & Lehmann, 2019), smaller startups draw on a supportive business environment created by national entrepreneurship policies at industrial, regional and ecosystem levels to create and recombine existing knowledge available in the economy into knowledge inputs, thereby creating new products and services (Ghio et al., 2015).

The implementation of entrepreneurship policies may unmask the numerous competency limitations of startup entrepreneurs in a region. For instance, a European Commission survey conducted on Slovenian entrepreneurs as a component of the implementation of Entrepreneurship 2020 Action Plan and National Action Plan (Slovenia – The Country of Startups) confirmed that these individuals had insufficient financial knowledge to run businesses successfully (Government of Slovenia, 2017; Kunsek & Djokic, 2018). Such evidence contradicts the Slovenia National Action Plan's claims on the effective implementation of measures it proposed, especially those relating to accentuating the entrepreneurial knowledge of entrepreneurs, increasing their ability to conform to business regulation, and encouraging free venture creation initiatives.

5.6. REGIONAL SMME FUNDING-TBI PROCESSES RELATIONSHIP: A SNAPSHOT

The next three sections discuss regional SMME funding as it relates to (1). incubation selection criteria, (2) IP and patenting and (3) incubation manager competence, which are all aspects of TBI processes. The next section articulates regional SMME funding's relationship with incubation selection criteria.

5.6.1. Regional SMME funding and incubation selection criteria

Regional funding policies for incubators and startups facilitate the recruitment and selection of well-trained incubation managers that direct the incubation selection process. The establishment of the government funded programme, 'Technology Parks and Innovations' at the regional level in Russia enabled universities to collaborate with public research organisations (PROs) in establishing high-tech business incubators and technoparks that selected incubatees for their programmes (Williams & Tsiteladze, 2016). The availability of funding via the programme ensured that a broad framework for the establishment of incubators was developed. This includes the institution of incubatee selection criteria focusing on the quality of the business plan, type and level of innovation and market attractiveness (Williams & Tsiteladze, 2016). While the availability of regional SMME funding can ensure the appointment of competent incubation managers who then design proper incubation selection criteria, incubators may need to be wary of governments imposing their sectorial and vested interests as conditionalities and political idiosyncrasies imputed into incubation selection criteria.

The prevalence of new innovative startups in biotechnology, micro-electronics and electrical equipment in the UK which are typically capital intensive (Wright et al., 2007; Clarysse et al., 2016), implies incubators' dependence on the public purse for financial resources. While these firms are reported to rely on the sustainability of long-term regional public funding (Clarysse et al., 2016) for their operations, the incubator models in the country are critiqued for their lack of a clear exit policy for incubatees (Bruneel et al., 2012). The high-tech firms' dependence on regional public funding is, therefore, problematic as huge capital expenditures are required in the incubation process from inception, selection of incubatees, participation in incubation programmes to taking the products and services to the market.

5.6.2. Regional SMME funding and IP and patenting

From a resource-based view, one would anticipate a correlation between provision of regional funding and the capacity of incubators to administer patents and manage the intellectual property of TBIs. Xu, Zhang and Gui (2020) examined the relationship between regional R&D financial subsidies, regional R&D input and intellectual property protection on the sustainable patent output of SMMEs. Their findings show that financial subsidies exert a positive influence on the sustainable patent output of SMMEs while regional R&D inputs mediate the relationship between R&D financial subsidies and sustainable patent output of SMMEs. The argument is that when startups access financial subsidies from regional funding bodies, this reduces the financial burden and increase the cashflow available for expanding R&D investment (Neicu, Teirlinck & Kelchtermans, 2014), which increase the capacity of innovation departments to avail resources for improving sustainable patent outputs (Guo, Guo & Jiang, 2016). Moreover, the increase in government financial subsidies to startups can provide positive signals that investment in patent research and development conducted will generate some economic and social benefits, thereby catalysing investors to invest more money into patent development (Dirk & Julie, 2015).

In short, investment in regional financial subsidies contribute to the development of sustainable patents among startups and facilitates the protection of intellectual property.

5.6.3. Regional SMME funding and incubation manager competence

For Buys and Mbewana (2007), competent management of incubators necessitates incubator managers to provide entrepreneurial and business management competencies to incubatees. Entrepreneurial competencies denote the ability of potential and incumbent entrepreneurs to recognise and exploit market opportunities by developing sustainable ventures. Business management competencies relate to marketing, finance, operations and human resource (Solomon & Lind, 2016), which make operationalisation of ventures possible. While Small Enterprise Development Agency (SEDA) has regional offices that render small funding opportunities, technical and managerial support to startup entrepreneurs and incubator managers to develop their competencies, a study conducted by Solomon and Lind (2016) shows that incubation staff often demonstrated lack of depth of insight, experience and professionalism on entrepreneurial and incubation matters. Therefore, the provision of regional funding opportunities has not necessarily translated into improved managerial competencies of incubator managers and incubatees. This clearly indicates lack of managerial skill transfer from regional funders to incubator managers and incubatees.

In a study that examined the capacity incubators to add value to innovative SMMEs in Russia, Williams (2011) highlights regional financially self-sustaining institutions such as public universities and public research organisations use their competent and enterprising staff in establishing incubation facilities that support the growth of spin-off companies to overcome state funding challenges. This means that availability of regional funding for SMME development makes the recruitment and appointment of incubation managers with managerial competencies possible. However, the establishment of regionally funded government programmes such as ‘Technology Parks and Innovations’ exposed some technical challenges relating to incubatee’s competencies such as the lack of experience in marketing and sales, which undermined startups’ growth potential (Williams & Tsiteladze, 2016). Therefore, while the availability of regional funding may enable the appointment of competent incubation staff, it may also expose the managerial competence constraints of incubates that undermine the performance of their businesses.

It is important to acknowledge that transfer of managerial competencies from incubation managers to startup managers is transactional. Given that 60% of SMMEs in the Slovakia file for bankruptcy during the first three years of establishment, financial investment into the establishment of the Consulting and

Development Centre at Comenius University in Bratislava (Mrva & Stachová, 2014) contributed to arresting the competence deficit of SMME managers and owners. Through this body, entrepreneurial academics and private sector experts trained entrepreneurs and students in technical specialisations (IT experts and technicians) with promising business ideas but lacking managerial skills and market knowledge, allowing for the effective transfer of knowledge between entrepreneurial experts and nascent entrepreneurs (Mrva & Stachová, 2014).

5.7. REGIONAL INNOVATION CULTURE-TBI PROCESSES RELATIONSHIP

Since the researcher could not identify literature that relates to regional innovation culture and TBI process' individual dimensions, the relationship between regional innovation culture and incubation process as a unidimensional concept was considered instead. There could be a bidirectional relationship between the innovation culture of a region and the uptake of incubation processes. On the one hand, the incubation processes and practices of structures such as innovation hubs facilitate the uptake and expansion of innovations in regions. Hannadige and Weerasinghe's (2021) research on factors influencing innovation capacity of regional innovation hubs established that the incubation startup processes and activities of the Upsala innovation hub contributed to the recognition of the importance of social value of innovation in the region and the sharing of resources available in Upsala region. On the other hand, the prevalence of a culture that supports the development of innovations in a region can also facilitate the development of incubation processes and activities. For instance, Al-Mubaraki et al. (2015) contended that the establishment of the incubators can contribute to the flourishing of an innovation culture in regions, which manifests in the formation of stronger entrepreneurship climate; increased incubation opportunities that facilitate technology commercialisation and transfer for graduated companies; sustainability of graduated companies in the market, and greater innovation acceleration with smart product and services. However, some studies have questioned the linearity of the relationship between regional innovation culture and entrepreneurship activity (which could involve incubation activity). Critiquing the simple linear association between innovation culture and entrepreneurial activity, Pinillos and Reyes (2011) submit that despite the positive association between innovation cultures that emphasise individualism and entrepreneurship, there are many countries displaying a collectivist orientation that also exhibit high levels of entrepreneurial activity (e.g., high levels of business incubation, venture creation).

5.8. LEGITIMACY-TBI PROCESSES RELATIONSHIP: A SNAPSHOT

The next sections discuss the legitimacy of incubation as it relates to different aspects of TBI processes, with a specific focus on incubation selection criteria, IP and patenting issues. The next section discusses legitimacy of incubation as it relates to incubation selection criteria.

5.8.1. Legitimacy of incubation and incubation selection criteria

Drawing on neo-institutional theory and the opportunity-based approach, Messeghem; Sammut and Beylier (2014) explore the traits that distinguish entrepreneurs in the new venture process in business incubators operating in Montpellier, France, and crafted a conceptual framework that draws on legitimacy, opportunity pursuit, role of networks, and new venture support as conceptual variables. Their findings illustrate that competitive and professional legitimacy are the traits that distinguish entrepreneurs from non-entrepreneurs. They elaborate that the degree of professional legitimacy of the entrepreneurs affects incubator expectations. One could infer that since incubatees must meet certain incubation selection criteria to be admitted into incubation programmes, their professional (e.g., their demonstration of professional conduct in their dealings) and competitive legitimacy (e.g., capacity to present innovative ideas with commercialisation potential) would be central to their qualification for and selection into incubation programmes.

In a study that draws on Kauffman Firm Survey – a longitudinal study covering approximately 5,000 organisations, Batchelor and Burch (2011) explore the extent to which legitimacy of incubatee tenants affects their entrepreneurial performance. They contended that, given the paucity of information available to incubators on individual entrepreneurs who enter the incubation terrain, the only “trump card” incubatees have in meeting the incubation criteria and incubation processes is establishing themselves as legitimate organisations from stakeholders’ standpoint. Legitimacy serves as an evaluative tool, just like bond ratings – it points to the significant superiority of the incubatee even though it may not speak to the future value of the firm (Batchelor & Burch, 2011). Given that new startups often suffer from the tragedy of smallness and newness, legitimacy therefore could be one mechanism through which such organisations gain acceptance of incubators during selection processes, secure their foothold in the market as well secure the vital resources they require for their long-term sustainability.

5.8.2. Legitimacy of incubation and IP and patenting

One would expect legitimacy of incubates to contribute to their access to critical resources, making the development of patents and intellectual property more feasible. While the legitimacy of a person lies in his/her networking with stakeholders (Liu, Schøtt & Zhang, 2019) and that of entrepreneurs is contextualised in networking with business contacts (de Clercq & Voronov 2009), the legitimacy of incubatee tenants lies in their capacity to demonstrate innovativeness of their products, exhibit their relevance by solving global societal problems and creating long-term sustainability. The legitimacy of the incubatee, therefore, enables it to acquire resources and develop products whose innovativeness finds expression in their patentable nature and capacity to generate intellectual property.

Nevertheless, the development of patents can also be instrumental in giving legitimacy to a business. The design and filing of patents can earn the firm the legitimacy it needs to secure external capital thereby guaranteeing its financial independence. While patent and intellectual property development can serve as the economic and innovative leverage in incubatees' gaining financial legitimacy, the lack of such capacity would undermine this credibility for those operating in technology intensive industries. Since social expectations dictate that firms obtaining financing on their own are considered as more legitimate than those lacking the capacity to do so (Hirsch & Andrews, 1984; Batchelor & Burch, 2011), one could argue that incubatees that have innovative patent and IP ideas with potential for commercialisation stand a better chance of (1) being assessed as legitimate candidates for incubation by incubators (2) accessing external funding from investors and funding agencies.

5.9. INCUBATION ECOSYSTEM DYNAMISM AND TECHNOLOGY ENTREPRENEURSHIP

As already discussed in Chapter 1, technology entrepreneurship finds expression in various forms such as the strong growth orientation, high rates of survival and sustainability of graduated companies, commercialisation of technology and transfer of knowledge of graduated companies. TE also manifests in financial investment; innovation acceleration with smart product and services; diversification of the economy from companies' outcomes and number of businesses graduated. Subsequent sections of the chapter examine the effects of different dimensions of incubation ecosystem dynamism as they relate to technology entrepreneurship. The dimensions of incubation ecosystem dynamism discussed in relation to TE are regional SMME funding, regional innovation culture and legitimacy of incubation.

5.9.1. National entrepreneurship policy and technology entrepreneurship

The development of national entrepreneurship policy could enable the establishment of institutions that drive TE. For instance, the Technology Incubation and Development of Entrepreneurs (TIDE) scheme (2008) in conjunction with the National Science and Technology Entrepreneurship Board (NSTEDB) in India (2014) have created a conducive environment for the realisation of TE through facilitating the creation of technology-based startups, creating value-added jobs and services, facilitating technology transfer, supporting the commercialisation of technology R&D output (TIDE, 2008; NSTEDB, 2014). In the

South African context, development of the White Paper of Science and Technology in 2019 provided a watershed moment to rethink the sectors of the economy with significant potential to support the development of new industries and new startups through commercialisation of R&D. Furthermore, this White Paper laid the foundation for the institution of a Presidential Commission on the Fourth Industrial Revolution that developed a comprehensive report on possible technologies with commercialisation potential in South Africa and highlighted sectors where technology commercialisation could be intensified and leveraged (Presidential Commission on the Fourth Industrial Revolution, 2020). However, complex policies and process of business registration, less user-friendly value-added tax registration and excessive documentation on corporate tax compliance can undermine TE pursuits as time devoted to high-technology operations is shifted to compliance matters of business.

5.9.2. Regional funding for SMMEs and technology entrepreneurship

A study conducted by Butler, Garg and Stephens (2015) into the effects of funding and regional advantages on TE established that although the prevalence of digital technologies in entrepreneurship has lessened the need for large amounts of funding for infrastructure development for digital business, cycles of funding availed per year in a region play a significant and positive role in influencing digital startup creation. It could be extrapolated that the availability of more calls for regional funding per year increases the opportunities of applying and accessing funding by technology entrepreneurs with bankable projects for commercialisation. Xue and Klein's (2010) study on the regional determinants of TE reported a positive correlation between R&D expenditures, the presence of anchor firms, availability of intellectual property lawyers and engagement in TE activities. Although funding exerts a positive direct effect of TE, there are other factors that may interact with it to shape TE.

The availability of funding in a region also makes the pursuit of TE possible. For instance, the successes of two technology park clusters in North Wales in the UK and that of small and medium software technology firms in the Silicon Valley in the USA are attributed to private venture funding and public funding in these regions (Jones et al., 2013). The success of technology innovations in these regions, which are dimensions of TE, is tied to the provision of regional funding to technoparks and venture capital of these regions respectively. For instance, the firms in North Wales attract European Social Funding while Silicon Valley is a high-tech cluster that relies on venture capital funding and collaborative networks between firms, bankers, capitalists and prestigious universities (Jones et al., 2013). However, assuming the high-tech firms also contribute to public fiscus through corporate tax payments, the availability of sustainable technology ventures can avail a large pool of public funds, which can be rechanneled to technology ventures.

5.9.3. Regional innovation culture and technology entrepreneurship

In their characterisation of regional innovation cultures, Trippl and Tödtling (2008) highlighted shared values and attitudes, a common language, common cognitive frames, patterns of behaviour and codes of conduct as the five components that are instrumental in shaping technology innovation (a dimension of TE) by enhancing communication, reducing uncertainty, enabling joint problem solutions and facilitating collective learning processes. Research has shown that regional innovation culture as signified by investments in innovation in special regions can enhance entrepreneurs' access and exploitation of knowledge to generate technology innovations, creating demand for technological goods and services (Guerrero & Peña-Legazkue, 2013; Castaño et al., 2015; Guerrero et al., 2016). For instance, location-based innovative clusters exhibiting shared cultural practices have been credited with supporting high growth-oriented ventures in specific geographic locations, helping researchers to grasp the contribution of regional innovation clusters to the thriving of ventures (Breschi & Malerba 2001; Li et al., 2016).

One can also expect TE to shape the regional innovation culture of regions. A long tradition of TE in a region forged through specific structures (e.g., venture capital structures) and high-tech industries can create a regional stock of knowledge and regional conditions for the emergence and thriving of innovative new businesses (Fritsch & Wyrwich, 2018), thereby creating a new regional innovation culture.

5.9.4. Legitimacy of incubation and technology entrepreneurship

One of the critical driving forces of TE is the social legitimacy of entrepreneurs and their activities (Etzioni, 1987; Fritsch, Obschonka & Wyrwich, 2019). This social acceptance, which finds expression in low stigma of failure and lower psychological costs (arising from fear of failure) of starting a firm (Wyrwich, Stuetzer, & Sternberg, 2016, 2018) may explain differences in pursuit of TE in specific regions (Saxenian, 1994; Fritsch et al., 2019). The argument is that social legitimation enabled by a supportive culture makes a TE career more valued and socially recognised in specific regions, thus forging a conducive institutional environment (Krueger et al, 2013). Conceived this way, this social legitimation impacts the acceptance and recognition of TE in specific regions, compelling more entrepreneurs to consider the creation of technology ventures as a more acceptable and dominant way of enterprise.

Other studies have positioned the prevalence of entrepreneurial role models as an antecedent to the social legitimacy of entrepreneurship which drives TE (Andersson & Koster, 2011; Fritsch, Obschonka & Wyrwich, 2019). The argument is that the observation of entrepreneurial role models shapes prospective entrepreneurs' cognitive representation. The latent effect of such cognitive representation is the enhancement of the social acceptance of entrepreneurial lifestyles, the boosting entrepreneurial self-efficacy beliefs, which increases in the propensity of adopting TE behaviour (Fritsch, Obschonka & Wyrwich, 2019). Therefore, the prevalence of role models triggers social acceptance of entrepreneurship, which propels a set of behaviours (e.g., risk taking, opportunity identification and resources exploitation), making TE pursuits possible.

The last segment of this chapter is devoted to unpacking good practices that have been identified in advanced economies, which would serve as incubation role models and useful templates for adaptation in emerging economies where TBI is an emerging phenomenon yet to be fully comprehended.

5.10. UNIVERSITY-BASED INCUBATION ECOSYSTEM ACROSS DIFFERENT CONTEXTS

Some of the most compelling examples of incubation ecosystems have been developed and reported in Europe. In a detailed report entitled *30 Good Practice Case Studies in University-Business Cooperation*, the European Commission employed 4 pillars of university-business corporation (UBC) (i.e., HEIs [academics, management and students, technology transfer personnel], governments, and businesses) to capture eight ways in which businesses interact and cooperate with HEIs and governments (Davey et al, 2011). These four pillars include strategies, structures & approaches, activities and framework conditions. These eight types of UBC collaboration are commercialisation of R&D results, entrepreneurship, governance, collaboration in research and development (R&D), mobility of academics, mobility of students, curriculum development and delivery and lifelong learning (Davey et al., 2011).

Table 5.3. provides examples of UBC, ecosystems that facilitate TBI and the generation of TE outcomes, how they were implemented including the results and impacts of these activities.

Table 5.3: Detailed narrative of the profile, implementation and outcomes of UBC

Profile	Implementation	Impact, results, outcomes	Sources
Supporting Entrepreneurship programme at Aalborg University (SEA) ▪ prepares students for entrepreneurial careers, as employees, researchers through training, mentoring and coaching and giving infrastructural support. ▪ focuses on developing ideas and establishing startups. ▪ university can either take up intellectual property rights or allow the inventor to commercialise invention.	Knowledge Exchange Office supports the creation and maintenance of mutually beneficial contacts, relationships and networks between university and organisations in industry. Project and Funding Office oversees formulation of joint projects, funding applications and formation of joint agreements. Patent and Commercialisation Office facilitates collaboration agreements between partners and spin outs are created. Students get entrepreneurship training in business development via courses, events and pre-incubators. SEA engagement with industry enables creation of startups. They also receive coaching in business plan development and mentoring in business establishment. Patent and Commercialisation Office facilitates disclosure of patentable inventions. Students get professional advice from experts on testing of knowledge-based ideas. The incubator facilitates entrepreneurs' access to student communities, internal and external resource persons with	Strong entrepreneurial focus has led to: ▪ Establishment of more entrepreneurial courses. ▪ Of the 400 incubation programme participants in 2010, 43% have established their businesses or registered their companies. ▪ Creation of an entrepreneurship board to secure a continued focus on developing problem-based learning. Have integrated entrepreneurship thinking with problem-based learning. However, the constraint is third stream activities have not been released It is difficult to obtain funding for the extracurricular activities via the university budget. Faculty depended on personal commitment of professors to fulfil startup activities	Davey et al., 2011 www.en.aau.dk/digital Assets/ 10/10516_collaboration _ with_aau.pdf Fostering Academic-Commercial Networks and Entrepreneurship University-Business Cooperation: www.czechtechnologyd ays.org/sites /default/files/Mr.%20 Jorn%20Kristiansen.pdf

	specialised knowledge who challenges their thinking on business ideas. Consultancy targets business idea development, operations, marketing and sales and financing.		
Demola Platform Hermia Ltd with Tampere University of Technology, University of Tampere and Tampere University of Applied Sciences Finland Demola is a Finnish open innovation platform for the creators of next generation products and services. It renders students and companies a collaborative multidisciplinary innovation environment where students from three regional universities create demonstrations of novel service and product concepts coming from companies. SMMEs and large firms work with multidisciplinary student teams in developing demo products and services based on company concepts. Have created a dedicated innovation environment for managing innovation ownership rights	Creates products, businesses, and new services-based on content development, and through co-operation between creative sectors and businesses. Focuses on creating innovation friendly markets, strengthening R&D resources, increasing structural mobility in Europe and the fostering a culture of innovation. Strive to involve consumers in product development and innovations. Uses an inter-disciplinary platform to create Universal tools and methods for industries. Financiers and Demola facilitators collaborate in monitoring projects. Dedicated programme allowing for collaboration between students, staff and industry experts. New Factory concept ensures that products are developed based on business concepts	▪ 500 students have made product and service concepts with project partners ▪ Over 110 projects were completed or are in development. ▪ 96% of results are licensed ▪ New jobs were created and new companies have been established.	Project Website http://demola.fi/what-demola-new-factory New Factory Open Innovation Platform http://uusitehdas.fi/en Funding Programme www.luovatampere.fi/eng
Chalmers School of Entrepreneurship,	Incubator receives projects, which are evaluated by business developers who evaluate them in terms of technology, cost,	CSE has graduated over 200 students. Students have created over 27 companies with a combined market value in excess of €56m.	CSE Website www.entrepreneur.chalmers.se/cse/

(CSE), Chalmers University of Technology, Sweden A master's programme allowing new technology companies' development by 'matching' student teams with a scientist or innovator in converting business idea into a business. CSE develops new entrepreneurs and new technology-based companies.	time, intellectual property regulation (IPR), and market potential of the idea. Student teams are matched to their ideas, a co-operation agreement is established between the idea generator and incubator. Student teams are given support by incubator in terms of mentoring support and access to incubation space, capital and networking opportunities.	Technology ventures are related to the construction of clusters and innovative research areas. CSE has branched into bio-science based programme, and strives to move the CSE concept into an incubator. The combination of master's education programme and entrepreneurial idea development is an example of University-Business Collaboration	Encubator Website http://encubator.com/
Student Placements for Entrepreneurs in Education (SPEED), Wolverhampton University and Its Partners Nine-month placement for university students that create a self-employed placement rather than industrial placement. Guide students with ideas through the formation of successful business. Created to develop a pool of creative and innovative graduates	Seed funding (€6m) was provided by Higher Education Innovation Fund (HEIF) Round 3 through a competition intended to fund innovative projects with a sustainable focus. A selection model and continual support are done by university on student businesses. Students on SPEED present ideas on product development to a panel. Student judgements are based on business potential, personal enthusiasm, aspirations and business feasibility. Selected students receive mentoring, training workshops and grants from academics and university project administrators. Operational committee reviews routine activities, processes, procedures and outcomes of programme.	Student societies concentrating on enterprise have increased. SPEED programme has funded over 770 students under the HEIF 3. 1200 students funded under HEIF 4 with the aim of establishing 140 businesses in 2011 Entrepreneurship and enterprise have been steered within the student body via SPEED programme Programme balances development of entrepreneurial skills set with creative and innovative business development. Students have been given control over resources in business development.	www.speedwm-wlv.org/ Moore (2011)

(Source: Adapted from Davey et al., 2011)

The key messages from the details of the Table 5.3 are that despite the heterogenous nature of university-business incubation ecosystem, some common converging traits are shared across these ecosystems. First, the establishment, survival and sustenance of cooperation in such ecosystems is dependent on collective mutual engagement among multiple stakeholders with specific structures, strategies, resources, performance-driven activities and outcomes. Second, the provision of tangible (e.g., physical and shared spaces, finance and human resources) and intangible resources (e.g., capabilities, competencies, organisational systems and processes) within an agile incubation ecosystem is critical to the realisation of intended incubation performance outcomes. Third, when capabilities and competencies (e.g., knowledge, expertise and skills) of consumers of innovations and incubation actors (e.g., customers, students and academics) are directly and skillfully integrated into critical stages of the innovation and incubation processes (e.g., prototype development, product development and marketing), and the motivation, commitment and dedication of these actors to realise intended outcomes is non-negotiable and guaranteed. Fourth, the division of roles and responsibilities between state and non-state actors (universities, patent offices, students and academics) and businesses is central to the proper alignment of goals and intentions, programmes and attainment of desirable outcomes.

5.11. CHAPTER SUMMARY

This chapter comprises four main segments. The first segment characterised a "system" and "ecosystem" and applied these terms in a real business context. Next, attention was devoted to the characterisation of an incubation ecosystem, articulating the synonyms with which it is understood, and the various stakeholders that constitute it. Subsequently, the diverse ways of defining an incubation ecosystem were articulated to clarify specific dimensions that constitute an incubation ecosystem. Thereafter, the researcher developed a working definition of an incubation ecosystem. The second segment of the chapter defined ecosystem dynamism and its constitutive dimensions and drew on and past studies covering this concept. Some parallels were also drawn between this concept and entrepreneurship ecosystem dynamism. The third segment of the chapter covered the dimensions of incubation ecosystem dynamism that affected TBI and TE. The final segment provided best practice examples of university-business cooperation which obtain in developed countries, which developing countries such as South Africa could learn from in their commitment to developing university-based incubation ecosystems.

The next chapter will concentrate on unpacking how the relationships between individual, institutional and environmental factors affecting technology business incubation and incubation outcomes merge by concentrating on those relationships linking different levels.

CHAPTER 6
CONCEPTUAL CHAPTER: A SYNOPSIS OF MULTI-LEVEL RELATIONSHIPS

6.1. INTRODUCTION

This conceptual chapter builds on the theoretical foundation laid in Chapters 3, 4 and 5, in which the individual, institutional and environmental factors that affect technology business incubation (TBI) and technology entrepreneurship (TE) were presented and discussed. The dimensions of TBI scrutinised were incubation selection criteria, intellectual property (IP) and patenting and competences of the managers of technology business incubators (TBIs). TE dimensions were technology firms' strong growth orientation, commercialisation of technology applications and financial investment on activities such as R&D innovations. Specifically, Chapter 3 explored the relationships between dimensions of entrepreneurial cognition and perceived entrepreneurial capabilities, TBI and TE dimensions. Chapter 4 examined the interactions among dimensions of incubator incentive and support regime such as physical, social and intellectual capital, TBI and TE dimensions. Chapter 5 evaluated and critiqued dimensions of incubation ecosystem dynamism such as national entrepreneurship policy, regional SMME funding, regional innovation culture and social legitimacy of business incubation and their relationships with TBI and TE dimensions.

The current chapter builds on the foundation established in the three previous chapters by drawing on the relationships not explored in the previous chapters. The chapter connects the missing puzzles by articulating the interaction of the following variables:

1. Entrepreneurial cognition dimensions and perceived entrepreneurial capabilities (i.e., relationships between individual factors exclusively),
2. EC dimensions and incubation support and incentive regime (i.e., relationships between individual and institutional factors),
3. PEC and incubation ecosystem dynamism dimensions (i.e., relationships between individual and environmental factors) and
4. TBI and TE dimensions (i.e., relationships between firm level factors).

The connection of EC to PEC is worthy investigating as literature suggests that while possessing exclusive cognitive dispositions is critical to locating and validating entrepreneurial opportunities, it is insufficient for pursuing entrepreneurial behaviours (Urban, 2015; Ndofirepi, 2017). Moreover, there is literature that supports the postulation that EC must be complemented by entrepreneurial capabilities for successful venture creation and entrepreneurship (Chaston & Sadler-Smith, 2011, Chen, Chang & Lin, 2018). For instance, EC such as entrepreneurs' creative cognitive style exerted a positive effect on their creative capabilities, even though planning cognitive style impacted negatively on the same capabilities (Chen, Chang & Lin, 2018).

The linkage of entrepreneurial cognition dimensions to incubation support and incentive regime is critical to entrepreneurship literature. It constitutes a response to the call to bridge the gap between the disparate body of literature explaining cognitive activities and behavioural idiosyncrasies of entrepreneurs (Pryor, Webb, Ireland & Ketchen, 2016). This approach is to the detriment of institutional factors that shape these behaviours and activities. It also addresses the clarion call for entrepreneurship researchers to recognise the social contextual influences that are the heart of venture creation and TBI (Cope & Down, 2010; Venkataraman et al., 2012).

The integration of PEC with incubation ecosystem dynamism (i.e., environmental determinants of TBI) is an acknowledgement that entrepreneurship (for which TBI and venture creation may be sub-components) does not unfold through “single action [by individual entrepreneurs], single insight, or any other single factor” (Dimov, 2011: 59). To the contrary, entrepreneurship is a consequence of the interaction of multiple individual (e.g., cognitive and behavioural) and environmental factors situated at different levels. For instance, Venkataraman et al. (2012) argue that although opportunities and solutions to social challenges are first conceptualised cognitively, their translation into value creating meanings are punctuated by multiple interactions that entrepreneurs undertake with institutions and stakeholders situated in the entrepreneurial environment. Therefore, the fusion of environmental determinants of TBI with cognitive dimensions of entrepreneurs render a more nuanced approach to understanding the multi-faceted influences of TBI, which supports venture creation.

Although individual, institutional and environmental factors coalesce and interact to shape TBI, this concept is not necessarily an end in itself but rather TE outcomes such as the realisation of sustained business growth, sustained revenue streams and commercialisation of applications/products and services. In fact, there is a growing body of literature that identifies TE as an outcome of TBI (Smilor, 1987; Al-Mubaraki & Busler, 2017, Stuetzer et al., 2018). Therefore, the linkages between TBI and TE of firms incubated at universities must be understood to complete the puzzle of explored relationships.

This chapter is structured as follows: first, it explores the relationships between EC and PEC and second, it traces the interaction between EC and incubation incentive and support regime dimensions. Third, it clarifies the relationship between PEC and incubation ecosystem dynamism dimensions. Lastly, it captures the interactions between TBI dimensions and TE. Thereafter, a model is developed to summarise the relationships discussed in Chapters 3, 4 and 5 combined with those explored in Chapter 6. The following section investigates the interaction between EC and PEC.

6.2. PERCEIVED ENTREPRENEURIAL CAPABILITIES: AN OVERVIEW

As already discussed in Chapter 3, PEC (also called perceived entrepreneurial ability) is an amalgam of perceptions and entrepreneurship capabilities (Tardieu, 2004) or entrepreneurial perceptions and capabilities (Edelman & Yli-Renko, 2010) or perceived capability and entrepreneurship (Tsai, Chang & Peng, 2016). This relationship between PEC and EC is explored further hereunder.

6.2.1. Perceived entrepreneurial capabilities and entrepreneurial cognition

There is controversy over whether PEC affects EC or vice versa (Johnson-Laird, 1983; Mitchell et al., 2011; Bayon, Vaillant & Lafuente, 2015), suggesting a bi-directional relationship between them. For instance, Johnson-Laird (1983) highlights that mental perceptions (e.g., those arising from one's knowledge base) contribute to the development of mental models, which describe the causal inferences entrepreneurs develop to represent real, imaginary or hypothetical situations. Therefore, the crystalisation of perceptions founded on the entrepreneur's prior knowledge, gives rise to the development of deep mental structures (i.e., entrepreneurial cognition) that shape the identification of entrepreneurship opportunities and taking risks. Palich and Bagby (1995) supports this view and reports that possession of (incomplete) entrepreneurial knowledge contributes to entrepreneurs exhibiting comparatively greater cognitive biases than those of non-entrepreneurs regarding perceptions of risk. Since entrepreneurs are required to act based on imperfect information in new, highly complex and uncertain situations, they may perceive greater potential to succeed in such situations compared to non- entrepreneurs. This claim gels well with Busenitz and Barney's (1997) observation that since they operate on imperfect information and knowledge, entrepreneurs show high susceptibility to cognitive biases such as over-confidence when making judgements and representativeness heuristics (e.g., generalising from small numbers). Drawing on these studies, entrepreneurs' knowledge base (a dimension of PEC) affects the development of cognitive orientations towards entrepreneurship.

Other literature contests the claim that PEC affects EC and presents EC as a predictor of PEC. Cognitive research highlights the effects of entrepreneurs' cognitive properties on their ability to identify, develop and exploit entrepreneurial opportunities (Mitchell et al., 2002; Baron & Ward, 2004; Cacciolatti & Lee, 2015). Mental models (e.g., entrepreneurship cognition) shape an individual's perception of reality (e.g., entrepreneurial pursuits) upon receiving new information/data from the external information (Mitchell et al., 2011) even though these mental representations may not necessarily trigger the execution of certain behaviours (Bayon, Vaillant & Lafuente, 2015). This demonstrates that EC has the potential to influence one’s perceptions of her capacity to influence entrepreneurial outcomes (PEC). Costa, Santos, Wach, and Caetano’s (2018) study examines the impact of cognitive training on the perception of the entrepreneurs’ capacity to develop a business opportunity prototype and concluded that cognitive training has positive significant effects on identification of business opportunities’ prototypical viability. Based on the foregoing discussion, there is a double, recursive relationship between PEC and EC as durable perceptions of one’s capability (PEC) may concretise into deep mental structures (i.e., entrepreneurial cognition), which further shape business ideation and incubation process. Similarly, cognitive structures are instrumental in developing entrepreneurs’ perceptions of their own capabilities to successfully run businesses successfully.

6.3. ENTREPRENEURIAL COGNITION, INCUBATOR INCENTIVE AND SUPPORT REGIME

As already articulated in Chapter 4, incubation incentive and support regime of university-based TBIs have been crystallised as comprising, *physical capital*, *social capital* and *intellectual capital* - the resources that entrepreneurial literature considers critical to successful incubation of technology-based businesses (Ayar et al., 2016; van Weele, van Rijnsoever, Groen & Moors, 2019). Since entrepreneurs deploy their cognitive mindsets to make sense of and exploit resources availed in the incubation environment, the relationships between incubation and support regime of a TBI and entrepreneurial cognition of technology business incubatees must be fully appreciated.

The relationships between entrepreneurial cognition (EC), incubator incentives and support regime are mudded by different views on the direction of causality. Some authors contend that EC affects incubatees’desire to secure diverse forms of venture support (Le Roux, 2005, Tran & Von Korflesch, 2016). Pokharel (2018) contends that cognitive orientations (e.g., risk-taking propensity, locus of control) and motivations towards entrepreneurship such as need for achievement may motivate entrepreneurs to solicit access to financial resources (e.g., venture capital opportunities), land (i.e., physical capital) and technical support facilities (i.e., intellectual capital) to pursue new venture creation opportunities. However, as much as EC is essential in entrepreneurs’ identification of financial resources and technical skills rendered through incubation support, Fraser, Bhaumik and Wright (2015) also affirm the significance of entrepreneurs’ cognition in identifying financial constraints to the growth of their firms. EC, therefore, may guide entrepreneurs’ search for support and incentives from incubators, as part of their calculation and externalisation of risk, where resource limitations persist. Gonthier and Chirita’s (2019) study demonstrates a direct relationship between cognition and incubation support in four ways: cognition may direct the appointment of staff with entrepreneurial potential, firms’ financial investments in knowledge articulation and codification, leadership that legitimises incubators as sources idea generation, and render entrepreneurship support to firms.

Other studies insist that incentives and support regimes provided by incubators may shape the entrepreneurial cognition of founders of new ventures (Tilana, 2015; Eid 2016). Therefore, the availability of a germane entrepreneurial environment (e.g., the ability of a TBI to avail resources such as land, markets, capital and various support) may also ignite new entrepreneurs' cognitive orientations to pursue entrepreneurship as a career. This view is corroborated by Eid (2016) whose study of business accelerators in Egypt presents such business support structures as integral to advancing entrepreneurial cognition. In the study, business support structures present unique and alternative pathways to opportunity recognition not presented in traditional forms of support. Yet another literature establishes bi-directional relationships between entrepreneurial cognition and incubator incentive and support (Pokharel, 2018). However, since entrepreneurial cognition is a complex construct, it is better to examine how its individual dimensions (i.e., intuitive thinking, heuristics and scripts) interact with forms of capital (aspects of incubator incentive and support regime) to appreciate its impact.

6.3.1. Intuitive thinking and forms of capital relationships: An overview

This section discusses the first variant of EC namely, intuitive thinking as it relates to capital forms. Intuition is not informed by perfect information and rational action but is founded on hunches and impulses in decision making. Intuition is informed by involuntary, unconscious cognitive processes connecting the decision to the demands of the uncertain context at play, as is the case with entrepreneurial action.

It remains unclear in literature whether intuitive thinking of individuals (e.g., incubation tenants and incubation managers) is a consequence of capital forms that TBIs have or whether capital forms are outcomes of intuitive thinking. The literature that supports intuitive thinking (e.g., gut feeling) as a product of the availability of physical, social and intellectual capital acknowledges the role of the physical and social environment in the shaping of cognitive processes (Marshall, 1961; Conicella, 2013). The central argument is that the thought processes (such as intuitive thinking), including the knowledge at the disposal of the individual and the organisation, emerge from the physical and social resources that the organisation possesses. These organisational resources include social capital, which supports knowledge generation through relationships between organisations and their referral groups (Hormiga et al., 2011). Knowledge generation comes from the interactions amongst suppliers, customers and regulatory authorities. Intuitive thinking may also arise from business incubator tenants or incubator managers' interaction with physical capital variants such as structural capital. However, it is also logical to expect intuitive thinking to trigger thought patterns that lead to the identification, validation and exploitation of different kinds of resources (e.g., forms of capital) that could be critical to the incubation process.

6.3.1.1. Intuitive thinking and physical capital

In TBI, physical capital dispensed for a fee or for free, allows the incubation tenants to source other resources more efficiently (van Weele et al., 2019). In the absence of experience and expertise of role models to draw upon in the development of their businesses, owners of new technology-based firms may be compelled to draw on intuitive thinking when making choices about funding sources, technologies to acquire and the best laboratories to test their prototypes. Blume and Covin (2011) argue that intuitive capacity is a powerful and valuable cognitive asset that allows an entrepreneur to make defensible judgements when available information (e.g., on resources needed) is not wholly up to the task. In an entrepreneurial ecosystem where there could be several funding agencies and the choice of the most appropriate one to finance a new venture can be complex, intuition provides vital cues for making high stake funding decisions. Though as it may influence complex decisions, Blume and Covin (2011) also warn that the challenge with intuitive thinking is the uncertainty regarding whether intuitive processes underlie the judgements made or not. Entrepreneurs may mislead themselves into believing that intuition is guiding their decisions when confronted with little evidence that they can identify as justifications for their decision preferences.

Agor (1990) reiterates four specific areas where the use of intuitive thinking is essential, namely, when: (a) there is a high level of uncertainty in the environment; (b) there is little previous precedence for action needed due to the prevalence of new emerging trends; (c) there are limited or no facts; and (d) there are several plausible alternative solutions to select from with good factual support for each option. In the knowledge economy where there is a proliferation of multiple digital technologies with complementary capabilities, the choice of an appropriate technology to acquire in support of the business networking can be a daunting task for entrepreneurs operating new technology-based firms. Therefore, intuition can be useful in making such technology choices. Moreover, in situations where few firms in emerging economies may desire to employ technologies such as artificial intelligence, drones, machine learning and sensors (whose functionalities they are yet to fully comprehend), the choice and application of these technologies in business development and service provision could be informed by intuitive thinking than rational action.

6.3.1.2. Intuitive thinking and social capital

Social capital, especially social networks may be instrumental in the formation of cognitive processes such as intuitive thinking. It has been postulated that psychological processes and behaviours are culturally framed and socially determined (Rambe & Ndofirepi, 2019), implying that social networks and cultural circumstances define entrepreneurs' thought processes (such as intuitive thinking) about business decisions. Other research strands do not corroborate this position and rather contend that founding entrepreneurs' switching from intuitive thinking to deliberate thinking is socially mediated (Herrity, 2017). Since socially mediated cognition can be interpreted as cognition forms that are facilitated or disrupted by social conditions (e.g., peers, work teams, social networks and tasks assigned in specific context), social networks can be conceived as enhancers of such thought processes. Therefore, social networks could be mediators of thinking processes such as progression from intuitive to rational thinking.

Alternatively, intuitive thinking can also trigger the development of specific forms of capital such as resource sharing affinities (i.e., social capital). For instance, one would assume that intuitive thinking may trigger a nascent entrepreneur's search for a wide gamut of networking resources (e.g., social networks, business networks, investment networks) that make venture development possible. Thinking processes such as intuitive thinking are credited with activating tendencies for entrepreneurs to make judgements (e.g., about social capital required, estimates of market response to product launches) without complete information (Le Roux, Pretorius & Millard, 2006; Swanepoel, 2008) and shaping consumers' evaluations (Piris & Guibert, 2015). Therefore, intuitive thinking can also compel emergent entrepreneurs to source social capital to facilitate provision of other resources for the realisation of entrepreneurship and venture creation.

6.3.1.3. Intuitive thinking and intellectual capital

Although there is paucity of literature that really points to a direct connection between intellectual capital and cognitive processes such as intuitive thinking, the relation can be inferred from (a) the characterisation of intellectual capital itself (b) intellectual capital's interaction with other intangible resources. For instance, Brooking (1996) defines intellectual capital as the collective sum of market assets, human-centered assets, intellectual property assets, and infrastructure assets. This could mean that intuitive thinking is a sub-set of intellectual capital variants under the ambit of human capital assets. Similarly, despite different classifications of intellectual capital as: a combination of human capital, structural capital, and customer capital (Hejazi, Ghanbari & Alipour, 2016), human capital, relational capital, and structural capital (Vergauwen, 2007), human, structural, organisational, social, and stakeholder capital (Schiuma, Lerro & Sanitate, 2008), human capital (which could include intuitive thinking), remain fundamental component of it. Drawing on these classifications, intuitive thinking may be a component of human capital, itself a dimension of intellectual capital.

6.3.2. Heuristics in entrepreneurship: An overview

Heuristics are shortcuts in thinking techniques that reduce mental effort and facilitate efficiency in making judgements when individuals process information (Urban, 2015) under conditions of complexity and uncertainty. To the extent that TBI and venture creation unfold in complex, fluid and dynamic environments characterised by multiple actors and intervening variables, quick common-sense decisions may shape entrepreneurial actions such as venture creation and business incubation. In the entrepreneurial process, the development of heuristics for managing uncertainty is a vital strategy for creating and accentuating competitive advantage of firms (Shane, 2003; Amezcua, 2010). For instance, when confronted with the risk of a global financial crisis in 2017, many global banks relied on heuristics to analyse voluminous data to make sense of results of their marketing campaigns and to increase dividends (Natsas & Roopnarain, 2018). Heuristics are also critical to leveraging corporations' stock of physical capital such as financial resources and intangible resources such as improved efficiencies in marketing. Just like expert intuition, heuristics often rely on intuitive thinking (Kahneman, 2011) and since the tacit know-how that underlies heuristics is difficult to communicate, such know-how is likely to be confirmed only when someone is asked to talk about what they did more than what they knew (Krueger, 2007; Herrity, 2017).

6.3.2.1. Heuristics and physical capital

Heuristics are fundamental to securing different forms of capital. For instance, in behavioural finance, which emphasise the significance of emotions in and their effects on social/group psychology of investors, are critical in speculating and anticipating the behaviours of investors (Shefrin & Statman, 2003). Such behaviour contributes to availing financial resources for the business. This means portfolio investments and bonds (i.e. which fall under physical capital) are affected by investment managers' application of heuristics to the behaviours of investors. From an entrepreneurial perspective, literature conceives heuristic-based logic such as pattern recognition and perceived alertness as instrumental to the entrepreneurial learning and development of entrepreneurs (Mitchell et al., 2007; Jørgensen, 2014), which makes the marshalling of physical capital such as finance more efficient. Despite these merits, Bergset (2015) warns that over-dependence on heuristics can lead to an increased level of systematic biases in investment decisions. The use of heuristics may contribute to investments in high interest short term loans by nascent entrepreneurs under the illusion that their sales may be sustainable enough to offset instalments for loan repayments.

6.3.2.2. Heuristics and social capital

Research on entrepreneurial personality also insinuates relationships between intuition-based heuristics and resource mobilisation. For instance, heuristics are credited with making future entrepreneurial decision-making (e.g., about appropriate social connections such as investment partners relevant for capital sourcing) based on business plans easier and timelier (Gately & Cunningham, 2014). Since heuristics constitute simple rules of thumb that solve complex uncertain situations precisely because of their simplicity, they permit faster decision making and the allocation of fewer resources (Mousavi & Gigerenzer, 2014) such as those allocated to the identification of business networks, incubation partnerships and social affinities. Therefore, one can infer that heuristics may direct emergent entrepreneurs to the location of fewer but effective social networks (i.e., social capital) that may become sources of social, technical, financial and intellectual support. However, since heuristics allow entrepreneurs to fixate their estimates on past outcomes rather than update their estimates based on new information (Tversky & Kahneman, 1974; Busenitz, 1999; Douglas, 2017), heuristics may contribute to liabilities in terms of social capital. For instance, dependence on heuristics in the identification of under-resourced social networks may work for small projects but would be ineffective for mega capital-intensive projects where different venture capitalists and business angels become more desirable.

Contrary to the foresaid premise on entrepreneurs dealing with under-resourced social networks, other studies have acknowledged the potential of heuristics to leverage social capital formation, in particular its capacity to transcend disciplinary parochialism (Woolcock, 1998) and enhance social cohesion (Stiglitz, 2006). However, other studies have postulated individual cognition (e.g., heuristics) and social capital as antecedents of entrepreneurial behaviours such as venture creation and business incubation. Specifically, entrepreneurial behavior is conceived as a product of the interplay of environments (i.e., social networks) and certain cognitive biases (e.g., heuristics) inherent in enterprising individuals who exploit lucrative opportunities from the environment (De Carolis & Saparito, 2006).

6.3.2.3. Heuristics and intellectual capital

Heuristics can also facilitate the generation of intellectual capital. Mthombeni (2018) contends that by downplaying the relevance of available information, heuristics aid entrepreneurial learning abilities (an element of intellectual capital), reduce total errors and accentuate accurate predictions under uncertainty through preference for bias, flexibility and variance to decision making. Since heuristics are pragmatic and context-specific, they assist in articulating the forms of cognitive actions that are necessary to achieve specific outcomes when entrepreneurs are presented with particular situations (Van Aken, 2004; Sagath, van Burg, Cornelissen & Giannopapa, 2019). One can infer that by making certain forms of actions plausible, heuristics can be instrumental in facilitating the acquisition of cognitive actions such as learning abilities (as entrepreneurs learn by experimenting with their decisions) and the acquisition of tacit knowledge. However, if historical trends, past performance and valuable market information that firm managers access to inform corporate decision making can be conceived as forms of intellectual capital of firms, then one could argue that there may be no significant relationship between use of heuristics and intellectual capital. This is because when they employ heuristics, entrepreneurs make decisions based on little or no historical trends, previous performance and market information on whether products or services will be accepted (Busenitz, 1996; Barreira, 2015).

However, intellectual capital can also influence the development of heuristics and hence a reverse relationship between these variables. This is because heuristics should ideally draw on both scholarly knowledge and practitioners' expertise (Van Burg et al., 2008), that is their stock of intellectual capital. This is plausible because the heuristics that entrepreneurs employ in problem solving under conditions of uncertainty take time to develop through accumulated expertise. Therefore, expertise and experience (dimensions of intellectual capital) are antecedents to the formation of heuristics. To illustrate this point, availability heuristic, which involves entrepreneurs making decisions based on most-recently-acquired or most-easily-recalled information despite this data being unrepresentative of the range of options available (Douglas, 2017), demonstrate that prior knowledge, expertise and past experience (i.e., aspects of intellectual capital) are fundamental antecedents to the development of heuristics. It can be argued that heuristics often develop with the persistence of relatively identical conditions where entrepreneurs are called upon to drawn on relatively similar information to achieve similar outcomes. Therefore, prior information and knowledge (as aspects of intellectual capital) can facilitate the development of heuristics.

6.3.3. Expert scripts in entrepreneurship: An overview

Scripts are 'observable, recurrent [behaviours] and patterns of interaction characteristic of a particular setting' (Barley & Tolbert, 1997: 98). This implies that when entrepreneurs are confronted with complexity or uncertain situations, they draw on their cognitive frames (i.e., existing mental structures) to interpret and make sense of such complexity or situations. As such, scripts guide the sequence of behaviours in specific or a variety of situations and social interactions in real life situations even though individuals may have a broad range of scripts appropriate for specific range of situational experiences (Abelson, 1981; Baum, Li & Usher, 2000; Pryor et al., 2016). When situations are frequently experienced, the behaviour to perform may be activated unconsciously following an established script as no active processing of information is required (Gioia & Poole, 1984). To the contrary, when unique situations are experienced, unscripted behaviour is activated because the situational cues are unfamiliar and the entrepreneur is oblivious of appropriate sequence of events or behaviors to adopt (Pryor et al., 2016). Since similar situations may require engagement in specific behaviours and deployment of similar scripts, while different contexts and interactions may necessitate the abandonment of specific scripts and the development new ones, one could assume that scripts are continually revised, revisited, transformed or abandoned.

The most documented ability scripts in the entrepreneurship literature are: (1) arrangement (e.g., venture diagnostic) scripts, (2) willingness scripts, and (3) ability scripts (Yan, 2011; Ling & Chok, 2013). The possession and application of such scripts would facilitate the identification of situational cues that increase the ability of entrepreneurs to act appropriately when confronted with particular situations compared to non-entrepreneurs. With reference to venture diagnostic scripts, entrepreneurs tend to believe that opportunities or solutions exist that have value creation possibilities (Wiklund, Davidsson & Delmar, 2003; Marvel, 2012). The next section discusses script types and forms of capital.

6.3.3.1. Arrangement scripts and forms of capital

Literature recognises arrangement scripts as those knowledge structures people possess about access to materials, tools, techniques, and resources (Mitchell et al., 2000; Mitchell et al., 2002; Ling & Chok, 2013). Therefore, the industrious and conscientious nature of emerging entrepreneurs find expression in their capacity to mobilise and assemble discrete and uncoordinated resources (finances, social networks, and technical skills), tools and materials in pursuing different goals that resolve complex social problems and transcend the individual self-interest. This definition demonstrates that scripts apply across a broad spectrum of capital forms – covering physical, social and intellectual capital. As such, to reduce cumbersome processes and increase efficient use of space, it would be critical to cover the diverse forms of capital than deal with each capital form individually. Moreover, the fact that there are different types of scripts means that, ideally, each script type would be considered against a particular type of capital, thereby further ballooning this section. As such, to increase conciseness, the entire section on scripts is tackled in relation to all capital forms.

For Yan (2011), arrangement scripts are the knowledge structures individuals have about the use of the specific arrangements that support their own performance and expert-level mastery in a specific domain. These include, (1) idea protection; (2) possessing a venture network, (3) having access to general business resources and assets, and (4) having venture-specific skills (Yan, 2011). It can be inferred that the arrangement script is fundamental to the development of intellectual knowledge, the generation of technical expertise, and intellectual property management (i.e., intellectual capital), creation of value generating social networks (i.e., social capital), acquisition of technology and the generation of finances (i.e., physical capital). Despite the foresaid importance of arrangement scripts in explaining venture creation and incubation processes, Smith (2015) bemoans the paucity of arrangement scripts, which explicates the incapacity and ineffectiveness of entrepreneurship-enabling organisations (e.g., technology business incubators, including microfinance organisations) in providing a full range of support for venture creation and TBI. He elaborates that these institutions' attempts at facilitating entrepreneurship (especially venture creation) and incubation tends to be frustrated by their failure to transfer and instill venture arrangement scripts, venture willingness scripts, and venture ability scripts (Smith, 2015). This implies that failure to supply arrangement scripts negatively impact the generation of physical, social and intellectual capital for both incubation management and incubatees.

However, it must be stressed that while arrangement scripts affect different forms of capital that constitute the incubator incentive and support regime, these scripts can also be consequences of specific forms of capital. For instance, Ling and Chok (2013) demonstrate that financial constraint dimensions such as bricolage and ability to raise capital are antecedents of arrangement scripts, while the desire for financial independence meditated the relationship between these financial constraint dimensions and arrangement scripts. In view of the foregoing discussion, there is evidence to suggest a bi-directional relationship between arrangement scripts and financial capital.

6.3.3.2. Willingness scripts and forms of capital

Willingness scripts are those knowledge structures relating to commitment to venturing and receptivity to the idea of starting a venture. Such scripts are actionable thoughts about (1) opportunity seeking; (2) commitment tolerance; (3) venture opportunity pursuit (Yan, 2011). According to Shapero's Entrepreneurial Event Model (Shapero, 1975), an individual's propensity to engage in entrepreneurship and venture creation is a function of their interaction with the environment and such interactions shape the individual's perceptions. The Entrepreneurial Event Model further propounds perceived desirability and perceived feasibility as the two determinants of entrepreneurial intentions, which arise from individual-environment interactions (Shapero, 1975; Rambe & Ntshangase, 2019). Therefore, it can be contended that the desire to seek opportunities, tolerate commitments notwithstanding their ambiguity including pursuing ventures (i.e., willingness scripts) are a function of perceived desirability and feasibility of such entrepreneurial actions and behaviours. Following this logic, perceived desirability and perceived feasibility are determinants of willing scripts, which entice individuals to seek incubation incentives and support in form of physical, social and intellectual capital. Therefore, willingness scripts serve as drivers of the acquisition of different capital forms. Given that entrepreneurs are envisaged to have highly developed willingness scripts relating to identification of opportunities, tolerance for commitments and pursuing ventures, they experience less risk and uncertainty compared to non-entrepreneurs (Yan, 2011), which entice them to seek different capital forms.

Contrary to the aforesaid studies, Ling and Chok (2013) postulate the desire for financial independence (i.e., need to secure physical capital such as finance) as an antecedent of entrepreneurial cognition especially willingness scripts. In view of these mixed results, the entrepreneurial cognition-incubation support regime relationship remains a contested area that needs further intellectual enquiry. Moreover, if such expert scripts possess a "sequential structure," and incorporate the "norms" that guide the actions of experts in their area of specialty (Leddo & Abelson, 1986: 107; Mitchell, Mitchell & Mitchell, 2009), one expects intellectual capital such as experience and expertise to shape willingness to engage in entrepreneurship (i.e., willingness scripts). Precisely, the more experience and expertise an entrepreneur exhibits, the more confidence they have in following a systematic structure and conforming to specific norms of their willingness scripts in guiding their entrepreneurship behaviours such as venture creation and TBI.

6.3.3.3. Ability scripts and forms of capital

Ability scripts are knowledge structures that individuals have about the capabilities, skills, knowledge, norms, and attitudes required to create a venture (Bull & Willard, 1993, Marvel, 2012). The central argument is that expert knowledge is "schematised" i.e., organised in chunks or packages such that, given an appropriate situational context, an individual has several possible inferences on subsequent events that would happen in each situation (Abelson & Black, 1986). Therefore, the claim about knowledge packages invokes the argument that, when limited amounts of contextual information (representations from expert scripts) are rendered to different individuals (e.g., individual experts and novices) as cues, their ability to recognise the context as applicable to them individually, may confirm the structure and content of an expert script, while simultaneously exposing these individuals' varying levels of expertise (Mitchell, Mitchell & Mitchell, 2009). It can be inferred from the study that when provided with situational cues, experts such as entrepreneurs are better able to identify the course of events and actions that might be appropriate to take entrepreneurially (e.g., acquisition of physical, social, and intellectual capital) compared to non-entrepreneurs. One would assume that, when confronted with uncertain context to either employ personal savings as private equity or to use financial debt as a basis to acquire equipment (i.e., physical capital) for a business during an economic recession where the cost of borrowing is high, entrepreneurs are better placed to consider and pursue the better option. Moreover, entrepreneurs might understand better the consequences of their business decisions due to the congruence between the situational cue and their knowledge structure. As such ability scripts inform entrepreneurs' in making better choices on the form of physical capital to use under adverse conditions.

Regarding the relationship between ability script and intellectual capital, expert entrepreneurs and novice entrepreneurs may take advantage of entrepreneurial opportunities differently depending on their levels of experience. For instance, limited ability scripts may compel novice entrepreneurs to hire friends (i.e., social capital) to minimise the overhead costs of running a new venture while experienced entrepreneurs may implement comprehensive annual reviews that retain and promote employees based on their knowledge and exceeding performance targets (i.e., use intellectual capital) (Pryor et al., 2016). Therefore, the possession of capabilities, skills, knowledge, norms, and attitudes required to create a venture contributes to the sourcing of different capital forms that facilitate different decision making by different individuals. Similarly, the under-developed ability scripts of nascent entrepreneurs may entice them to align themselves with family networks (bonding social capital) as source of knowledge while experienced entrepreneurs may associate with diverse, weakly coupled affinities (bridging social capital) as information sources to access external resources outside their networks. Therefore, ability scripts can affect social capital which mediate the acquisition and exploitation of knowledge resources. As such, dimensions of ability scripts, such as ability-opportunity fit and risk diagnosis have potential to increase social networking which increases individuals' level of entrepreneurial self-efficacy (Gist & Mitchell, 1992; Yan, 2011).

6.4. PERCEIVED ENTREPRENEURIAL CAPABILITIES-INCUBATION ECOSYSTEM DYNAMISM RELATIONSHIP

Since PEC has already been characterised as comprising knowledge, skills and experience of entrepreneurs, a deeper appreciation of the PEC-incubation ecosystem dynamism relationship necessitates the disentangling of components of incubation ecosystem dynamism as they relate to PEC. To this effect, each component of incubation ecosystem dynamism, namely national entrepreneurship policy, regional SMME policy, regional innovation culture and social legitimacy of incubation, is individually discussed with reference to individual PEC dimensions. The subsequent sections, therefore, discuss these components of incubation ecosystem dynamism as they related to specific PEC dimensions in entrepreneurial contexts.

6.4.1. Entrepreneurship knowledge and national entrepreneurship policy

The first segment discusses how national entrepreneurial policy strengthens or weakens the development of entrepreneurial knowledge of entrepreneurs. Although entrepreneurial policy can be multi-faceted and multi-dimensional (Audretsch et al., 2018), it can also be analysed at individual (Autio et al., 2014), industry level (Qian 2018; Colombelli & Quatraro 2018), national level (Audretsch & Lehmann 2016, Acs, Stam, Audretsch, & O'Connor, 2017), international level, (Belitski & Desai 2016) and regional level (Audretsch et al., 2015). Since new incubatees often operate at individual and firm levels and rarely operate at industrial and regional levels due to their size, it is logical to discuss the impact of national policy on entrepreneurial knowledge (i.e., individual entrepreneur) and firms (i.e., incubatee levels). Consistent with the Knowledge Spillover Theory of Entrepreneurship (KSTE), when entrepreneurial policies are conducive for knowledge development, entrepreneurs will acquire external knowledge from ecosystem holders of resources within their proximity (Acs et al., 2017; Stam, 2018). However, small firms have also been reported to endogenously seek knowledge in industrial, regional and ecosystem contexts as well (Qian & Acs 2013; Audretsch et al., 2018; Stam 2018), thereby creating and recombining existing knowledge from the economy into knowledge inputs, that generate new products and services (Ghio et al., 2015). Therefore, it can be inferred that national policies provide the critical stimulus for the development of entrepreneurial knowledge at individual entrepreneur and firm levels.

With reference to Slovenia, Article 74 of the Constitution of the Republic of Slovenia (US, 1991), Companies Act (ZGD-1, 2006) and Business Register Act of the Republic of Slovenia (ZPRS, 2006) set the legal framework for implementation of entrepreneurship, organisational systems of involvement in entrepreneurship through pursuit for free economic initiative at individual levels, conditions for creating commercial organisations and procedure for creating a company respectively (Kunsek & Djokic, 2018). The entrepreneurship policy climate and infrastructure support expedient registration of entrepreneurs in the national value added tax (VAT) register and facilitate tax payment for companies under Corporate Income Tax Act (ZDDPO-2, 2006). It also provides low tax rate for companies (19%), and the easing of administrative burdens through the decentralisation of registration of sole traders through the One-Stop-Shop System (called VEM) established by national program PHARE 2003 (Kunsek & Djokic, 2018).

Despite the prevalence of these legislation in the Slovenian context, the prevalence of business transgressions by entrepreneurs aimed at circumventing administrative burdens imposed by some legislation point to the negative effects of entrepreneurial policy and legislation on the application of entrepreneurship knowledge. For instance, some deviations from appropriate business practices coupled with the double-crossing of free business evidenced by the creation of multiple mantle companies and those listed on the national stock exchange (Kunšek, 2011; Kunsek & Djokic, 2018) and non-active companies (Gajšek, 2017) suggest a negative connection between administrative constraints brought by national policies on entrepreneurship and use of entrepreneurial knowledge to pursue ethical practices among Slovenian SMME entrepreneurs.

To appreciate the connection between national entrepreneurship policy and entrepreneurial knowledge, some national policies and landmark institutions are worth mentioning in the South African context. Diverse measures aimed at creating a germane environment for SMME development were developed under the auspices of the National Strategy for the Development and Promotion of Small Business and the National White Paper on Small Business in South Africa (Department of Trade and Industry, 1995) – policies that emphasised broadening access to small business support and information, strengthening small business advocacy, delivering effective service and monitory impact (Department of Trade and Industry, 2004). Moreover, the provision of institutional support to SMMEs and startups under the auspices of the Small Enterprise Development Agency (SEDA), an agency of the Department of Trade and Industry (Solomon & Lind, 2016), has facilitated a wide range of measures. These include provision of financial support, easing startup registration process, incentivising entrepreneurial process and increasing demands for enterprise goods (Department of Trade and Industry, 2007; Herrington et al., 2009, Endeavour SA, 2010; Kassim, Soni & Karodia, 2014).

Despite the South African government having a multiple-pronged policy strategy for developing and supporting the development of SMMEs, the schism between these policies and the development of entrepreneurial knowledge among business startups and SMME owners is surprising. One could argue that the provision of strong entrepreneurship policies, institutions and basic infrastructure has not translated into the effective propagation of entrepreneurial knowledge. For instance, South African SMMEs lack the critical and excellent entrepreneurship and business management knowledge, which explains the small number of startups incubated (Solomon & Lind, 2016). There is compelling evidence to suggest that, despite having a strong entrepreneurial policy and relevant support infrastructure, South Africa business and the labour market lacks competent first line and middle-level business management knowledge to expand the economy (Dzansi, 2020) judging from startup closures and failure to exploit entrepreneurial opportunities. Moreover, National List of Occupations in High Demand (Department of Higher Education, 2018) point to the dire need for business managers across all economic sectors of South Africa. Moreover, the lack of adequate business management knowledge (e.g., strong customer orientation and customer retention) as well as the dearth of a strong entrepreneurial orientation in South Africa are highlighted as major contributors to the high failure rate of SMME in South Africa (Agbobli, 2013; Amoakoh, 2016). As such, there are calls for increased entrepreneurship training and enterprise development to ensure SMME success in the belief that investment in entrepreneurship development could lead to job creation (Dzansi, 2020). Solomon and Lind (2016) affirm that South African incubatees have not demonstrated proactivity and cooperativeness in acquiring and developing deficient resources such as entrepreneurial knowledge required to run their businesses successfully. In short, there strong national policy has not contributed significantly to the development of entrepreneurial knowledge in the country.

6.4.2. Entrepreneurship skills and national entrepreneurship policy

An entrepreneurial skill is defined as the ability to create something new with value by devoting the necessary time and effort, assuming the accompanying financial, psychic and social risks, and receiving the resulting rewards of monetary and personal satisfaction and independence (Hisrich & Peters, 2002). In short, entrepreneurial skills comprise those action-oriented capabilities relevant to the effective pursuit of entrepreneurial actions and execution of tasks. They are skills relating to identification of economic opportunities, acquisition of scarce resources, implementing organisational and technical innovations, internal management of firms and managing firms' relations with external stakeholders (Kilby, 1971; Adeyemo, 2009).

Entrepreneurial policy research has discussed various modes through which entrepreneurship policy shapes entrepreneurial skills developed at the individual, industry, and regional levels (Audretsch et al., 2007; Khyareh, Khairandish & Torabi, 2019). In addition to creating regulatory conditions, market conditions, access to finance and culture, national entrepreneurship policy hones entrepreneurial skills by creating and promoting the diffusion of entrepreneurial knowledge (Industry Canada, 2015). National entrepreneurship policy shapes the supply of entrepreneurial skills of potential entrepreneurs by availing training programmes, fostering values and attitudes that inform individual preferences to pursue entrepreneurship practically (Khyareh, Khairandish & Torabi, 2019). As such, the South African government can create a policy environment that catalyses the development of entrepreneurship skills through rendering economic and investment stimulus packages for supporting entrepreneurship behaviours. This was the case during the lockdown imposed by the Covid 19 pandemic when funds were availed to support fragile businesses' operations. Entrepreneurship policy expressed in favourable economic climate, supportive regulation and legislation and easy access to markets all contribute to the development of entrepreneurship and business management skills as they allow entrepreneurs to experiment with their skills and expertise to grow their business (Cooney, 2012).

With reference to South Africa, there seems to be a direct relationship between national policy initiatives and the development of entrepreneurial skills. For instance, Industrial Policy Action Plan (IPAP) of 2018 in conjunction with the National Industrial Policy Framework (NIPF) strive to incentivise investment in plant and technologies to enhance the entrepreneurial and managerial skills of large and small businesses to improve productivity and increased social welfare of citizens (Davies, 2018). By extension, the establishment of the Black Industrialist Scheme (BIS) in South Africa strives to support the development of committed black industrialists' entrepreneurial skills rather than merely transfer ownership in existing large companies to empower individuals without any real change in skills acquisition, decision-making and control (Industry Policy Action Plan 2018/2019-2020/2021). In particular, this programme which is funded by the Industrial Development Corporation and the National Empowerment Fund, renders support in the development of business management skills, including access to finance, access to markets, standards, quality and productivity improvements (Industry Policy Action Plan 2018/2019-2020/2021). Therefore, national policy has the potential to contribute directly to the developments of entrepreneurial and business managerial skills.

The surprising reality is that entrepreneurial skills can also thrive in adverse economic environments when they are properly regulated by government. For instance, the growth of businesses in the USA under adverse economic circumstances (e.g., after the 2008/2009 financial recession) was attributed to the capacity of leading entrepreneurial institutions such as the National Business Incubation Association (NBIA) and Association of University Research Parks (AURP) to develop innovation habitats that drive entrepreneurship skills development in the USA over a long duration (Plonski, 2016). For instance, NBIA and AURP founded in 1985 and 1986 respectively, created innovation habitats that steered the development of entrepreneurship skills by supporting knowledge-based economic and social development activities (Plonski, 2016). The success of most ventures that were created during the recession could be partly attributed to the development of entrepreneurial skills of owners and managers of these firms.

6.4.3. Entrepreneurship experience and national entrepreneurship policy

The relationship between national entrepreneurial policy and entrepreneurship experience is not clear-cut as policies cover a wide spectrum of entrepreneurship issues external to operations of firms and entrepreneurship process upon which entrepreneurs' experience is built. For instance, Global Entrepreneurship Monitor (GEM) which discusses various countries' national policies that drive the entrepreneurial process, highlights the entrepreneurship process to comprise the conception, startup, persistence and established phases (Bosma & Levie, 2010) and for each stage, different entrepreneurial experiences are required. In a study that examined the interaction between government entrepreneurship policies and entrepreneurs in Nigeria and South Africa, Akinyemi and Adejumo (2018) acknowledge that while entrepreneurs can harness their entrepreneurial experience to set out business policies to guide their internal operations, entrepreneurial policies that shape and inform businesses are developed by national governments. Therefore, although government policies and regulation relating to business registration process, corporate income tax, market regulation, and labour laws may be external policies beyond the control of the entrepreneur (Akinyemi & Adejumo, 2018), they have a bearing on firm operations, regardless of the level of entrepreneurial experience of the entrepreneur. It would appear as if entrepreneurial experience does not significantly moderate the interaction between government entrepreneurial policy and firm operations. However, they attributed the difficulty of conducting business in Nigeria to poor tax administration, which compelled entrepreneurs with limited entrepreneurial experience to evade tax to re-invest the revenue they had acquired into their business.

6.5. PERCEIVED ENTREPRENEURIAL CAPABILITIES-REGIONAL SMME FUNDING RELATIONSHIP

The next three sections discuss regional SMME funding as it relates to three dimensions of perceived entrepreneurial capabilities namely, entrepreneurial knowledge, skills and experience. The relationship between regional SMME funding and entrepreneurship knowledge is discussed in the next section.

6.5.1. Entrepreneurship knowledge and regional funding for SMMEs

With reference to South Africa, regional funding for SMMEs can be conceived from different angles such as national policies as they apply at regional levels through regional and provincial implementing agencies and institutions. These policies that speak directly to increasing funding instruments and broadening access to financial and non-financial resources at regional levels include the White Paper on National Strategy for the Development and Promotion of Small Businesses; Accelerated and Shared Growth Initiative South Africa (AsgiSA), the Micro-economic Reform Strategy; National strategy for the development and promotion of franchising in SA and National Youth Enterprise Strategy (FinMerge, 2015). For instance, AsgiSA stipulates the mechanisms for increasing access to finance especially through venture capital and easing cashflow challenges for SMMEs that conduct business with government at regional and local levels. The National Youth Enterprise Strategy (NYES) renders mechanisms for increasing access to financial and non-financial resources for young women and men who are in business or planning to enter business (FinMerge, 2015). In their operations at regional level, these policies intersect with complex regional policies and bylaws such as Municipal Systems Act, legislation (e.g., Development and Planning Act) and bylaws (Trading by laws, Business licensing, taxation laws) (Pahwa et al., 2006). For instance, tax laws provide some intangible resources through tax incentives such as tax exemptions for SMMEs with certain revenue base (e.g., those firms generating below R500 000 per year).

Although it is impossible to examine all regional SMME funding instruments, policies and legislations, the extent to which they impact entrepreneurial knowledge is critical. Evidence suggests that regional policies relating SMMEs can support as well as restrict the acquisition of business knowledge. Despite the prevalence of legislation that targets provision of SMME funding and investment in infrastructure for SMME development (e.g., local procurement), such legislation has not developed South African SMMEs especially SMME capacity building and training to enhance entrepreneurship knowledge of owners and managers (Pahwa et al, 2006; Solomon & Lind, 2016). The multi-layered, intersecting and sometimes inconsistent legislation often undermine SMMEs owner/managers' capacity to leverage on their entrepreneurial knowledge to operate their businesses profitably within the precepts of legislation. Since running a business profitably requires business owners to understand and abide by municipal bylaws, SMME owners' lack of knowledge of entrepreneurship and legislation (Ferreira, 2007; Nodada, 2011; Solomon & Lind, 2016) seems to suggest that policies on regional SMME funding have not fundamentally broadened entrepreneurs' knowledge of business operations. Pahwa et al. (2006) affirmed SMMEs managers' lack of constructive knowledge on applicable legislation relating to funding instruments and rates payment, especially those using properties for multiple purposes, further point to knowledge deficits among entrepreneurs. Despite the availability of different funding instruments at regional levels for SMMEs, Bhorat, Asmal, Lilenstein and Van Der Zee (2018) bemoan that a lack of entrepreneurial education and training contribute to the paucity of entrepreneurial knowledge among SMME owners and managers. As such, most SME owners are compelled to employ consultants in management areas where they themselves lack knowledge and experience (Ferreira, 2007; Bhorat et al, 2018). This evidence points to a negative relationship between lack of entrepreneurship knowledge and regional SMME funding as the availability of regional funding for SMMEs as not translated into enhanced entrepreneurial knowledge for SMME owners and managers.

6.5.2. Entrepreneurship skills and regional funding for SMMEs

Bhorat et al. (2018) acknowledge the importance of entrepreneurial skills for SMMEs to start and expand their businesses. The regional offices of SEDA often devote some funding to provide education and training to enhance SMMEs' entrepreneurial skills. Therefore, the provision of funding for SMMEs for entrepreneurial education and training has potential to enhance the entrepreneurial skills of SMME owner and managers. However, the paucity of entrepreneurial skills (e.g., financial and venture management skills), including risk mitigation strategies has contributed to high credit risk profiles for SMME entrepreneurs (Bhorat et al., 2018) as training provided by regional SMME funding institutions, though subsidised, is not free of charge. Moreover, incubation managers have reported incubatees' lack of business skills, business processes, concepts, a lack of focus, which have contributed to abuse of incubation machinery and equipment (Solomon & Lind, 2016). Overall, there seems to be a negative relationship between paucity of entrepreneurial skills and regional SMME funding as such funding has not significantly impacted the entrepreneurial skills of entrepreneurs.

6.5.3. Entrepreneurship experience and regional funding for SMMEs

The relationship between regional funding for SMMEs and entrepreneurial experience is not a straightforward one as it is context dependent. Nodada (2011) underlines the critical role of accumulating entrepreneurial experience in context, arguing that even though experience may not guarantee business success, the paucity of such experience can accentuate the failure of SMMEs in South Africa. By extension, the lack of experience in accessing regional SMME funding could contribute to the lack of access of critical funding, which may adversely impact SMME operations. For instance, despite the multiple funding instruments availed at regional levels by National Youth Development Agency (NYDA), DESTEA and Industrial Development Corporation, the high failure of SMMEs in South Africa has been attributed to SMME owners and managers' lack of experience in comprehending the requirements of funding instruments (Mpiti, 2016). Even if they have entrepreneurial experience to comprehend these funding instruments, new startups' lack of alternative sources of revenue, unreliable income streams and poor financial management skills render SMMEs entrepreneurs unattractive to retail banks and regional funding bodies due to their high risk of defaulting (Bhorat et al., 2018).

The Faculty of Management at the Comenius University in Bratislava mobilised funding to establish the Consulting and Development Centre (*Poradenské a Rozvojové Centrum* [PRC]) in 2005 to tackle head on new startups' lack of entrepreneurial and managerial experience in personal, financial, marketing, strategic, information technology matters (Mrva & Stachová, 2014). Graduates such as technicians, IT experts and other specialists with novel business ideas but lacking entrepreneurial experience are supported by academics and private sector experts with diverse knowledge on business development, consulting, entrepreneurial and business management. Academic and private consultants provide graduates and students with business incubation courses, seminars, lectures, apprenticeships and training in real business contexts to enhance students' entrepreneurial experience (Mrva & Stachová, 2014). It can be inferred with reference to new startups in Slovakia that, the provision of funding at regional level has potential to enhance the entrepreneurial experience of students, enabling them to start new businesses.

6.6. PERCEIVED ENTREPRENEURSHIP CAPABILITIES AND REGIONAL INNOVATION CULTURE

Since PEC comprises entrepreneurial knowledge, skills and experience, it is critical to connect these dimensions of PEC to regional innovation culture to fully appreciate the role of this environmental factor in shaping TBI. As such, the next sections cover each of these aspects of PEC as they relate to regional innovation culture. The next section discusses the relationship between the regional innovation culture and entrepreneurial knowledge.

6.6.1. Entrepreneurial knowledge and regional innovation culture

In simple terms, regional innovation culture describes the extent of receptivity of a region to innovation. In more complex terms, it denotes the shared collective orientations and inclinations (including values, beliefs and behaviours) of individuals to the identification, exploitation and mobilisation of resources for the facilitation of new ways of processing, producing, and marketing goods and services in a specific geographical area. These cultural values, beliefs and expected behaviours of a region concerning innovation may stimulate entrepreneurs to search for funds of knowledge that facilitate their identification, validation and exploitation of entrepreneurial opportunities. In their theoretical study, Audretsch et al. (2006) reports that the culture of innovation and entrepreneurship in a region provides strategies for enabling the spillover of knowledge and ideas from organisations to locations where those opportunities are actualised. As such, the innovation culture of a region provides the necessary impetus for the expression, exploitation and actuation of knowledge, which makes organisational productivity possible.

Other studies have proposed a confluence of factors that affect entrepreneurial knowledge. The innovation culture of the region, coupled with knowledge of the labour market, sophistication of labour market conditions (e.g., supply and demand) and facilities offered by the local banks to support businesses, collectively contribute to the enhancement of entrepreneurial knowledge and venture creation (Global Business School Network, 2013). Others have contended that regional innovation culture and knowledge are predictors of other variables. For instance, Audretsch et al. (2019) established that the co-presence of subcultural amenities and subcultural knowledge is positively associated with entrepreneurship, even though the mainstream culture has little to no effect. Therefore, it is inconceivable to perform homogeneous analyses and talk about “one-size-fits-all” regional culture (Asheim et al., 2011) of innovation as individual regions possess unique traits that shape the development of entrepreneurial knowledge.

Some studies demonstrate the critical importance of processes of generating and exploiting knowledge by entrepreneurs in advancing regional culture of innovation (Cooke, 2007; Huggins & Thompson, 2015). The argument is that entrepreneurs with the capacity to access and exploit knowledge generate some investments whose success contribute to developing a culture of innovation and research and development, which ultimately create demand for goods and services (Guerrero & Peña-Legazkue, 2013; Castaño et al., 2015; Guerrero et al., 2016). Therefore, those who exhibit entrepreneurial knowledge would generate a culture of innovation by converting their concepts and ideas into innovative services and products. In a study that explores amenities, subcultures and entrepreneurship, Audretsch et al. (2019) contend that the acquisition of entrepreneurial knowledge and creativity facilitate a culture of regional innovation. It is clear from the aforesaid studies entrepreneurship knowledge is critical but insufficient for generation of regional innovation culture as the exploitation of such knowledge requires creativity in converting concepts into commercialised applications. In short, there is a bi-directional relationship between regional innovation culture and entrepreneurial knowledge.

6.6.2. Entrepreneurial skills and regional innovation culture

Given that individuals' levels of understanding and consciousness are products of their cultural contexts (Gadamer, 1989; Lessem & Schieffer 2008), one would expect the regional culture of innovation to shape entrepreneurial skills. The innovation culture of a region shapes the entrepreneurial skills (e.g., networking skills) and habits because when developing their entrepreneurial social networks enabled by such a culture, entrepreneurs' behaviours may conform to cultural norms and practices (e.g., of innovation) of one's country region (Klyver & Foley, 2012). Similarly, the regional innovation culture established in the Silicon Valley and the agglomeration effects arising from the proximity of high technology firms has contributed to the spillovers of entrepreneurial skills as entrepreneurs benefit from resource advantages arising from proximity to one another. However, Bushe (2019) contends that inaccessibility of entrepreneurial skills to new startups may contribute to the lack of an innovation and enterprising culture in a region. Therefore, it is logical to postulate a bi-directional relationship between regional innovation culture and entrepreneurial skills, even though the direction of the relationship could be context dependent.

6.6.3. Entrepreneurial experience and regional innovation culture

There is a bi-directional relationship between regional innovation culture and business experience. Fritsch and Wyrwich (2018) explored the role of regional culture of innovation and historical knowledge in the development of new ventures in innovative industries. Their findings demonstrate that most knowledge bases from which sustainable innovations and entrepreneurial opportunities arise are embedded in the innovation culture and history of a region. Although the study does not speak directly to entrepreneurial experience, it is evident that the stock of knowledge from which entrepreneurs derive their experience to explore entrepreneurial opportunities is rooted in the regional innovation culture. Since entrepreneurial experience is the vehicle through which entrepreneurs' capacities transform over time (Bergmann, 2017), clearly the regional innovation systems developed over time shape the entrepreneurial experience and potential that entrepreneurs acquire to drive innovation in peripheral regions further (García-Rodríguez, Gil-Soto, Ruiz-Rosa & Gutiérrez-Taño, 2017). Therefore, these narratives suggest that while entrepreneurial experience is embedded in regional innovation culture, once the experience is established, it takes a life of its own. This is achieved by reinforcing and deepening innovation culture in the region through knowledge spillovers, resource exchange and shared experiences.

6.7. PERCEIVED ENTREPRENEURSHIP CAPABILITIES-LEGITIMACY OF INCUBATION RELATIONSHIP

As already stated in the previous chapter, legitimacy involves "the assumption that organisational activities are desirable, proper or appropriate within some socially constructed systems of norms, values, beliefs and definitions" (Suchman, 1995: 574). The legitimacy of incubation implies the extent to which incubation principles, mandates, processes, actions and activities are desirable and appropriate by incubation stakeholders based on socially constructed precepts. The next sections discuss legitimacy as it relates the three dimensions of PEC, starting with entrepreneurship knowledge.

6.7.1. Entrepreneurship knowledge and legitimacy of incubation

Consistent with institutional theory, DiMaggio and Powell (1983) highlight three mechanisms through which institutional actions occur and change to guarantee the legitimacy of institutions, namely coercive, normative and mimetic. *Coercive isomorphism* relates to the pressure that government and funding institutions apply on TBI to conform with certain standards and expectations, thereby affecting their conduct, behaviours and structures. Regarding cohesive isomorphism, government funding agencies and investors may withdraw funding and technical support in situations where TBI managers' entrepreneurial knowledge and experience to drive incubation processes are deemed inadequate. This could also happen when incubation processes (e.g., admission criteria, revenue generation models) are questionable and therefore not legitimate. Such action becomes a coercive strategy of enforcing compliance and re-configuring legitimacy of such institutions. Normative professionalism stems from professionalism that influences the characteristics of the organisation (DiMaggio & Powell, 1983). The diverse entrepreneurial knowledge possessed by incubator managers may increase the levels of professionalism and conformity to incubator standards and thereby contribute to enhanced incubation performance. Such enhanced performance increases the social legitimacy of incubators and incubatees in the minds of external stakeholders. Mimetic isomorphism means the pressure to model the organisation's institutional structure and activities when goals are unclear or when confronted with uncertainty (DiMaggio & Powell, 1983). During uncertain times such as those created by Covid-19 lockdown restrictions, more learned management (i.e., those with entrepreneurial knowledge) of incubators may seek to gain legitimacy by experimenting with best-practices, incubation processes and models of renowned incubators.

Yusubova and Clarysse (2016) highlight that the legitimacy and success of incubation processes are tied to the entrepreneurial competence and experience of the incubation manager in attracting the right ventures through appropriate selection processes and assisting new startup companies in the business development process. It can, therefore, be inferred that entrepreneurship knowledge and experience of the incubator managers contribute to business development success. In the long run, this increases the legitimacy of the incubation processes in the eyes of stakeholders of incubators.

6.7.2. Entrepreneurship skills and legitimacy of incubation

Since the legitimacy of the TBIs is tied to their capacity to engage in acceptable and appropriate behaviours (e.g., accelerating technology commercialisation, incubating high growth-oriented startups), the tragedy of newness may mean that incubators lack legitimacy (Yusubova & Clarysse, 2016). This lack of legitimacy emanates from a lack of entrepreneurial skills among incubation staff and an inability to demonstrate successful outcomes in their short term. Where the tragedy of newness persists, effective incubation selection criteria may not attract incubatees with the broad range of entrepreneurial skills relevant to the successful incubation, thereby affecting the incubator's legitimacy.

A study conducted by Messeghem; Sammut and Beylier (2014) on the relationship between new venture legitimacy and entrepreneurial support suggests that new startup entrepreneurs' level of professional legitimacy exerts an impact on expectations for the incubator. In situations where the entrepreneurs lack professional legitimacy by expecting the incubator to do everything for them, this may be problematic to incubator managers even if they had sophisticated entrepreneurial skills to provide support to incubatees. Similarly, where incubatees exhibit professional legitimacy by going an extra mile in seeking support and expertise beyond the incubators, the entrepreneurial skills of incubator managers would complement incubatees' professional legitimacy in ways that contribute to increased TBI outcomes.

6.7.3. Entrepreneurial experience and legitimacy of incubation

Ideally, incubatees' acquisition of entrepreneurial knowledge through participation in incubation activities can stimulate a desire to articulate knowledge even though such willingness may not translate into actual articulation (Gonthier & Chirita, 2019). If knowledge articulation contributes significantly to engagement in meaningful incubation outcomes, which increases the legitimacy of incubators, then failure to generate knowledge means that entrepreneurial experience may not be a significant predictor of incubation legitimacy. One would expect experienced incubator managers to institute incubation processes, business models, mobilise resources, and steer incubation activities that sustain the incubation performance. This way the experienced managers enhance the legitimacy of incubation than their counterparts with limited experience. For instance, entrepreneurial experience would capacitate them to develop coherent incubation tenant selection processes that attract promising startup teams, design sophisticated programme structures and activities (e.g., business assistance and network opportunities that attract multiple stakeholders) (Yusubova & Clarysse, 2016). These processes and structures may contribute to increased TBI performance (e.g., more spin off companies, sustained revenue streams, and sustainable innovations), which guarantee the legitimacy of the incubator.

6.8. TECHNOLOGY BUSINESS INCUBATION AND TECHNOLOGY ENTREPRENEURSHIP: AN OVERVIEW

This segment explores TBI and its relationship with incubation outcomes, especially technology entrepreneurship (TE). There seems to be a bi-lateral and bi-directional relationship between TBI and TE as the incubation of technology business can give rise to the commercialisation of technology inventions and innovations, the same way commercialisation of ideas contributes to the development of sustainable incubation of technology businesses. Mauer and Brettel (2008) acknowledge this bi-directional effect of TBI on TE and contends that the incubation of new technology-based firms is influenced by newly developed innovative technologies while TE (e.g., technology transfer and research on business creation processes) can be drawn from the knowledge about established incubated companies.

Other researchers do not seem to support this bi-directional perspective and postulate that TE predicts business incubation processes. For example, Landoli (2008) highlights that TE triggers the creation and incubation of new high-tech startups, which may generate a major technological revolution. Similarly, other performance measures of TE such as expenditures on R&D at university are positively related to the incubation of new firms (Kirchhoff et al., 2007). These studies give credence to the claims that those nations with a higher technological density in a specific year exhibit higher levels of high-tech firm creation in subsequent years (Van Roy & Nepelski, 2017). This demonstrates the impact of the concentration of technology-based firms (i.e., a dimension of TE) on business incubation.

Other studies seem to confirm that TBI facilitates the TE. Xue and Klein's (2010) study on regional determinants of technology entrepreneurship demonstrates that the presence of anchor firms (as is the case with those that support business incubation) is important to technology innovation (which is one of the dimensions of TE) if such anchors leverage the engagement of individuals within and beyond firms. In the same way, technological innovations are viewed as consequences of individual entrepreneurs and groups' recognition and exploitation of technological opportunities through new venture creation and business incubation (Clarysse et al. 2009; Parker 2011). In view of the aforesaid literature, there is a bi-directional and bi-lateral relationship between TBI and TE even though this relationship is predominantly studied from the perspective of venture creation and not necessarily business incubation.

Perhaps an in-depth analysis of different aspects of TBI (especially incubation selection criteria, IP and patenting and incubation manager competence) as they relate to TE would give a clear picture of the relationship. The choice of these aspects of TBI was informed by their prominence in incubation literature as drivers of TE (Teplov, 2013; Al-Mubaraki & Busler, 2017; Stuetzer et al., 2018; Fritsch, Obschonka & Wyrwich, 2019). Although they highlight the significance of these factors as antecedents of TE, some of these studies were conducted in advanced economies, casting doubt on whether their findings are transferrable to emerging economies. To illuminate understanding of this relationship, subsequent sections examine each aspect of TBI as it relates to TE, starting with incubation selection criteria.

6.8.1. Incubation selection criteria and technology entrepreneurship

Logic would dictate that the development of relevant and appropriate incubation selection criteria would be instrumental in the creation of high-tech firms, as one of the dimensions of TE. Incubators are charged with the responsibility of developing the needs analysis of incubatees, selecting and monitoring incubatees for inclusion in incubation programmes (Smilor, 1987; Autio & Klofsten, 1998). The proper selection and monitoring of incubatee performance potentially triggers TE outcomes such as viable hi-tech firms, technology diversification, generation of profits from innovative products, creation of sustainable jobs and economic development opportunities (Smilor, 1987; Al-Mubaraki & Busler, 2017). Therefore, the proper selection of ventures with growth potential and entrepreneurs with certain qualities (e.g., risk propensity, entrepreneurial self-efficacy and achievement orientation) is fundamental to the establishment of successful high technology ventures as dimensions of TE. This inference gives credence to claims that proper management of the selection, overseeing of incubatee projects as well as the incubator skills contribute to successful incubation outcomes such as TE (Shefer & Frenkel, 2002). Recent literature affirms a positive correlation between incubation selection and incubation outcomes.

Al-Mubaraki and Busler (2017) emphasise that those incubators concentrating on the identification and selection of high technology startups for inclusion in their programmes contribute positively to the expansion of technology sectors in their countries in terms of the development of new product and new services; and fostering enterprise and innovation. This is important in fostering a convivial environment for growth of startups and accelerating smart growth. Evidently, the development of proper incubation criteria and business models is fundamental to the realisation of TE outcomes.

6.8.2. Intellectual property, patenting and technology entrepreneurship

With reference to TE, literature gives priority to patents than intellectual property generated through investment in research and development at regional levels. Research conducted at the regional level in Europe shows a positive association between patent development at regional level and growth in employment levels between 1950 and 1998 (itself a measure of TE) (Beugelsdijk, 2007; Stuetzer et al., 2018). Similarly, other studies have demonstrated that European cities that exhibit more positive risk attitudes often display higher levels of patenting, which predicts higher economic growth in the long term (Beugelsdijk, 2007, Caragliu, Del, Kourtit & Nijkamp, 2016). An inference from these studies is that, there is a direct positive connection between patent development and different dimensions of TE such as employment levels (at firm levels) and economic growth (at regional levels).

Fritsch, Obschonka and Wyrwich (2019) regressed the number of patents per member of the working population and the share of R&D employees in the regional workforce on historical self-employment rates and the entrepreneurial personality structure in German federal states. They controlled for regional policy making, population density and sectoral structure of the regional economy. Their results demonstrate a statistically significant relationship between the historical self-employment rate, number of patents, and share of R&D employees in the regional workforce, when regional controls are excluded. This demonstrates a strong statistically significant relationship between patent development and dimensions of TE (e.g., self-employment; share of R&D employees). When regional controls are included, the relationship is insignificant for R&D employment, but weakly significant for patenting when the general historical self-employment rate is employed (Fritsch et al., 2019).

6.8.3. Incubator management competence and technology entrepreneurship

Schumpeterian theory of entrepreneurship positions knowledge creation as an expression of competence. For instance, valuable knowledge (a dimension of incubator management competence) created by incubation managers combined with functional R&D transfer mechanisms are integral to the development of high-tech enterprises founded on knowledge transfer (Acs, 2006; Levie & Autio, 2008, Teplov, 2013). Individual manager competencies may find expression in knowledge created in university incubators and research centres being transferred to business incubatees to support real innovations with greater commercial value (Acs, 2006; Teplov, 2013). It can be inferred from these studies that the transfer and assimilation of incubator management's knowledge by incubation tenants, coupled with support for transfer of R&D knowledge, are fundamental to the development of TE.

There is compelling evidence to suggest that human capital (e.g., that manifested through business incubator competences) is a critical factor impacting entrepreneurial venturing outcomes (Bendickson, Muldoon, Liguori & Midgett, 2017; Huggins, Prokop & Thompson 2017). This implies that human capital such as the competencies of incubation managers can contribute to the development of high-growth oriented ventures, graduation of innovation-oriented businesses, acquisition of investment capital as well as growth in sales and innovations (Phan, Mian & Lamine, 2016). This happens when incubatees deploy them for entrepreneurial learning, improving their entrepreneurial efficacy and improving their entrepreneurial values (e.g., achievement motivation, risk taking, resilience). While the proliferation of technological advances (e.g., videoconferencing, social media networking, and cloud-based collaboration tools) is credited with reducing the role of human competencies in the development of incubation processes, the availability of adequate human capital remains a critical factor in the development of new startups in the technology sector in emerging markets such as Ghana (NewsGhana, 2016). As such, while technology complements and sometimes substitutes human competencies (e.g., need for networked communication, crowd funding, online communication) required in business incubation, the actual process of venture creation that drives TE necessitates entrepreneurs to build strong competencies.

6.9. THE PROPOSED MODEL POSTULATING RELATIONSHIPS BETWEEN CONCEPTS

To fully appreciate the blending of factors located at various levels in the incubation ecosystem, a convergence strategy is a useful heuristic framework for understanding the interaction between different factors holistically, integrating their different components, their linkages and convergence to a form synergetic whole (Roco & Bainbridge, 2003; Roco, 2020). Convergence processes not only connect different domains of activity (e.g., innovation ecosystems, TBI and TE) across time but also different behaviours and actions to ensure mutual compatibility, synergy and integration of seemingly different disciplines and communities to create value-added transformation for shared goals (Roco, 2020). A holistic view of the convergence process requires not only an identification of components of the ecosystem, their unifying features and systemic interdependencies (D' Agostino & Scala, 2016), but the four phases typical of a convergence approach. The *convergence–confluence phase* involves the confluence and assembling of knowledge, tools, domains, and modes of thinking driven by a set of unifying concepts for realising a common goal. These phases are the *convergence–integration phase*, which involves a process of deep integration of the new system behaviour to form new frameworks, paradigms or systems that that address questions, resolve problems, and build things that isolated components and capabilities cannot. The *divergence–innovation phase* facilitates the creation of novel pathways, opportunities and frontiers diverge (expand, branch-out) for new problem-solving and the expansion in knowledge, innovation, competencies, technologies, and applications. The *divergence–spin-off phase* involves the initial outcomes of innovation creating opportunities for spin-off development to new areas not planned in the initial phases and create seeds for new convergence divergent cycles (Roco, 2020). Based on this understanding, the next section provides the proposed model summarising the relationships between variables in the incubation ecosystem that interact with TBI to shape TE.

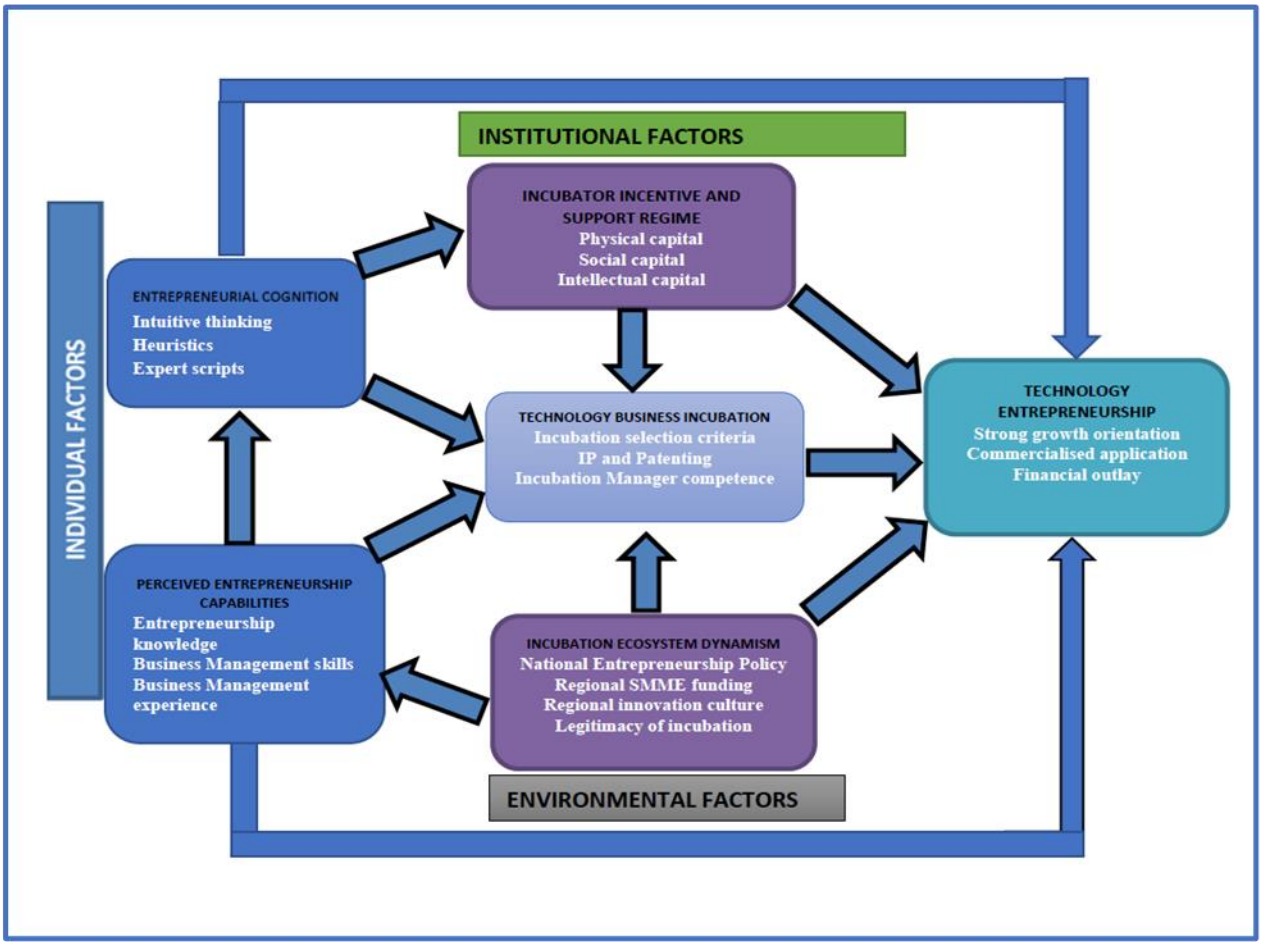

Figure 6.1: Proposed model demonstrating the postulated relationships

As illustrated in Figure 6.1, TE is conceived as an outcome of TBI. It is shaped by a confluence of factors operating at the individual entrepreneur (i.e., entrepreneurial cognition and perceived entrepreneurial capabilities), institutional (i.e., incubator incentive and support regime) and environmental levels (i.e., the incubation ecosystem dynamism).

At the individual entrepreneur level, entrepreneurial cognition and perceived entrepreneurial capabilities can either directly impact TE (when business pursue technological innovations on their own accord without incubator interventions) or affect technology business incubators' (TBIs) activities and processes. When business ventures are incubated through TBIs, the process is affected by institutional factors of the individual incubator (e.g. the quality of its physical facilities and finance, value of social networks and academic knowledge shared within these facilities) and the favourability or hostility (i.e. dynamism) of the incubation ecosystem (e.g. national entrepreneurship policy, regional funding regimes for SMMEs, regional innovation culture and the legitimacy of incubators as perceived by external stakeholders). These institutional and environmental factors can also affect TE directly or interact with TBI to influence TE. Within the TBI context, the considerations include the incubation selection criteria, IP and patenting and competences of managers of business incubators.

However, several direct relationships also unfold at the individual, institutional and environmental levels. For instance, an individual entrepreneur's knowledge, experience and skills may directly affect their use of heuristics while entrepreneurs' entrepreneurial cognition can influence their access to incentives and support system with or without the intervention of a technology business incubator. The regional innovation culture and national policy on entrepreneurship may also have a direct influence on an entrepreneur's perceived entrepreneurial capabilities to successfully incubate a technology-based business. Nonetheless, for the sake of increasing clarity and reducing complexity, there are some relationships beyond the scope of this study. For instance, it can be assumed that incentive regimes can also affect the entrepreneurial cognition of entrepreneurs just as much as PEC of entrepreneurs can collectively affect the innovation culture of a region.

6.10. CHAPTER SUMMARY

This chapter captured the four outstanding relationships left out in Chapters 3-5. Specifically, it examined EC-PEC (individual factors relationships), EC-incubator incentive support regime (individual-institutional factor relationships), PEC-incubation ecosystem dynamism, and TBI-TE relations. While Chapter 3, 4 and 5 examined individual factors, institutional factors and environmental factors' interactions with TBI and TE respectively, Chapter 6 explored those relationships which these three chapters did not cover at the individual, individual- institutional, individual and environmental and it the firm levels, to provide an integrated view on relationships. The next chapter presents and discuss the research methodology adopted in this study.

CHAPTER 7
RESEARCH METHODOLOGY

7.1. INTRODUCTION

The current chapter presents and discusses the methodology adopted for this study. First, the chapter presents and discusses the research methodology, research paradigm and the research epistemology. Second, it discusses the research approach, research design, research setting and provides a justification for its selection. Third, the study describes the population, the sample, the sampling technique, and how access to participants during the pilot and the main study was negotiated. Fourth, the data collection techniques, data analysis process are discussed. Given the detailed nature of the analysis, the outcomes of the data analysis are contained in the appendices to the thesis. Fifth, the research ethics are discussed, including the dependability, credibility, confirmability and transferability of the study results. Lastly, a summary of the chapter is provided. The next section presents the methodology adopted for this study in diagrammatic form.

7.2. RESEARCH METHODOLOGY

A research methodology connects the researcher's philosophical standpoint (on research paradigm and epistemology) and method (research approach, design and data collection tools) together (Hesse-Biber & Leavy, 2011). It is a strategic guide for developing assumptions, collecting data, analysing, and explaining phenomena (Nieuwenhuis, 2016). A methodology, therefore, summarises the researchers' philosophical position relative to the intellectual enquiry that entails understanding the world, how researchers know it and the procedures followed in knowing it (Nieuwenhuis, 2016). It is an abstraction of how the researcher conceives social reality, the epistemological stance and choice of strategies and methods in investigating phenomena.

A methodology employs a research paradigm, an epistemology, research design, strategies and empirical materials (Becker, 1998; Denzin & Lincoln, 2011) to make sense of the phenomenon investigated with a view to addressing the research problem in its broad social context. For this study, the methodology includes the research paradigm, epistemology, approach, design, population, sampling techniques, research instruments, data analysis techniques, research ethics, credibility and dependability of the research process and results of the study (see Figure 7.1).

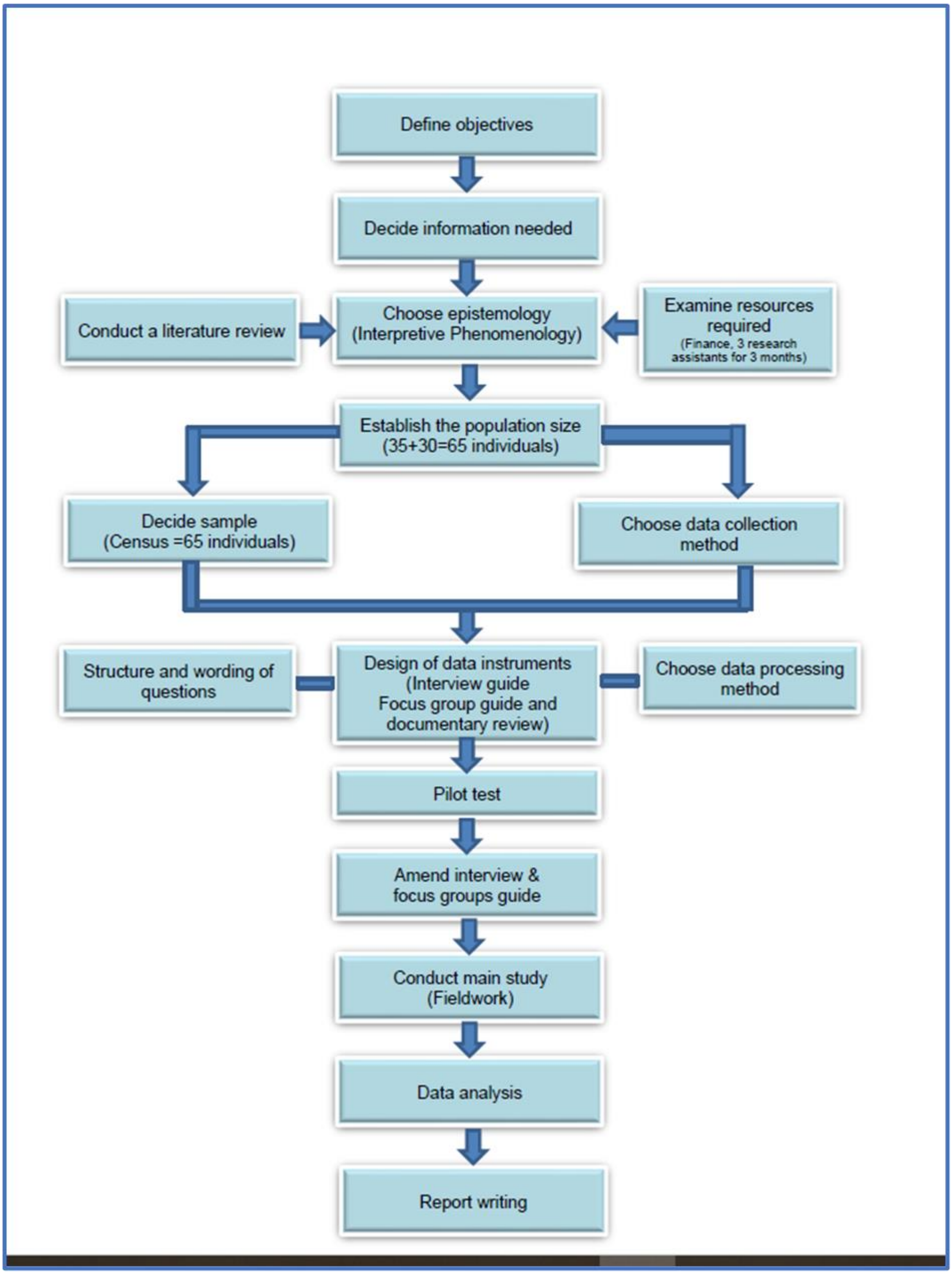

Figure 7.1: Research methodology for the study (Adapted from Davidson, 1970)

A methodology integrates a particular research paradigm, approach, perspectives, methods, tools and techniques of representation to facilitate meaningful interpretation (Denzin & Lincoln, 2011) of phenomenon. It ensures scientific rigour, breadth and depth of the enquiry. In view of the complexity surrounding the individual, institutional and environmental factors that affect technology business incubation (TBI), including the diversity of stakeholders that interact in TBI to generate incubation outcomes such as technology entrepreneurship (TE), an in-depth analysis of selected factors and agents was critical to identify how these factors intersect and synergise with TBI in shaping TE.

As illustrated in Figure 7.1, the research methodology is an adaptation of Davidson's (1970) outline of the research process. It comprises the formulation of research objectives, establishing the information needed drawing on the appropriate research epistemology, conducting a literature review to identify the concepts and constructs for the study. This process also entails locating the diverse resources required to identify the appropriate research design for this study. The next methodological process involved determination of the population size from the cases examined (i.e., university-based TBI and TE), determination of the sample size and figuring out the data collection and data analysis methods. This was followed by a pilot study designed to improve the precision and focus of data collection instruments, and ensuring a coherent structure of questioning. The processing of the data (e.g., coding, developing categories and themes) was followed by the writing of the detailed report. These methodological aspects are addressed in the following sections of the study.

7.3. RESEARCH PARADIGM

For Denzin and Lincoln (2011), a paradigm comprises belief systems which orient a researcher towards a specific world view. It captures the researcher's beliefs which shape her ontological view regarding whether social reality is objective, external to the observer, can be empirically examined and logically verified. Ontology relates to whether social reality is subjective, internally experienced by subjects and therefore, necessitates interaction between the researcher and what is researched (e.g., the participant) to extract it. This study was informed by the humanist paradigm. The humanist paradigm is anchored in a subjectivist approach to the social world and postulates that diverse individuals perceive the world in different ways based on their unique experiences (Greenfield, 1975). The humanist paradigm is ideal for this investigation because diverse stakeholders interacting in a university-based technology incubation ecosystem tend to assign different meanings and interpretations to factors they consider fundamental to the development of TBI and incubation outcomes. Since the subjective meanings and interpretations that incubation stakeholders assign to incubation factors differ depending on their experiences (Greenfield, 1975; Cohen Manion & Morrison, 2010), a humanist approach allows an investigation of the complexities, nuances and subtleties that different individuals perceive in each individual factor as it relates both to TBI and TE. As such, knowledge on TBI and TE was constructed through the negotiation of meanings that participants assigned to concepts and relationships as they interacted with the researcher and the questions asked.

7.4. RESEARCH EPISTEMOLOGY

Burrell and Morgan (1979) assert that epistemology entails the foundation of knowledge and what is deemed to be truth – the constitution and typologies of knowledge, the processes of its acquisition and its communication to other human beings. An epistemological position, therefore, deals with one's beliefs about what counts as knowledge and truth, the methodological approach that one employs to extract that knowledge, including the position of the researcher relative to the subject of enquiry. Consistent with Paulston and Liebman's (1996) conceptual cartography, each epistemological stance is derived from a specific research paradigm. For instance, while phenomenology and ethnography stem from a humanist paradigm, the modernisation theory and neo-functionalism are derived from a functionalist paradigm. In the same vein, while the poststructuralist and critical theoretical perspectives emerge from a radical humanist perspective, the historical materialist perspective derives from a radical functionalist paradigm (Paulston & Liebman, 1996). Since these other paradigms and epistemologies are not the subjects of investigation, they are beyond the scope of this study. For this reason, the next section discusses interpretivism, the epistemological stance that guides this study.

7.4.1. Interpretivism

This investigation takes an interpretivist epistemological stance. Associated with the work of Martin Heidegger and Hans-Georg Gadamer (Heidegger, 1962; Gadamer, 1986), interpretivism focuses on the reciprocal relationship between understanding and interpretation, the whole and the combinations of its parts being intricately intertwined. Since the incubation ecosystem comprises an integrated holistic structure (the incubator, incubator sponsors, incubatees, entrepreneurial and innovation champions and academic community), an understanding of individual actors in this system helps in unravelling their interactions in this complex structure, namely the technology incubation ecosystem. Nieuwenhuis (2016) argues that an interpretive epistemology inclines the researcher to reject a hypothetico-deductive approach common to the positivist paradigm. This is largely because interpretivists believe that theories are generated from data derived from individual perspectives, experiences and interpretations. Therefore, the conception of knowledge as personal, subjective and unique is upheld by interpretivists (Burrell and Morgan, 1979; Cohen, Manion and Morrison, 2010). An interpretive epistemology necessitates researchers' active engagement with participants to get to the bottom of their personal perspectives and experiences to establish what count as authentic knowledge.

Interpretivists foreground the intersubjective, socially constructed meanings that participants assign to their experiences (Husserl, 1965; Jansen, 2016) as they engage with each other. Given the researcher's interest in unravelling the experiences and meanings technology business incubatees attach to incubation processes, the support structures incubators provided them and their implications for TE, an interpretivist stance was deemed appropriate for this investigation. Since interpretivism considers social reality as socially and experientially based, dependent for its form on persons who experience it (Guba, 1990), all key players (i.e., incubator managers, incubatees, technology transfer officials, entrepreneurial and innovation champions) were engaged to generate an understanding of their experiences of incubation processes and outcomes. In interpretivist approaches, attempts are made to access the feelings and emotions of the person experiencing a phenomenon to understand the person from within rather than impose an external structure, which privileges the observer's views rather than the viewpoints of the participant directly involved (Cohen, Manion & Morrison, 2010). Accessing the experiences and perspectives of individual actors in university technology incubation ecosystem allows the researcher to particularise each subjective experience of incubation processes and outcomes as well as compare it to other experiences rather than universalise an individual's experiences. Drawing on personal experiences and understanding of everyday life in natural settings, the researcher generates theory that explains human and social behaviours (Cohen, Manion & Morrison, 2010) drawing on raw data.

However, the interpretive epistemology is not infallible. This epistemology is critiqued for not seeking objective truth through verification beyond the self-narratives and accounts generated by participants (Rex, 1974). Interpretivists' claims to the distinctly human nature of social reality and their dependence on social constructions of reality (Nieuwenhuis, 2016) downplays certain traits and behaviours which are common in all human lives. To overcome the limitations of over-reliance on narrative and personal accounts, the current study drew on mainstream incubation literature to identify concepts and constructs which were subsequently put in conversation with the narratives from diverse participants in diverse contexts in the incubation ecosystem. This was designed to compensate for the qualitative study's reliance on data-driven approaches to theory generation. This is because interpretivists are critiqued for overstretching individual experiences to the extent of negating scientific procedures of verification and identification of some generalisations in social behaviours (Mead, 1934; Cohen, Manion & Morrison, 2010).

7.5. RESEARCH APPROACH

Broadly speaking, there are three approaches to scientific research: quantitative, qualitative and mixed-method research (De Vos, Strydom, Fouche & Delport, 2011; Maree, 2016). However, since the quantitative and mixed-method approaches fail to sufficiently consider the socially constructed nature of human experience, including their inconsistency with the paradigm and epistemology applied in this study, they were inappropriate for this investigation. Instead, the qualitative research approach adopted for this investigation drawing on the paradigm and epistemology applied in this study.

Qualitative research captures an assemblage of approaches committed to using multi-methods geared at an interpretive grasp of human experiences in their naturalistic settings. It draws on various political and cultural allegiances (Denzin & Lincoln, 2000). To the effect that an extraction of individual experiences of TBI processes, the factors that trigger them and their outcomes necessitates an emic perspective to accessing participants' views, orientations, and justifications of their personal views, a qualitative approach is ideal for this investigation. Moreover, qualitative research advances a world of lived experiences founded on the intersection of individual beliefs, individual actions with their cultural and social contexts (Denzin & Lincoln, 2011). As such, the subjective experiences of stakeholders directly and indirectly involved in natural settings, especially university-based TBI, are more illuminating and informative than associations and predictions of relationships between variables. This is because while quantitative computations could have established the magnitude and significance of associations between variables, they would fall short of establishing the reasons why some relationships would be more significant than others, including the explanations and justifications for some factors being more valuable than others. These nuances are captured more comprehensively and succinctly through a qualitative framework.

A qualitative approach strives to generate new knowledge through making sense of the world to address questions on how the other is represented (Schwandt, 2007). Qualitative researchers rely on interpretive techniques and material practices that illuminate the social world by drawing on representations, field notes, interviews, conversations, recordings and memos developed by the researcher (Denzin & Lincoln, 2011). While one could argue that factors that shape and affect TBI can be examined from a quantitative perspective, the challenge of social desirability inherent in the quantitative research design and information elicitation instruments (e.g. survey and questionnaires) and self-serving biases inherent in respondents often make a quantitative approach inadequate clarifying the actual reasons why factors are configured and related the way they do as well the motivations for respondents feeling the way they do. As such, a qualitative approach is more informative for expressing participants' representations of their perspectives on how different factors interact as it draws on their personal experiences of incubation processes. Consideration of the individual, unique and distinct nature of personal experiences also helps overcome the generalisations inherent in quantitative studies that rely on samples.

7.6. RESEARCH DESIGN

A research design involves decisions the researcher adopts pertaining the topic to study, among which population, with what methods and for what specific purpose (Babbie, 2007; Fouché, Delport & De Vos, 2011). It ideally captures the conceptual and research road map a researcher employs in the investigation of a phenomenon, including identifying the level at which a phenomenon is investigated, the choice of participants, justifications for the choices of data generation tools and techniques for data analysis. Therefore, a research design describes the procedures for conducting a study that aid researchers to derive answers to the research questions (Cohen et al., 2010). Although there are multiple qualitative research designs such as narrative biography, ethnography, grounded theory and qualitative case study (Fouché & Schurink, 2011), this study adopts a phenomenological design. Phenomenology seeks to understand the phenomenon under study on its own account and therefore, renders a narrative of human experience as it is experienced by human actors (Bentz & Shapiro, 1998). Therefore, the experiences and perceptions of TBI sponsors, TBI staff, incubatees, entrepreneurship champions, and innovation champions who directed and interacted with incubation process were documented to develop context-situated narratives of incubation and incubation outcomes. Phenomenology studies direct everyday experiences and conceives human behaviour as dependent on the phenomenon of experience rather than objective, external and physically described reality (English & English, 1958; Fouché & Schurink, 2011).

In interpretive phenomenological studies, the researcher examines the phenomenon in its naturalistic setting and detaches him/herself from his/her judgements and preconceptions about the nature of events in the everyday world (Schram, 2006; Neiuwenhuis, 2016). This distancing of the researcher's judgements and preconceptions from the object of research allows the phenomenon to unfold naturally with limited intervention. The process of business incubation, including its management and regulation, is experienced differently by TBI sponsors, TBI staff, incubatees, technology champions and technology innovation leaders and hence the need for their emic, subjective experiences of this reality. Consistent with interpretivist thinking that contests the determination of reality objectively but considers its social construction in social settings (Husserl, 1965), interpretive phenomenology enables the development of rich, in-depth and complex accounts of the phenomenon to engender understanding of meanings that individual assign to social phenomenon in their context (Neiuwenhuis, 2016). Through interpretive phenomenological accounts that unfold in everyday incubation practices, the researcher was able to understand how incubation stakeholders construct their social realities.

Several studies have employed phenomenological approaches based on qualitative interviews to establish the dynamics of technology incubation (Dalbello, 2005; Ramraj, 2018). Ramraj (2018) employed a phenomenological approach to investigate the contribution of technology transfer to the development of incubators that sustain SMMEs in South Africa. Similarly, Mackin (2014) employed a phenomenological approach, utilising nine in-depth interviews and observations of women entrepreneurs' routine firm operations, to establish how these firms in different industries employed their entrepreneurial expertise, their finances and management backgrounds to navigate the challenges encountered in their incubation and entrepreneurial ecosystem. Other studies have been largely qualitative (McAdam & Marlow, 2007, 2011; Vanderstraeten & Matthyssens, 2012). In fact, 58 of the studies reviewed by Charry, Pérez and Barahona (2014) on business incubator research adopted qualitative approach, demonstrating the significance of such an approach to researching TBI and its outcomes. These studies demonstrate how qualitative approaches such as phenomenological studies employ detailed and rich narratives of individuals' everyday practices to understand the meanings and interpretations that they assign to their practices. Since business incubation and incubation outcomes are experienced differently by different individuals in the incubation ecosystem, drawing on multiple interpretations of these individuals' social life worlds illuminated the diversity of experiences and realities across different contexts.

7.6.1. Research settings and justification for their selection

Due to the sensitivity of some issues discussed in this thesis, the research settings of this study was called University incubator A and University incubator B and the respective stakeholders (TBI funders, TBI staff, incubatees, innovation and entrepreneurial champions) situated in two provinces in South Africa, were anonymised to protect their identities. University A's entrepreneurial ecosystem was chosen because it has a TBI and research commercialisation and innovation agency that provides ideation, business incubation and commercialisation. It exploits best practices of incubation whose social and economic impact has been felt regionally and nationally. Such impact finds expression in the numbers of businesses incubated, number of spinoff companies created, income generated and jobs created by startups and spin offs (Paschal, 2019). In the same vein, the entrepreneurial ecosystem of University B has a fairly protracted history of innovation (starting around 1997) even through the technology incubation ecosystem was established around 2011. A strong TBI ecosystem exists at this institution judging from the nature, calibre, national and global impact of institutions created to support TBI – with a world-renowned centre being among the best equipped additive manufacturing institutions in the Southern Hemisphere (Centre for Additive Manufacturing*[Pseudonym], 2018). Table 7.1. summarises the institutions and divisions created at university A and B to support innovation, entrepreneurship and TBI.

Table 7.1. Institutional structures supporting innovation and TBI at University A and B

University A's organisations and institutional structures and their purpose		
Structure	**Purpose and foci**	**Researcher's comments**
University A's incubator [Pseudonym]	Incubator A is a startup incubator, created to support university's spinouts and incubatee startups from the incubation ecosystem and partner universities in South Africa and Africa (University A's incubator, 2020a). University A's incubator is the brainchild of Venture Creation and Innovation Commercialisation Agency [Pseudonym], the industry interaction and innovation company of University A, in collaboration with Nedbank, which provides business coaching and mentorship programmes to startups (University A's incubator, 2020b). University A's incubator seeks to leverage and grow entrepreneurs so that they transition from incubatees into fully-fledged growth-oriented businesses and spinoffs. University A's incubator hosts University spin-out companies and student and external (non-university) entrepreneurs (University A's incubator, 2020b)	The University incubator that supports incubation processes and growth of incubatee and spinoff companies
Venture Creation and Innovation Commercialisation Agency (VCICA) [Pseudonym]	VCICA is university A's university-industry interaction and innovation company geared at commercialising the university's assets, ideas and entrepreneurship efforts (University A's Venture Creation and Innovation Commercialisation Agency, 2020a). VCICA prides itself in technology transfer, entrepreneurial support and development and innovation at the university. It manages the commercialisation of the University's innovation and intellectual property portfolio through patenting, licensing and creation of spin-out companies. It employs the university's research outputs to promote entrepreneurship, new jobs, new products and services to fulfil South Africa citizens' needs (University A's Venture Creation and Innovation Commercialisation Agency, 2020b).	The organisation responsible for the conversion of university research outputs, ideas into commercialised products and services.
University B's organisations, institutional structures and their purpose		
University B's Ideation Facility [Pseudonym]	The ideation facility is a developmental hub where experts and lecturers provide support to students, staff and the public to develop innovative ideas and projects into products and services with potential for commercialisation. It provides training in grant proposal writing, idea pitches, demonstration of new technologies, workshops from industry to students, staff and the public on entrepreneurship and innovation (University B's ideation facility, 2018).	Ideation arm of the university that supports experimentation with innovative ideas from students, staff and the public.

	Innovative ideas are later channelled to University B's units - Product Development Facility [Pseudonym], Centre for Additive Manufacturing [Pseudonym], Unit for Manumation Systems [Pseudonym], University B's Innovation Services [Pseudonym] and the Technology Transfer Office, which are leaders in prototyping, research and business development.	
University B's Fabrication Facility [Pseudonym]	The Department of Science and Technology (DST) established University B's fabrication facility and assigned the Council for Scientific and Industrial Research (CSIR) to implement it (University B's Fabrication Facility, 2018). A fabrication facility comprises a comprehensive set of innovative, industrial grade, digital fabrication tools, an electronics workbench, computers and programming tools, supported by opensource design software (University B's Fabrication Facility, 2018). The Fabrication Facility is a small production factory employed by local designers, innovators and engineers for developing prototypes in arts, crafts, engineering and architecture models. Computer assisted design software is employed to develop designs that are subsequently manufactured by a precision cutting, milling, forming or additive manufacturing machine (University B's Fabrication Facility, 2018). The Fabrication Facility gives individuals an opportunity to experiment with basic engineering and design technologies to demonstrate creativity and innovation (University B's Fabrication Facility, 2018).	Product development section that employs engineering and design technologies to manufacture tools and products for the market.
University B's Centre for Additive Manufacturing (CAM) [Pseudonym]	Founded in 1997, the CAM specialises in Additive Manufacturing (AM), that is 3D printing. The Centre supports world class research and commercialisation efforts in rapid prototyping, rapid manufacturing, rapid tooling and medical product development technologies (University B's CAM, 2018).	World class AM Centre that employs state-of the-art technologies and designs to manufacture engineering and medical products.
University B's Product Development Facility (PDF) [Pseudonym]	PDF facilitates the designing, prototyping and short run production of products. It employs product development, product enclosure development, agricultural equipment development, machine design and manufacture and tool development to transform ideas into products (University B's Product Development Facility (PDF), 2018). The PDF employs detailed engineering to develop businesses and individuals through the new product development process. It improves business competitiveness by rendering technological support for designing and manufacturing innovative new products (University B's PDF, 2018)	A section of CAM that employs scientific techniques and research and development to support the entire product development process

University B's Innovation Services [Pseudonym]	As a legal and commercial entity of University B, Innovation Services was created to generate third-stream income for the university and to stimulate commercialisation efforts of its resources, intellectual property and fundraising activities. This institution develops and implements innovative solutions for resolving socio-economic and technological challenges faced by the regional and national environment (University B's Innovation Services, 2018).	University B's division that specialises in commercialisation, contract development and expanding third-stream income.
University B's Centre for Venture Development and Innovation (CVDI) [Pseudonym]	CVDI staff conduct scientific research within both public and private sectors that empowers society and public enterprises and private companies, from a responsible entrepreneurship perspective. Its main research areas are in entrepreneurship and small business development; sustainable and ethical business practices; tourism and hospitality entrepreneurship; corporate governance and accountability (CVDI, 2019-2023).	Centre that supports cutting edge academic research in innovation, entrepreneurship and the generation of third-stream income.

At university A, the study concentrated on the incubator and the Venture Creation and Innovation Commercialisation Agency staff including the incubatees and sponsors these institutions worked closely with in incubation processes and generation of incubation outcomes. University incubator A was considered as an ideal type of a successful incubator having incubated more than 195 startups and spinoffs in various fields including technology to-date (VCICA, 2020). As a division of Venture Creation and Innovation Commercialisation Agency, incubator A presents entrepreneurs with state-of-the-art infrastructure, including networking opportunities and mentorship from academic experts and captains of industry to facilitate the launching of their business ideas (VCICA, 2020). It is critical to acknowledge that very few incubated startups and spin offs were technology driven or oriented, and hence not every startup or spin off incubated was worthy of inclusion in this study.

7.6.2. Population and sample

A population refers to the totality of subjects that conform to particular specifications, comprising the entire group of persons of interest to the researcher and to whom the research results can be generalised (Polit & Hungler, 1999; Rudhumbu, 2015). For this study, the population comprised all individuals who were directly and indirectly involved in the creation, management, provision of or influence the provision of technology-based incubation services and recipients of such services in two provinces in South Africa. These individuals were deemed to either have solid expertise in incubation processes, the entrepreneurship ecosystem or had direct experience of the TBI outcomes. These individuals comprised funders of TBIs, TBI staff including technology transfer officials, technology incubatees, entrepreneurial champions and innovation champions. These comprised 30 individuals from University incubator A and 35 individuals from University incubator B. For University incubator A, these comprised incubator CEO, climate technologies director, startup business builder, programmes lead, chief director and director of VCICA, science and industry research director, technology sponsorship agency deputy director, technology implementation agency manager and business manager, 20 technology incubatees and 5 spinoffs. For University incubator B, these comprised deputy vice chancellor of research and innovation, senior director of innovation and learning and her project manager, Centre for Venture Development and Innovation leader and one innovation champion, fabrication facility manager and four staff members, ideation facility manager, Innovation services CEO, deputy director and TTO business manager, Centre for Additive Manufacturing leader, co-leader and lead investigator, public funding agency CEO and two staff members, 6 technology incubatees and 4 spinouts.

The Free State Province was appropriate for this study as it has the highest concentration (14%) of high technology industries in South Africa (South African History Online, 2019). The high incubation success of Western Cape Province makes it a role model from which the Free State Province can draw experiences and learn lessons on incubation and incubation outcomes.

7.6.3. Sampling technique

A sample is a representative subset of a study population. The determination of the right sample in qualitative studies is controversial. Patton (1990) argues that there are no rules for the sample size in phenomenological research as all depends on the purpose of the study, what the researcher sees as important, the time and resources the researcher possesses. Nieuwenhuis (2016) contradicts this view by emphasising that data collection should continue in qualitative research until saturation point has been reached. Morse (1994) complicates this debate on the right sample size by postulating that even though data saturation is fundamental to qualitative studies, there are no tests of adequacy for determining sample size necessary to arrive at saturation point. Neuman (2003) reiterates that sample size is a function of the heterogeneity of the population, degree of accuracy required, number of variables in the data and the resources available to the researcher.

The right sample for phenomenological studies is therefore heavily contested. For instance, Morse (1994) recommends six participants as the minimum number required for such studies. Bertaux (1981) considers 15 as the acceptable smallest size for phenomenological studies. Guest, Bounce and Johnson (2016) claim that data saturation was attained when they had analysed 12 interviews, making this a median point. Romney, Weller and Batchelder (1986) argue that small samples are most desirable for providing complete and accurate information in specific contexts provided the participants have competence in the phenomenon under study. Although a census was applied in which all the 65 participants identified as the population components were contacted for some in-depth interviews with the researcher, only 30 participants were successfully interviewed as the rest declined the interviews for various reasons. These reasons included hectic schedules, fear of providing information to rival incubators and competitors (for incubatees despite the researcher giving a guarantee of anonymity and non-disclosure of information to third parties), and some incubatees' expectations of some financial compensation for the time lost during interviews (something the researcher was ethically bound not to accept). Also, some participants' contributions were excluded from the study as their responses did not address all questions in the interviews or focus groups discussions.

Purposive sampling was employed in the study. Purposive sampling is based on the judgement of the researcher that the sample elements contain most characteristics which are representative attributes of the population that best serve the study's purpose (Grinell & Unrau, 2008). Therefore, all individuals directly (e.g., incubators and incubatees) and indirectly (e.g., TBI funders, innovation champions, and entrepreneur champions) involved in the TBI process and TE in the two universities' entrepreneurship ecosystem were selected as study participants. The inclusion criteria for participants included (1) direct or indirect involvement TBI processes and the generation of incubation outcomes, (2) capacity to address most interview or focus group questions cogently and (3) prior experience in TBI and TE processes in various capacities (4) ability to provide expert opinions or expertise on these matters by virtue of one's knowledge of the targeted university TBI process and incubation outcomes. This meant that that TBI ecosystem members who were remotely involved in TBI and incubation outcomes who could not address most questions on TBI and TE were eliminated from the study. Therefore, the in-depth interviews conducted with directors of Venture Creation and Innovation Commercialisation Agency (VCICA) and Innovation Services of University B assisted in eliminating stakeholders who were not involved in TBI processes.

Table 7.2 summarises the 30 participants who responded to the interviews. These comprise 7 senior executive managers (i.e., 2 CEOs, 4 directors [three of whom were also innovation leaders], 1 deputy director), 7 middle executive managers, 1 lower executive manager, 12 incubatees, 2 entrepreneurial champions and 1 innovation champion. Although there were 30 interviews conducted with individual participants, for the two focus groups (each with two participants and the researcher) conducted, the participants for each focus group were counted as one person as only one transcription report was developed. Therefore, when each one of the focus group participants are individually counted for the separate interviews conducted on each one of them, there are 4 participants and the total number of participants is 30 instead of 28. For clarity, these participants are listed in Table 7.1. below.

Table 7.2: Interviews and focus group participants' demographic profiles

Participants	Age	Gender	Race	Entrepreneurial Experience	Designation
Participant 1	27	Male	White	2	University A's incubatee
Participant 2	44	Male	White	23	Senior executive manager of Centre of Additive Manufacturing
Participant 3	26	Female	Black	3	University B's incubatee
Participant 4	39	Female	Coloured	4	University B's incubatee
Participant 5	52	Male	Black	13	University B's Entrepreneurship champion
Participant 6	59	Male	White	32	Senior executive manager of University B's Centre of Additive Manufacturing
Participant 7	35	Male	Black	5	Senior executive manager of University B's Innovation Services
Participant 8	46	Male	Black	15	Senior executive manager of University B's Innovation Services
Participant 9	32	Male	Black	6	University B's incubatee
Participant 10A &B (Focus group discussion 1) ***	45 37	Male Male	Indian Black	23 10	Middle executive manager and funder of incubator A&B Middle executive manager and funder of incubator A&B
Participant 11	39	Male	White	1	Senior executive manager
Participant 12	36	Male	Black		Middle level manager
Participant 13	54	Male	Black	8	Entrepreneur champion and Middle level manager
Participant 14	No provided	Female	Indian	10	Senior executive manager and sponsor of incubatees in incubators A&B
Participant 15A &B Focus group discussion***	39 32	Male Female	Indian Black	15 12	Middle level manager and sponsor of incubators A & B. Middle level manager and sponsor of incubators A & B.

Participant 16	37	Male	Black	5	Lower-level manager and innovation champion
Participant 17	31	Male	Black	3	University B's Innovation Services Middle level manager
Participant 18	33	Female	Black	8	University B's incubatee/ entrepreneur
Participant 19	45	Male	White	14	University A's incubatee
Participant 20	46	Female	Black	3	University B's spinout and middle level manager
Participant 21	45	Male	White	4	University A's incubatee
Participant 22	45	Male	White	17	University A's incubatee
Participant 23	46	Male	Coloured	22	University A's incubatee
Participant 24	40	Female	White	5	Venture Creation and Innovation Commercialisation Agency (VCICA) Middle level manager
Participant 25	44	Male	White	20	VCICA senior executive manager
Participant 26	33	Male	Black	2	University A's incubatee
Participant 27	38	Male	White	5	University A's incubatee
Participant 28	36	Male	White	6	University A's incubatee

***Please note that although participants 10 and 15 were independently enumerated as individual participants for interviews, for their participation in focus groups they were treated differently. Participants of focus group discussion 1 (two participants and the researcher) were conceived as one participant (Participant 10) as one focus group transcript was developed based on their narratives. Participants of focus group discussion 2, were classified as one participant (Participant 15) as one focus group transcript was developed based on their narratives.

7.6.4. Negotiating access to research participants for pilot study

A pilot study tests and validates the data generation instrument by administering it to a few participants from the test population (Barker, 2003). It finetunes the research instruments in line with the methodology and sampling techniques to ensure their adequacy and appropriateness (Bless, Higson-

Smith & Kagee, 2006). The purpose of the pilot data collected was to finetune the instrument's questions, improve their conciseness and their relevance in addressing the research questions.

After the Department of Business Management and the Faculty of Economic and Management Sciences' General/Human Research Ethics Committee (GHREC) at the University of the Free State (UFS) approved this study and its ethical standards, the researcher sent emails with research documentation (i.e., letter confirming institutional approval of the study, the consent letter and all research instruments employed in the study) to the Director of Contracts and Innovation in the Research Development division and the Manager of Innovation and Technology Transfer at UFS to facilitate access to pilot study participants. This leadership had previously expressed willingness to avail their staff for the pilot study once the study had been approved at institutional level. The documentation of the study was availed to these senior management of the UFS incubator (Director Contracts and Innovation and the Manager of Innovation and Technology Transfer). Both agreed to participate in the study and the Director subsequently authorised the manager to avail the details of technology transfer office (TTO) staff, incubatees and incubator sponsors. These comprised the Director himself (with 20 years of technology transfer (TT) experience), the Manager (a TT expert), UFS entrepreneur with a startup company, UFS entrepreneur with startup that received R3m loan from an external sponsor; and UFS inventor with massive TT & IP experience (he later declined on the grounds of non-participation in incubation process at UFS) and TTO officer who managed UFS student entrepreneurs. The Director, the manager and TTO staff were interviewed individually while the entrepreneurs participated in focus groups. Since the pilot study was conducted during the Covid 19 pandemic, all interviews and focus groups were conducted on Microsoft teams and Zoom to comply with social distancing regulations. The UFS director also facilitated the researcher's access to a TT expert from University incubator A with 20 years of experience and an entrepreneur who established the first startup company in 2000.

Based on these interviews and focus groups, the phrasing of some questions was perfected, and repetitive questions were removed. The questions examining the interaction between physical, social and intellectual capital and incubation process were reduced to avoid the cumbersome detail. This also reduced anticipated fatigue of participants during completion. The contextual meanings of psychological terms (e.g., scripts, heuristics and intuitive thinking) and technology entrepreneurship were refined and finetuned to improve comprehension by non-technocrats.

7.6.5. Negotiating access to main study TBI stakeholders

Two phenomenological cases were dealt with consecutively in the main study, namely the University A and B cases. The process of accessing these two cases is elaborated in the sections below.

7.6.5.1 Accessing the University B TBI stakeholders

Upon ethical approval of the study at UFS, the researcher provided all documentation (i.e., letter confirming institutional approval of the study, the consent letter and all research instruments employed in the study) to the Director of Institutional Planning and Quality Enhancement at University B to secure ethical approval. Once institutional approval was granted, the researcher contacted the director and deputy directors of University B's Innovation Services to provide the names of critical stakeholders in their TBI community. First, both directors approved the study and supplied their ethical approval letters. The deputy director subsequently sent an email to TTO staff and other divisions introducing the researcher, the intent of the study and encouraged his staff to participate in the study. The staff comprised TTO, incubation facility and ideation facility staff. The incubation facility manager also provided the names, designations and contact details of University B technology business incubatees and sponsors for further correspondence. All these were contacted by email or telephone and interviews and focus groups were organised on Microsoft Teams or Zoom.

As the Leader of Innovation and Entrepreneurship Cluster in the Higher Education Regional Development Initiative of Central South Africa (HERDIC-SA), the researcher attended a HERDIC meeting in August 2020. After this meeting, the researcher established contact with the Director of the Centre for Additive Manufacturing [Pseudonym] and the director of the Product Development Facility, who also availed themselves and their respective staff for interviews with the researcher on Microsoft Teams.

7.6.5.2. Case of University A TBI stakeholders

The researcher gained access to University A's TBI community through the Director of Innovation of University A's incubator, whom he had met in 2019 at the Annual Entrepreneurship Development in Higher Education (EDHE) in Durban. He had provided his email details to conference delegates after his presentation on University A's business incubation experience. The researcher emailed this Director expressing intention to use University A's TBI community as a best practice case of incubation that could be compared to University B's incubation experiences given both institutions' strong orientation towards technology startups. Subsequently, the Director provided the contact details of University A's TBI community upon his granting of ethical approval for the study. He informed the researcher that since University A's incubator, Venture Creation and Innovation Commercialisation Agency (VCICA)[Pseudonym], and incubatees and spinoffs were independent entities, the researcher needed to contact these entities. The director of Venture Creation and Innovation Commercialisation Agency (VCICA) provided the names of staff dealing with technology transfer and incubation matters for further correspondence and these were contacted. University A's incubator website also hosted the data base of incubatees and their email addresses and the researcher individually emailed those incubatees whose business operations had a strong technology orientation. The names of sponsors of TBI were also available online and were also subsequently contacted by email for interviews and focus groups.

7.6.6. Data collection

Interviews, focus groups and document reviews were employed in data collection. Although documents were reviewed throughout the literature review, critical national and institutional documents relating to TBIs were also reviewed in the findings of this study. These data generation techniques are elaborated in subsequent sections.

7.6.6.1. Review of documents

Document reviews targeted literature ranging from journal articles, national policy documents on business incubation, University A and B's institutional documents on TBI and TE. Document review involved identification of relevant documents representative of the phenomenon under study and inductive reasoning (Nieuwenhuis, 2016) to understand the factors affecting TBI processes and incubation outcomes. Published national policy documents, University A and B's annual reports, administration documents, journal articles, theses and dissertations were assessed for their authenticity and accuracy pertaining to the TBI and TE phenomena. This was done at the level of literature review and the presentation of findings. The summary of national policies, legislation and institutional documents reviewed is provided as the last part of the appendices (see the last table in the appendix).

7.6.6.2. Interviews

While Creswell and Plano-Clark (2007) argue that phenomenological studies rely on unstructured interviews, Fouché and Schurink (2011) submit that such studies should use naturalistic methods of study without using reconstructing methods such as interviews. Since such studies are preoccupied with grasping the meaning of everyday experiences (Cohen, Manion & Morrison, 2007) from the perspective of those who experience them, interviews become essential for soliciting such experience. In-depth semi-structured interviews were used to elicit stakeholders in University A and B TBI community's views on factors affecting TBI and incubation outcomes. These interviews were informed by Moustakas' (1994) exhortation for researchers to identify a phenomenon, suspend their pre-conceived judgements, and collect data from multiple persons who experienced the phenomenon. Since the data collection process

(June-August 2020 [first phrase], October-November 2021 [second phrase]) unfolded at the height of national lockdown imposed by the South African government in March 2020 due to the Covid-19 pandemic, the first 20 (first round) and last 10 (second round) interviews and two focus groups were all conducted online using Microsoft Teams and Zoom meetings in the researcher's office. This was to comply fully with the government imposed social distancing regulations. Only one interview was conducted using WhatsApp video call, as the interviewee had not downloaded Zoom or Microsoft Teams on their laptop. To build trust with all new participants unfamiliar to the researcher, videos and audio materials were recorded with the participants' consent. All video and audio materials were also recorded via Microsoft Teams and Zoom and backed up with digital audio recording, saved, downloaded and transcribed in Microsoft Word and saved for detailed analysis.

7.6.6.3. Focus groups

Phenomenology requires the identification of a phenomenon of interest for which the researcher then reflects the themes that capture the constitution of these lived experiences (Van Maanen, 1997). Therefore, information gaps identified by the researcher in the TBI process and TE issues raised by leaders in innovation and entrepreneurship champions provided the guiding themes for conducting focus groups. Incubation funders of University A and B incubators participated in the focus groups to illuminated issues raised by TTO leaders, innovation and entrepreneurship champions. Rapley (2007) observes that focus groups complement and corroborate in-depth interview evidence. Two focus groups were conducted using the Microsoft Teams platform.

7.6.7. Data cleaning, organisation and management

The audio recorded interview and focus group data were transcribed, cleaned, converted and transcribed. The transcribed data was then uploaded into NVIVO 12 plus for organisation and management. The process of cleaning data involved the identification of typographical errors and missing words and the deletion of errors. The data was organised, grouped, refined and finalised to ease the data analysis process. To make sense of the data management process, data was continually aligned with theoretical framework, research questions, and objectives of the study.

Computer-Assisted Qualitative Data Analysis Software (CAQDAS) NVivo version 12 Plus software was used to organise and manage all the information provided by the participants in the study. NVivo version 12 was perceived as the most useful software for the study because it saves time and organises work clearly and logically rather than manual coding. Furthermore, the software assists in building networks and relationships, resulting in the creation of a graphical representation of the data (Ngalande & Mkwinda, 2014). Although the software coherently organises transcript data in preparation for analysis, it does not analyse the data as the analytic part remains the responsibility of the researcher. A trained qualitative data analyst, with the guidance of the researcher, facilitated the analysis of the quantitative elements in CAQDAS and the research analysed the largely qualitative data using phenomenological data analysis.

7.6.7.1. Coding process

Coding involves using tags to mark data with a tallying theme, category, keyword, or phrase. After coding data, the data was grouped into categories related to the codes. The grouping allows for the development of a formal structure comprising themes, categories and codes as illustrated in Figure 7.2. below.

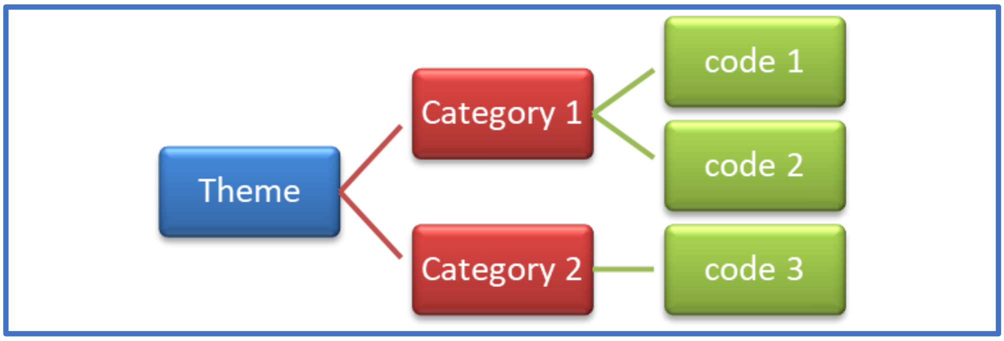

Figure 7.2: Coding process

Table 7.3 shows an example of the coding process; how themes and codes were created. The code **Intuitive thinking** was used to give meaning to the transcription excerpts provided by the participants. Therefore, the theme **Individual factors** was generated through the code grouping.

Table 7.3: Example of the coding process: Theme, code and data hierarchy

Theme	*Category*	*Code*	*Information from transcript*
Individual Factors	Entrepreneurial cognition	Intuitive thinking	"Yeah, I mean, at **some point everyone has to make a decision based on some instincts**, but I think that, if you ask entrepreneurs; if you ask an entrepreneur **how much of your decisions are based on gut feeling or instincts –** if they tell you it's 50% or more, I'll tell you that, **that business is going to fail**" (Participant 11).

7.6.7.2. Participants' contribution to the study

Before the phenomenological data analysis was applied, the data was first organised and managed in NVIVO 12. Figure 7.2, Table 7.3. and 7.4 and were generated using NVIVO 12. They illustrate the 20 participants who contributed to the study in phase 1 of data collection. As illustrated in Table 7.4, Participant 1, University A incubatee, shared more insights to the study than any other participant with 242 quotations extracted from his transcript whilst participant 6 generated the least quotations. Participant 6 contributed the least due to his hectic schedule. As a world-renowned innovation champion with a busy schedule, he allocated only 30 minutes for the discussion with the researcher, which significantly reduced the number of extracts generated from his interview.

Table 7.4: Contribution of the 20 participants in phase 1

Participants	Number of codes	Number of quotations
Participant 1	39	242
Participant 2	39	185
Participant 3	32	206
Participant 4	39	189
Participant 5	29	157
Participant 6	6	11
Participant 7	13	29
Participant 8	36	160
Participant 9	37	201
Participant 10	33	171
Participant 11	33	145
Participant 12	40	228
Participant 13	20	103
Participant 14	35	155
Participant 15	22	70
Participant 16	20	64
Participant 17	34	161
Participant 18	37	124
Participant 19	33	116
Participant 20	36	112

Since there were only 10 additional interviews in phase two of data collection as data saturation had already been attained in phase 1, it was deemed unnecessary to subject the 10 transcripts to data management using NVIVO 12. Given that the second phase of interviews was conducted only to clarify issues which were left hanging in phase 1 of the study, such data was only subjected to phenomenological data collection. Figure 7.3: illustrates participants' contribution to the study in phase 1.

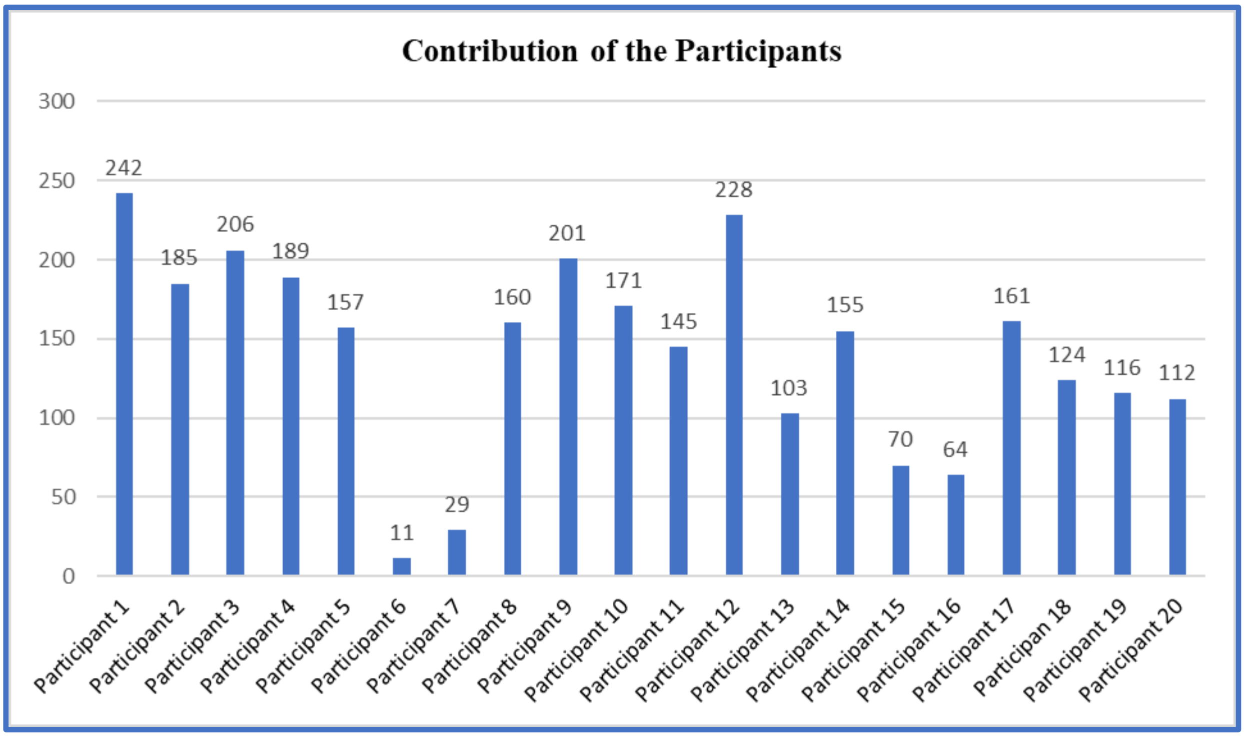

Figure 7.3: Bar graph illustration of participants' contribution to the study in phase 1.

7.6.8. Data analysis

The process of data analysis must be clearly informed by the purpose of the study, the sample size and unit of analysis, data collection method and the techniques (i.e., method) employed in data analysis. Some of these issues are illustrated in Table 7.5. Since the study employed phenomenological inductive analysis, theoretical constructs and concepts these were not "forced to fit data" per se but provided a general broad framework to understand and interpret themes and categories developed from raw data as shown in Table 7.5.

7.6.8.1. Data analysis method

McPheeters (2010) perceives an analytical method as linking concepts, evidence from data collection methods, and populations in relation to their intended outcomes to ensure precision in questions posed. This also ensures recruitment of appropriate participants, and refining bodies of evidence for inclusion in the study. Since the study drew on three qualitative data sources, the research process integrated Creswell and Plano- Clark's (2007) phenomenological research design with Shaban's (2011) phases in qualitative data collection and analysis.

The Table 7.5 summarises the process followed in the analysis of research data drawing on data triangulation. Consistent with Shaban's (2011) view on the importance of understanding contexts before data collection proceeds, an in-depth literature review was conducted drawing on multiple sources to fully appreciate the economic, social and political contexts in which incubation occurred nationally, regionally and institutionally. Next, key informant interviews were conducted with incubation management, innovation and entrepreneurship champions at Universities A and B to grasp the intent, imperatives and goals of incubation including the factors that shaped TBI and incubation outcomes from incubation management and experts' viewpoint. Lastly, other incubation stakeholders, especially incubation sponsors were interviewed using focus groups to corroborate evidence provided by incubation management, innovation and entrepreneurial champions as well as establish their own experience and constructions of incubation processes and outcomes (see Table 7.5).

Table 7.5: Summary of phenomenological approach to data analysis

Dimensions	**Overall Purpose**	**Data sources**	**Analytical method**
Theory and concepts (my addition)	The purpose of theory is not to "force" concepts on data but use theory as a general guide/ framework for the interpretation of themes and categories generated from raw data. Concepts must continually be compared with raw data	Literature	
Focus	An interpretive phenomenological study to grasp main TBI stakeholders' essence of experiencing TBI and incubation outcomes especially technology entrepreneurship (TE) including factors that drive them.	See data collection row below	Direct interpretation Correspondence and patterns in text Categorical aggregation
Data collection method	Explore the key issues on TE that emerge from prior studies on individual (i.e., PEC, PEC), institutional (i.e. incubation incentive and support structure) and environmental (i.e. business incubation ecosystem) factors affecting university-based TBI.	Articles, books, reports, national and institutional policies, theses and dissertations were reviewed using a literature review	
	Explore incubation management, innovation and entrepreneurship champions' perceptions and experiences of individual, institutional and environmental factors that shape TBI and TE	Long, in-depth semi-structured interviews	

	Investigate incubation sponsors' personal experiences and constructions of individual, institutional and environmental factors that shape TBI and TE	Focus group discussions	
Data analysis strategy	Develop a phenomenology-based inductive analysis process and strategy that captures TBI stakeholders' individual experiences and constructions of incubation processes and outcomes	Search for statements, meanings, themes and categories that capture TBIs' phenomenological experience.	
Synthesis or reporting form	In depth, thick descriptive report of TBI participants' experiences of TBI processes and outcomes including factors that affect them.	A description of the essence of experience	

(Source: An adaptation from Creswell and Plano-Clark's (2007:22) phenomenological research design and Shaban's (2011) phases of qualitative data gathering process and data analysis strategy).

Although this table summarises the authors that influenced the flow of the data collection and direction of the data analysis strategy, the actual analysis is described below.

7.6.8.2. Analysis of interview transcripts

Since literature on interpretive phenomenology does not necessarily approach data analysis with a set of prescribed rules (Van Maanen, 1997; Hycner, 1985), the study sought to complement and strengthen the data collection and data analysis strategy (described in Table 7.5) with textual analysis of interview transcripts. Hycner (1985) provides more detailed outline of phenomenologically analysing interview data. The process involves, transcription of data, bracketing and phenomenological reduction (i.e., suspending the researcher's judgements and interpretations to access the unique world of the interviewee), extracting a sense of the whole from the interview, delineating units of general meaning (and those relevant to research questions), clustering units of relevant meaning, determining general and unique themes from clusters of meaning, member checking, contextualising themes and composing the report summary (Hycner, 1985). This framework was deployed for the analysis of interview data from the detailed study.

7.6.8.3. Analysis of focus groups and document reviews

Documents were analysed using content analysis. Content analysis involves systematic procedures for the rigorous examination and verification of the content of written data (Flick, 1998). It involves coding, categorising (creating meaningful categories into which units of analysis-words, phrases and sentences are placed), comparing (categories and codes and linking them), and concluding (drawing final categories from text) (Cohen, Manion & Morrison, 2007). The comprehensive details of the main themes that emerged from the data analysis process are presented in the appendix.

7.7. ETHICAL CONSIDERATIONS

Ethical considerations are often considered under three main areas: informed consent, confidentiality and consequences of data collection techniques (Cohen, Manion & Morrison, 2007). As already highlighted, the researcher sought ethical clearance from the faculty research ethics committee of UFS where the study was registered and where pilot study was conducted. He also secured institutional ethical approval from the Institutional Planning and Quality Enhancement Office of University B, where the first phenomenological case was studied. Although the director of University A's incubator authorised the study to be conducted in among his incubator staff, he expressly stated that no ethical approval was required for conducting the study among incubatees, spinoffs and sponsors as these were independent entities outside the purview of the university. Moreover, University A and B documents that were reviewed were unclassified, already in the public domain for which access was open and ethical approval was not required.

The in-depth interview guide and focus group guides' cover pages solicited research participants' consent to voluntarily participate in the study, including their right to withdraw from the study without threats of physical and psychological harm. These cover pages provided information on the research's intent, how participants would contribute to the study, and the research's expected knowledge outcomes. Participants were also be appraised of their anonymity, and that the study findings would be reported in aggregate form to protect their identities and to ensure the non-traceability of the information they provided. The researcher shared with each research participant a consent form with the study purpose, information sought, ethical procedures the researcher would follow and requiring that each participant append their signature on the interview and or focus group consent form. Interviews and focus groups were conducted at times and places deemed convenient to participants to ensure that their privacy was not violated. All transcriptions were saved and kept on a secure password-protected laptop only accessed to the researcher. All documents were stored electronically. Two research assistants who assisted with data transcriptions were required to sign a confidentiality and non-disclosure agreement that ensured they would not disclose to third parties any information they acquired through their participation in the study. All their transcriptions were kept on password-protected computers accessible to them exclusively.

7.8. VALIDITY AND RELIABILITY

While internal and external validity, reliability and objectivity are considered significant for establishing the truth in quantitative studies, these measures are unfit for qualitative studies (Schurink, Fouche & De Vos, 2011) due to variations in the role of context and differences in sizes of samples employed. For instance, when compared to quantitative studies that employ large samples, downplay contextual influences and rely on numerical information to make judgements on results, qualitative studies employ small samples, emphasise social, cultural and political contexts on phenomena being studied and rely on personal subjective feelings and texts of participants. Lincoln and Guba (1999) propose credibility (i.e., authenticity), transferability, dependability and confirmability as alternatives to validity and reliability employed in quantitative studies. These are discussed in subsequent sections.

7.8.1. Credibility

As an alternative to internal validity, credibility strives to illustrate that the study ideally located and described appropriate participants of the study and captured their utterances. As such, credibility is achieved when participants can recognise the researcher's descriptions and interpretations as their own (Shaban, Considine, Fry & Curtis, 2017). The researcher must strive to establish congruence between participants' narratives and his/her reconstruction and representation of these narratives (Schurink, Fouché & De Vos, 2011). The researcher employed *member checking*, in which all transcriptions conducted by two trained research assistants were availed to participants to ascertain if these transcriptions and researcher's research report were true reflections of the narratives they provided during interviews and focus group discussions. To ensure the authenticity of findings, research participants were provided with a summary of their transcriptions and an analysis of these narratives to establish convergence and divergence of the emerging themes to validate the interpretations of the researcher (Shaban et al., 2017). Member checking also requires the verification of raw data and results by other individuals than those originally involved (Maree, 2016). Therefore, transcribed data were also shared with the study supervisor to establish its conciseness, clarity and lack of ambiguity.

The qualitative data must clearly articulate the problem, context, variable complexity and interactions to ensure greater credibility. Lincoln and Guba (1999) recommend extended engagement and continual observations during fieldwork, triangulation of methods, peer debriefing, and analytic induction. In terms of engagement, a typical interview involved some serious probing and lasted between 55 minutes to 1 hour 20 minutes to sufficiently capture participants' responses to interview questions. Moreover, the entire data collection process lasted 6 months (I month for pilot study, three months and two months of the first and second phrases of data collection respectively) to sufficiently capture all key informants' narratives in the study. Shaban et al. (2017) contend that prolonged engagement and investment of time increases the researchers' familiarity with the field, allows for the development of trust, increases clarity of data to avoid misinterpretations and misinformation. The researchers employed *memoing* (as an observation technique) in which video and audio transcriptions were complemented by note taking covering contexts of interaction, body posture and non-verbal communications to completely capture the context and content of interactions with participants. *Peer debriefing* in which all transcriptions were discussed with research assistants who served as data transcribers worked to increase credibility of results. Lastly, data were recursively and repetitively interacted with during open and axial coding to facilitate the development of themes, categories and theoretical constructs.

Hycner (1985) and Cohen, Manion and Morrison (2007) provide several measures of improving the credibility of results of phenomenological studies. These are inclusion of text, *bracketing* (suspending the researcher's pre-conceived judgements) and *phenomenological reduction* (emphasising the participant's reflections), *listening to the interview to* understand the context of emergence of units of meaning and themes, which increase credibility of results. These techniques ensure understanding of the broader situated contexts in which units of meaning and categories are derived. They reduce personal bias arising from pre-conceived judgements during the analysis and interpretation of data and improve the authenticity of data generated respectively. While textual and para-linguistic signals and cues were used as linguistic resources, non-verbal communication such as body posture and facial expression were not always available as some participants preferred using audio during interviews and focus groups rather than video to conserve their data.

7.8.2. Transferability

Licoln and Guba (1999) replaces generalisability of quantitative research with transferability of specific situation or case to another, to ensure external validity. In view of the particularity of phenomenological cases that make generalisability problematic, Schurink, Fouché and De Vos (2011) emphasise the need for the researcher to draw on the conceptual framework to demonstrate how the process of collecting and analysis data will be guided by concepts and models. Therefore, while the study employed analytical induction to allow themes and categories to emerge from raw data (i.e., transcriptions), once these themes and categories were developed, there were aligned to the concepts drawn from the conceptual framework to ensure coherence of conceptualisation with data analysis (see the analytical framework in Table 7.5).

Merriam (1998) also recommends the use of *crystallisation* in which several investigators, sources and methods must be employed to compare findings with each other to ensure transferability. Although the researcher later conducted all interviews and focus groups exclusively online due to Covid-19 and lock-down regulations that eliminated the involvement of research assistants in face-to-face data collection, these assistants transcribed all data. Their involvement allowed for the comparison of their impressions of transcribed data with the researcher's interpretations of the same transcripts. This involvement ensured the conduct of *collaborative research,* which cohered with Merriam's (1998) exhortation for a research team to continually interact during the data collection and construction process. Interview and focus group transcriptions from different incubation stakeholders were also compared across the two university ecosystems and with mainstream incubation literature for congruence and coherence. Lastly, the research involved a pilot study conducted at UFS (with incubation staff, incubatees and sponsors) to establish the completeness, precision and conciseness of questions.

7.8.3. Dependability

As an alternative to reliability, dependability is realised when the reader can logically trace all critical steps the researcher undertook throughout the research (Shaban et al., 2017). Dependability requires logical sequencing, proper documentation and auditing of research processes and activities to capture shifts in the phenomenon under examination and in research designs as a refined understanding of the phenomenon improves (Schurink, Fouché & De Vos, 2011). This constitutes a stark variation with reliability used in quantitative studies that strive to test a stable, unchanging phenomenon because in qualitative research, social phenomenon is continually negotiated, constructed and re-constructed. The sequencing of the methodological process and analytical framework are well illustrated in Figure 7.1, Table 7.1 to Table 7.5. Memoing, transcriptions and keeping record of reflections and interpretations of the researcher, interactions with the research assistants and the supervisor facilitated documentation of experiences and crystallisation of reflections.

7.8.4. Confirmability

Confirmability is conceived to capture objectivity. The study applied reflexivity, in which the researcher *took a step back* from the data by suspending his assumptions, views and orientations (Merriam, 1998) to eliminate researcher bias. The researcher and research assistants re-listened to transcriptions and re-read transcriptions at different times to suspend their presumptions to allow the data to "speak for itself". The training of independent judges to independently evaluate and verify data units for their relevant meaning, cross checking if units cluster together during data analysis, and member checking involving second round of interviews to check if themes cohere with data (Hycner, 1985) and to ensure the researcher's own views do not predominate the interpretation of data (Cohen, Manion & Morrison, 2007) is recommended to ensure confirmability. The research involved two data collection phases in which 20 participants participated in the first phase and 10 participants participated in the second phase to bring clarity to issues that were ambiguous in the first round of data collection. An audit trail was ensured by keeping detailed field notes to provide trail of evidence, maintaining a chain of evidence through documentation methods, decisions and data (Glassman et al., 2012) at all stages of data collection. Lastly, data saturation was also employed in which the process of data collection progressed until no new themes and categories could be identified and extracted. Moreover, a *critical gaze* was adopted in which no statement was taken at face value but was critically analysed for any hidden meanings, taken-for-granted assumptions and possible ignorance of contextual and historical developments by the participants. In short, confirmability is achieved when credibility, transferability, and dependability are established (Lincoln & Guba, 1985).

7.9. CHAPTER SUMMARY

This chapter presented and discussed the concept of methodology, research paradigms, research epistemology, research approaches, research designs, identifying those that applied to this study and justifying the choices taken. The study adopted humanism, interpretivism, qualitative research, interpretive phenomenology as paradigmatic, epistemological, research approach and the research design for this study respectively. Informed by purposive sampling applied to University A and B TBI ecosystem, the study drew on a review of relevant documents, in-depth interviews and focus groups conducted on incubation sponsors, incubation management, staff and sponsors, incubatees, innovation and entrepreneurship champions. The last segment of the study covered the phases and procedures employed in data collection and data analysis, the research ethics adhered to and the credibility and dependability of research results. The next chapter presents and discusses the research findings of this study.

CHAPTER 8
FINDINGS AND DISCUSSION

8.1. INTRODUCTION

The previous chapter provided a detailed description of the research methodology. The current chapter renders a comprehensive presentation and discussion of the research findings on the individual, institutional and environmental factors that affect technology business incubation (TBI) and incubation outcomes, especially technology entrepreneurship (TE). First, the chapter discusses the different stakeholders' views and perspectives on the contribution of dimensions of the selected individual, institutional, and environmental factors to the realisation of TBI. Second, it discusses the results on the contribution of these factors to the realisation of TE. The need to transcend the individual perspective to grasping TE was precipitated by the process-oriented and contextual focus of what a [technology] entrepreneur does (Low & MacMilllan, 1988), including embodied cognition's negation of real time actioning of events in the context of distributed relational interdependence (Selden & Fletcher, 2021). Moreover, it is important to reconcile the tensions arising from the embodied nature of entrepreneurship process research between theorising the entrepreneurial process from a relational perspective and theorising it from individual, subjective viewpoint coupled with performative ontology (Selden & Fletcher, 2021). On the one hand, the entrepreneurial process is ontologically relational as it arises from co-evolving and co-creating intercontextual, interspatial and intertemporal connections, transactions and associations (Langley et al., 2013; Hjorth et al., 2015). On the other hand, the entrepreneurial process is theorised as an indivisible bodily experience of continuous, and seamless recontexualisation in which change is driven by agency-oriented individuals and situated instantiation of events (Hjorth, 2007). If the entrepreneurial journey involves distributed events with material properties, then it must be understood as a combination of bodily and cognitive processes as much as it is deeply socially constructed from entrepreneurs' interactions with groups and the broader environment.

The need to understand the practice perspective of entrepreneurship and the socially situated nature of cognition means that entrepreneurship practice and action as ways of explaining human thinking and doing (Mitchell et al., 2011; Cacciotti et al., 2016) cannot be understood outside context. Therefore, practice theories of entrepreneurship emphasise understanding the relationship between individuals' cognitive, motivation and emotional abilities and their greater social context (Gartner et al., 2016). As such, contextualised approaches to entrepreneurs emphasise theorising and researching phenomena by transcending individual explanations in explaining entrepreneurship to accommodate "the much broader phenomenon of entrepreneurial action in its social and institutional contexts" (Watson, 2013:16). Therefore, the current study considered a multi theoretical approach to accommodate the different levels in which entrepreneurial thinking, practices, processes and interactions happen in incubation context to give effect to TE. Although there are multiple theories that inform the multi-level analysis of TBI and incubation outcomes, those deemed most relevant for this study are entrepreneurial cognition theory (for individual factors), resource-based view (institutional factors), and entrepreneurial ecosystem theory (environmental factors). However, institutional theory and stakeholder theory were drawn upon to complement the resource-based view and entrepreneurial ecosystem theory at institutional and systemic levels respectively. These theories explain incubation ecosystem actors' perspectives on the dynamics of the factors affecting TBI and their incubation outcomes.

8.2. INDIVIDUAL FACTORS THAT AFFECT TECHNOLOGY BUSINESS INCUBATION

This section explores individual factors that affect TBI. The selected individual factors investigated are entrepreneurship cognition and perceived entrepreneurship capabilities. Following Mitchell et al. (2002: 97) entrepreneurial cognition is defined as "the knowledge structures that people use to make assessments, judgements, or decisions involving opportunity evaluation, venture creation, and growth." In the context of TBI, entrepreneurship cognition denotes knowledge structures that direct incubatees to make assessments, judgements, or decisions involving evaluation of opportunities for business development and technology entrepreneurship arising from business incubation. Under entrepreneurial cognition, concepts such as "expert scripts", "heuristics," and "intuitive thinking" are discussed drawing on narratives of stakeholders elicited during in-depth interviews and focus groups.

Since perceived entrepreneurial capability (PEC) entails entrepreneur's knowledge, skills, and experience required to start and run a business successfully (Bayon, Vaillant & Lafuente, 2015; Ibrahim & Schøtt, 2018), it was critical to the entrepreneurial process and was deemed to shape the process of incubation. For instance, PEC is an antecedent and predictor of entrepreneurs' intentions to engage in venture creation (Walker et al., 2013; Tsai, Chang & Peng, 2016). The next section discusses the entrepreneurial cognition theme and its associated categories.

8.2.1. Entrepreneurship Cognition

Given that incubatees often seek business incubation to enhance their entrepreneurial process (e.g., opportunity recognition, business concept development, resource mobilisation, business organisation and creation) and increase the chances of venture success (e.g., technology development, product development) (Madyda & Dudzik-Lewicka, 2014; Baran & Zhumabaeva, 2018; Van Stijn, Rijnsoever & van Veelen, 2018), the line of questioning pursued in the study targeted the role of cognition in enhancing or disrupting entrepreneurship behaviours in incubation contexts. Entrepreneurial behaviours relate to the intentions, activities and decisions of incubatees relating to the founding and growth of startups. Since business incubation involves supporting the development and sustenance of new ventures, and the venture creation process targets the identification of opportunities, venture planning, mobilisation of resources, and the implementation of entrepreneurial decisions (Timmons, 2005; Kickul et al, 2009), the questions asked sought to establish the application of thought processes (e.g., intuition) in these processes. Since the common factors for incubatees' involvement in incubation tended to be venture creation and development, this made the entrepreneurial process a good proxy for establishing the nexus among entrepreneurial cognition, incubation and incubation outcomes especially technology entrepreneurship (TE).

When requested to reflect on whether incubatees exploited cognition and if so whether its deployment contributed to the advancement of their entrepreneurial process, the responses of stakeholders fell within three sub-dimensions of entrepreneurship cognition, namely "intuitive thinking," "expert scripts," and "heuristics." These concepts are amplified in the following sections of this chapter.

8.2.1.1. Intuitive thinking

Intuitive thinking comprises "hunches" or "gut feelings" that incubatees may use in the recognition, evaluation, and exploitation of business opportunities to achieve specific entrepreneurial outcomes. Although most participants provided positive feedback on their application of intuitive thinking, their responses indicated that its deployment is not always a straightforward process. Their assignment of percentages on their extent of use of "gut feeling" during their incubation process suggests that such use fell within a spectrum, indicating varying degrees of (un)certainty during its application. The next section discusses the perspectives of TBI sponsors on this matter.

8.2.1.1.1. TBI sponsors' perspectives on incubatees' use of gut feelings

The elicitation of TBI sponsor perspectives on incubatees' use of gut feeling in the incubation process generated "pattern-based decision making" and "data-driven decision making" as the main codes. These are discussed in subsequent sections.

a. Pattern-based decision making

When asked about how entrepreneurs they sponsored used gutfeel to engage in decision making regarding their entrepreneurial activities, one sponsor narrated that:

> *Gutfeel plays a significant role in making decisions about entrepreneurship among startups and entrepreneurs. It plays a role when incubatees and startups just invest in deals or*

decisions based on their tracing and tracking of patterns within their sector without doing in-depth market research. Entrepreneurs that we engage with are immersed in the sector, so they spot certain activities and patterns and based on what they see, they make decisions without understanding the market broadly. They procure certain goods or conclude sales and investment deals without conducting any market testing. Their decision to invest or procure is informed more by what they think based on general trends they have observed in their minds or in the environment without really identifying what the market wants through research. They use much intuitive thinking because they are immersed in and know the industry but without really testing the market demands (Participant 23).

The plotting and matching of patterns to inform entrepreneurial decision making resonates with the view that intuition comprises the exploitation of one's professional judgement and context-relevant cues to recognise patterns that shape decision making in uncertain situations (Simon, 1987; Myers, 2002; Pira, 2010). The exploitation of pattern recognition to inform entrepreneurial decision making such as sales and investment deals is likened to intuitive decision making of a Grand Chess Master who deploys knowledge and skills derived from experience of the patterns and clusters of pieces prevalent on a chessboard to make swift moves (Pira, 2010). As a form of intuitive thinking, pattern recognition is a critical process to entrepreneurship (Baron, 2004) even though finding the connections between these dots is more important to entrepreneurial success (Baron & Ward, 2004; Akinci & Sadler-Smith, 2012).

b. Data-driven decision making

When interviewed on whether gut feelings facilitate (or obstruct) business incubation decisions and the extent to which they do so, the response of a middle-level manager of a private financial institution that supported TBI of university A and B related more to business development than technology business incubation per se:

I can speak to business decisions because I am not sure what business incubation decisions are. However, one of the things we (i.e., the business development staff of the private financial institution) do is to up-skill the entrepreneur to make disciplined decisions by engaging in data-driven decision making or evidence-based decisions as opposed to the gut feel. As part of business development training that we take entrepreneurs through, we introduce them to discipline when making entrepreneurial decisions. Otherwise, they will be more prone to making decisions that are not based on either scientific data or evidence (Participant 15).

He elaborated that*:*

However, if you mean how do they decide to join or not to join our business development programme, it would be difficult to answer because we will only know when they have joined. That is when they have made their decision already though we have a formal process that they follow before they make up their mind. For instance, we introduce the programme in townships and communities where several entrepreneurs attend some information sessions before they become part of the programme. They must do certain things such as provide *evidence of having a viable business or demonstrate commitment to pursue their innovative idea, which will see them getting admitted into the programme. So, I am not sure whether it is gut feeling or intuition but there is a process that they follow to become part of our programme. I cannot find a connection between the process of them deciding to be part of the programme and the question* (Participant 15).

From the private financier staff's perspective, business incubation and business development were somewhat different, and intuition has no place in their business development programme. The view that their entrepreneurs were compelled to employ data-driven and evidence-based decision-making in entrepreneurial decision-making and that intuition had no role to play in the business development seems to contradict the narrative that intuition has a significant role to play in the entrepreneurial process. For instance, intuitive decisions are considered pertinent to entrepreneurial setting largely due the task uncertainty that undergirds the production of new products or services (Gustafsson, 2006; Baldacchino et al., 2015), including the typical inexperience which surrounds specific roles or contexts that accompany entrepreneurial endeavours (Baron & Ensley, 2006; Dew, Read, Sarasvathy, & Wiltbank, 2009; Organ & O'Flaherty, 2016).

The foregoing discussion on the use of strict business criteria as a condition for admission into business development programmes (which is indicative of gut feeling having no place in business development) contradicts the narrative that successful entrepreneurs employed their gut feeling to engage in entrepreneurial decision making. For instance, the inventor and serial entrepreneur of Apple Company, once said:

You cannot connect the dots looking forward, you can only connect them looking backwards. So, you have to trust that the dots will somehow connect in the future. You have to trust in something, your gut, destiny, life, karma, whatever. This approach has never let me down and it has made all the difference in my life" (Steve Jobs, cited in Sibanda, 2021).

In the same vein, other entrepreneurs have attributed their success to intuition. For instance, Oprah Winfrey, the American social entrepreneur who dominates the entertainment industry, states that, "My business skills have come from being guided by my intuition" (Oprah Winfrey quotes. https://loveexpands.com/quotes/oprah-winfrey-1215575/). In the same line of thinking, Bill Gates, the world-renowned technology entrepreneur once said, "You cannot ignore your intuition" (La Pira, 2010). Despite this strategic use of gut feelings expressed by successful entrepreneurs, the invisibility of intuition in Participant's 15 remarks does not cohere with Sadler-Smith's (2015) view that when applied to entrepreneurship, intuition involves entrepreneurs' exploitation of involuntary, rapid, non-conscious, cognitive processing that culminates in affectively charged recognition and evaluation of a business venturing opportunity.

8.2.1.1.2. TBI management's perspectives on incubatees' use of gut feelings

Since incubator management directed incubatees' activities, their views on incubatees' use of gut feeling to facilitate incubation processes were sought. The codes that emerged from their narratives comprised "entrepreneurial process and empirical hypothesis testing," "application of business principles," "entrepreneurial grit" and "well-calculated decision making." These codes are elaborated and discussed in subsequent sections.

a. Entrepreneurial process and empirical hypothesis testing

The study explored TBI management's perspectives on the extent to which incubatee used gut feelings during TBI processes. The views of this matter ranged from positive to negative. The senior executive managers of both university A and B incubators were critical of the application of gut feelings even though one middle manager strongly encouraged their use by incubatees. When asked how incubatees employed gut feelings when exploring, evaluating and exploiting business incubation opportunities, the senior executive manager of incubator A's response was negative:

> *I disagree with the statement that incubatees use their gutfeel. Many people believe that entrepreneurship is all about gut feeling. Most of these narratives around entrepreneurism are just not true. It is not about gut feeling, it is about really being a deep expert, using business logic, and using business systems and processes to make good decisions. I think mystifying it by saying that it is a gut feeling, is very amorphous. Everyone must trust that whether you are working at a corporate firm or startup, there is a scientific process* (Participant 11).

He elaborated that:

> *A startup is a series of untested hypotheses - like you are not a company yet, you are searching for a business model that works, you have different hypotheses you want to test through different methods; the same way scientific methods activate a process of discovery of new scientific material and knowledge. Look at the lean startup methodology and design thinking as methodologies that create processes towards entrepreneurism. So, I think this narrative around entrepreneurs just winching a gut feeling is not true. Nothing in life is built by gut feel. That is not how you and I would operate, why would an entrepreneur operate that way*? (Participant 11).

This senior executive manager's rejection of the use of gut feeling among incubatees and preference for the scientific entrepreneurial process that relies on business logic, business systems, and processes including the testing of multiple hypotheses about businesses gels well with previous literature. Sanker's (2016) study into the effects of nascent entrepreneurs' faith in intuition on entrepreneurial decision-making process verified that their intuition did not trigger a preference for effectual or causational decision-making but rather confidence in the scientific process of entrepreneurship. The rejection of intuitive thinking in the entrepreneurial process somewhat contradicts entrepreneurial literature, which suggests that intuition is critical to the creation of new ventures, especially the initial stages of the venture creation process such as opportunity identification and recognition (Blume & Covin, 2011; Sadler-Smith, 2015; Organ & O'Flaherty, 2016). For example, intuitive entrepreneurs are deemed to have the proclivity to discover opportunities by observing signals in unstructured information (Olson, 1985), employ intuition to identify opportunities to engage in entrepreneurial action (Miner, 1997) as well as employ intuitive cognitive style to enhance opportunity identification stage of the new venture creation process (Kickul et al., 2009).

b. Application of business principles

When asked the same question on whether their incubatees employed gut feeling, the senior executive manager of incubator B concurred with the senior executive manager of incubator A's objection:

> *Although the gut feel is important, it is not necessarily something that entrepreneurs need to rely on. The most important thing is to use business principles. Incubation is about empowering entrepreneurs to consider processes, activities, and decisions from a business perspective. Gut feel is not something that I would propagate entrepreneurs or incubatees to rely on for making incubation or entrepreneurship decisions* (Participant 8).

The pre-eminence of rational decision-making by emphasising the use of business principles, logical sequencing of activities and decisions about the entrepreneurial process further deviates from the intuitive thinking style that is characterised by spontaneous and unconscious decisions and actions. While Sayed (2017) identifies intuitive and analytical thinking styles as possible pathways that entrepreneurs could employ to realise preferred decision-making processes in the context of entrepreneurial behaviour, the senior executive manager of incubator B seemed to identify with and emphasise the analytical thinking style. The preference for analytical thinking style, which is deliberative, effortful, intentional and systematic (Bargh, 1989; Higgins, 1989) seems to cohere with the view that when prospective entrepreneurs contemplate creating new successful ventures, they harness certain cognitive styles which trigger certain self-perceptions while others are suppressed (Kickul et al., 2009). In this case, the analytical thinking style was activated while the intuitive thinking style was muted. **Proposition 1: Gut feelings are more relevant and effective for supporting entrepreneurship decision making when experienced entrepreneurs can track and recognise patterns and connections from activities unfolding in their entrepreneurial environment. Proposition 2: Since business processes involve the testing of hypothesis, they involve a rigorous scientific process in which gutfeel has little relevance. To the extent that TBI requires entrepreneurial practices, logical processes, detailed activities, and justifying decisions from a business perspective, gut feeling may not be important.**

c. Entrepreneurial grit

Although the senior executive manager of incubator B's emphasis on the deployment of business principles resonates with the senior executive manager of incubator A's affirmation of logical thinking, testing hypotheses, and embarking on a deliberate entrepreneurial process, these approaches sharply deviate from the view of middle executive manager of incubator B that gut feeling is critical to incubation processes. When asked about the extent to which incubatees in his incubator employed gut feelings in their entrepreneurship decision making during their incubation phase, the response was affirmative:

> *Okay, out of five, I will say four. About 80% of our incubatees or entrepreneurs have used their gut feelings to make sure their business survives. Their gut feelings compelled them to soldier on above all negativity and eventually their businesses survived* (Participant 12).

The use of gut feel among incubatees in incubator B was affirmed by another middle executive manager from the same incubator:

> *There is little regard given to the logical processing of decision-making by incubatees. So you can meet an incubatee or entrepreneur who says, "this is the greatest idea, and nothing like this has ever been done before" but then this remark is based on his/ her feelings that s/he has not seen anything like that before and not rigorous research or the scientific process* (Participant 17).

The divergence of views between senior executive managers of incubators A and B and their middle executive managers pertaining to the role of intuitive thinking in the entrepreneurial process suggests polarity of perceptions on this matter. While senior executive managers of both incubators emphasised the ideal scenarios where incubation processes must be informed by business principles, rational decision making informed by evidence and scientific processes, middle executive managers who routinely interacted with incubatees, believed that most incubatees extensively relied on gut feelings. The fault lines between senior and middle executive managers give credence to the co-existence of *intuitive* cognitive style and *analytical* cognitive style in the entrepreneurial process (Kickul et al., 2009), especially the incubation phase. The middle managers' view partially resonates with literature that emphasises the prevalence of the intuitive cognitive style at the opportunity identification and recognition stages of the venture creation (Kickul et al., 2009). Similarly, senior managers' preoccupation with the ideal situation where incubatees must employ rational judgements and empirical evidence when engaging in entrepreneurial decision-making mirrors the *analytical* cognitive style in which entrepreneurs exhibit higher competency regarding making judgements and evaluations of information and choosing entrepreneurial actions to effect - competencies that are germane to later phases of the new venture creation process (Olson, 1985). **Proposition 1: Gut feelings enhance the entrepreneurial grit of**

entrepreneurs which increases startups' chances of survival. Proposition 2: Incubatees may alternate rational decision-making and gut feel at different stages of the entrepreneurial process. Proposition 3: Incubator managers' perceptions of their incubatees' use of gut feelings is informed by their level of proximity to routine business operations of incubatees. The more proximate incubation managers are to incubatees' routine business operations (depending on their designations), the more likely they will affirm incubatees' use of gut feeling to support their business incubation activities.

8.2.1.1.3. Incubatees' perspectives on the role of gut feeling in incubation processes

The views of incubatees were centred around "deal negotiation and cancelling culture," "cautious gut feel that needs validation" and "well-calculated decision making." These codes are elaborated in the following segments.

a. Deal negotiation and cancellation culture

When one IT entrepreneur was asked about how he employed gut feelings in his business operations, he highlighted:

> *From my past experiences, my gut feelings have helped me to negotiate sales deals. For example, when I meet with a new customer who is a difficult person constantly asking about and negotiating the price of my product, then my gut feeling normally tells me that this person is not an ideal customer who would buy my product as they are trying to get a bargain. Alternatively, my gutfeel would tell me that my product is overpriced for this customer. So, I pick some cues in meetings which help with making sale deals or making sales decisions going forward. Alternatively, if I see many customers cancelling their orders I must know if these customers reside in a certain area. If they do, my gutfeel tells me that maybe I should reach out to these guys to find out more information about reasons for their cancellation. Is it a financial reason why they are cancelling or is the quality of the IT product or the overall IT service? Such use of gutfeel based on experience helps to guide me going forward. We previously would just not have understood it or we relied on books which told us that something about a product is wrong* (Participant 21).

The fact that gut feelings are employed by incubatees in sales negotiation and price determination resonates with some literature that demonstrates that, when judging a potential business venturing agreement and assessing a potential business partner, entrepreneurs often deploy gut feelings which they can express in metaphors such as "picking some cues." The use of statements such as "don't ask me *why*, this deal *just stinks*" or "don't ask me *why* but I would trust her, she's a really *warm person*" to describe a business venturing agreement and a potential venturing partner respectively demonstrates that gut feelings as expressed in metaphors of smell and somatic experience of feeling could be harnessed to rationalise business decisions (Feldman, 2008; Akinci & Sadler-Smith, 2012).

b. Cautious gutfeel

When an incubatee, a scientist whose business was servicing the pharmaceuticals and healthcare sectors, was requested to explain how he used intuitive thinking, his response pointed to a cautious use of gutfeel, one that combined current knowledge with the application of intuitive thinking:

> *My use of gutfeel depends on what level of decision is involved and how it takes my business forward. I mean it depends on whether it is a funding decision? A partnership decision, relationship management decision? Analysis of data and at what stage of the entrepreneurial process? Or what stage of the entrepreneurial process do you stop with analysis and then say let us just push the button and go with instincts. So yes, intuition plays a role, but it is a calculated role. I mean it is a cautious gut feeling that works with the available knowledge that I have at that time. So, it is a gut feeling that works in conjunction with information on for example when to pitch to investors instead of keeping on extrapolating information to identify and establish the size of the market. If this is a therapeutic candidate that we want to work on, we use our gut to determine if it is compelling to engage with the client and if it is feasible. So, the gut feel was we think, and we feel that we have sufficient information to take the risk now and say this is what we have, we are going to pitch this to investors* (Participant 22).

A combination of a gut feel with empirical evidence is well articulated by participant 21:

> *The gut feeling tells you that something is there. When it feels like you are busy with a technical solution that is really going to help farmers then you need to validate your gut feeling. Your gut feeling helps you to make sure that yes something is out there. When follow this gut with meeting more clients, you start seeing the same problem coming up then you think you have got a good solution. Then your gut feelings are telling you that well this vision and this answer will fit together well. Regarding the use of the gut to exploit market opportunities, we would look at the numbers of industry's statistics to see most of the farmers that fit the criteria we have developed and the developments in the industry. I used another company to do the development of our products but their experience helped show that no, while you are busy with this nonsense, that (something else) is definitely a good idea. We can see this working based on their experience, so it is triangulating different experiences with one another and asking more questions, this helps get a better gut feeling for the business* (Participant 21).

The application of a cautious gutfeel regarding pitching to investors and market size identification and exploiting market opportunities demonstrates that the use of gut feeling by entrepreneurs does not unfold blindly but rather incubatees take some calculated risks involving empirical validation of their ideas. This finding partially corroborates Koudstaal, Sloof and van Praag's (2019) view that the desire to quickly grab windows of opportunities may reduce intuitive entrepreneurs' rational decision making involving the collection of sufficient information before making some decisions. In this case, although intuitive entrepreneurs need to act swiftly to pitch to investors, determine market size, and seize market opportunities as soon as they arise, these incubatees sought satisficing (i.e., satisfactory and sufficing) information before making entrepreneurial decisions. Therefore, the decisions were rational as they involved satisficing information even though they were first activated by a gutfeel that needed validation.

c. Well calculated decision-making

Although some participants highlighted their use of intuition, participant 20 from incubator B explicitly highlighted her reluctance to use gut feelings when quizzed about the extent to which she used them. She asserted:

> *"I do not use gut feel very much. My decision-making process was well calculated, it was not based on gut feelings. So, when you say to what extent, I will say not too much. On a scale of 0-100%, maybe 10% but everything was well thought out".*

Another incubatee from incubator A concurred with this view of the minimum use of intuitive thinking coupled with extensive rational decision making:

> *The company started on a "gut feel" even though as a young entrepreneur coming out of his studies, I do not think anyone could have a good gut feel on what could happen. So, I think to a large extent we relied on the relationship with the University and the incubation which guided us in the right direction* (Participant 1).

The combination of limited intuitive thinking and considerable rational decision-making signals that both are critical to different stages of the venture creation process compared to a dependence on either of them. This view resonates with literature that highlights intuition as more fundamental in inception venture creation stages especially recognising and evaluating opportunities, which depend on distinguishing patterns and prototypes (Baron & Ensley, 2006). Moreover, these stages also require actively scanning for opportunities, application of divergent thinking, and making connections between disparate information (Tang, Kacmar, & Busenitz, 2012; Koudstaal, Sloof & van Praag, 2019). However, the resource mobilisation and opportunity exploitation stages require entrepreneurs' dependence on deliberative analytical cognition (Schenkel, Matthews & Ford, 2009) including the possession of invaluable resources and the construction of networks for delivering successful ventures (Smith et al., 2009; Sadler-Smith, 2015). Based on the findings on incubatees the following propositions are made: **Proposition 1: Gut feelings are relevant and effective for supporting entrepreneurship decision making when experienced entrepreneurs can track and recognise patterns and connections from activities unfolding in their entrepreneurial environment. Proposition 2: Entrepreneurs combine gut feeling with available information to make calculated decisions based on their stages in the entrepreneurial processes.**

8.2.1.1.4. Innovation champions' perspectives on the role of gut feeling in TBI processes

Innovation champions were individuals who were regarded by their academic and research peers as leaders and catalysts that facilitated the advancement of innovation exploits (e.g., the divisional heads who directed innovation activities such as additive manufacturing, surgical and bone repair implants), directed innovation ecosystems or facilitated the creation of physical and digital innovation platforms. Although all innovation champions were requested to articulate their views regarding the role of intuitive thinking in TBI processes, only one innovation champion expressed a substantive view on the matter. This view is discussed next.

a. Contingent view

The response of the innovation champion regarding the role of intuitive thinking in TBI processes emphasised the exploitation of the rational process at the beginning and accommodation of gut feel in later stages of the entrepreneurial process:

> *The gut feeling is important for a general direction but if the incubatee must develop a patent, she must develop that patent into a sellable product. I think on one side, you know in the initial phases of the entrepreneurial process that you must work more with a scientific approach. The gut feeling is important when identifying a finished product to sell or business process, but you must go to facts, you must do a market analysis* (Participant 2).

This view contradicts the literature which conceived the intuitive cognitive style as relevant in the earlier stages of the entrepreneurial process while rational cognitive style becomes integral in later stages such as resource mobilisation and exploitation. This polarity of views between this innovation champion and established literature regarding stages when intuition and rational decision making happen buttresses the view on the conjoining of intuitive cognition and deliberate affect in the venture creation process (Sadler-Smith, 2015). **Proposition: Both intuitive thinking and rational thought are critical to various stages and activities in the entrepreneurial decision-making process.**

8.2.1.2. Expert scripts

A script is a knowledge structure that fits predictable, conventional, or frequently encountered situations – they are schemas for understanding events and behaviours (Gioia & Poole, 1984). Since scripts are often associated with the prior knowledge of entrepreneurs relating to the execution of entrepreneurial activities, especially those that unfold in a sequence, they are called “expert scripts” because they arise from years of cumulative experience and expertise in executing such events and activities. Therefore, expert scripts denote thought structures and processes employed to organise knowledge relating to the identification of entrepreneurial opportunities, the mobilisation of resources, and their effective exploitation in the incubation of businesses.

8.2.1.2.1. TBI sponsors' perspectives on the role of scripts in TBI processes

To the extent that funders of TBIs may have some indirect influence in their operations through their specification of incubation models and activities, it was critical to solicit their perspectives on incubatees' use of scripts. "Risk calculation and risk mitigation" and "defaulting to industrial practices" were the main codes that emerged from the funders' responses to the question relating to incubatees' use of scripts during incubation. These codes are presented and elaborated in subsequent sections.

a. Risk calculation and risk mitigation

To establish the contribution of selected individual factors that affect university-based TBI at the cognitive level, the study investigated the extent to which participants employed expert scripts at different levels in the entrepreneurial processes such as opportunity identification, opportunity validation, planning the venture, resource mobilisation and venture creation (Kickul et al., 2009). Since incubation involves supporting and guiding incubatees to generate successful ventures using, participant 14, a senior executive manager of a public funding agency, was asked how incubatees employed scripts in any of the business incubation or business development processes her organisation supported. The response was affirmative:

> *Part of their scripts is their risk strategy and how they will mitigate risks. So, they need to identify what the risks are. Scripting requires an evaluation of business processes in a manner that will make economic sense such as the calculation of risk(s). Talking through scenarios with business partners and colleagues is probably the best way to see how things unfold, what are the different directions business decisions can go. Another area of scripting is the skill guide. It is critical to identify what type of skills does the entrepreneur need so that they will identify this in their [business] plans and we will source the resources either internally or externally to take them through a process of skill development* (Participant 14).

Reference to the evaluation of business processes (especially those that are rational from an efficiency, effectiveness, and economy viewpoint), risk mitigation and use of skills guide collectively point to the alignment of utilising scripts in the venture creation process. Consistent with entrepreneurial cognition theory, which emphasise the knowledge structures that entrepreneurs use to make assessments, judgements or decisions about evaluation of opportunities, creation and growth of ventures (Muruganantham et al., 2018), the use of scripts by incubatees demonstrates their instrumental nature in business incubation processes. The different application of scripts resonates with literature that conceives entrepreneurial cognition as providing cognitive processes that entrepreneurs use to acquire the knowledge needed to successfully operate and grow their firms (Ubierna et al., 2014; Essey, 2021).

Given that scripts are fundamental to engagement with business partners, determining the direction the business can take based on decisions to be adopted, the identification of the skills deficits of the entrepreneur (e.g., skills gaps analysis) as well as determining the resource acquisition of the firm (see participant 14 above), the scripts the participant described constituted arrangement scripts. These scripts are integral to venture creation and successful incubation processes. For Sánchez (2013), arrangements scripts describe knowledge structures that entrepreneurs possess regarding contacts, relationships, resources, and assets fundamental to the formation of new economic relationships. The reported narrative was qualitatively different from what another sponsor of business development processes highlighted.

b. Defaulting to industrial practices

The study also solicited other sponsors' views on whether entrepreneurs participating in university incubation programmes and associated business development programmes employed scripts and if so, how they employed them. A middle executive manager of a private financial institution that sponsored incubation at both university A and B and operated a business development programme was ambivalent about the incubatees in his organisation's business development programme:

> *It is a tricky question to answer because it presupposes that we ask them on admission, or we ask what they use to make business decisions. However, what I have noticed or heard more often is that when you interrogate the decisions for participating in our programmes, you get sentiments like: "In this industry, this is how these things work." So, I am not sure whether that falls into the category of scripts, but it would suggest to me that the entrepreneurs are defaulting to some pattern of behaviour or decision making that is prevalent in their industry* (Participant 15).

He elaborated:

> *We get instances, for example, when you challenge an entrepreneur to justify a decision they have, they will tell you that in this industry such as fresh flower business, this is how things work, even though on the face of it, it does not seem to make much business sense* (Participant 15).

To the extent that incubatees based their views on their prior experience with their field of expertise, one infers that scripts are founded on cumulative experience and expertise. This would suggest that Participant 15 was referring to ability scripts. Ability scripts range from 1. Diagnostic scripts (which emphasise the entrepreneurs' ability to assess the potential of new business and comprehend the components required in its creation), 2. Situational knowledge scripts (which encapsulate the ability to learn from lessons derived from ventures and apply them to specific contexts), and 3. Opportunity recognition scripts (which denote the capacity of the entrepreneur to conceive customer and venture value, which could be forged by integrating products, services, and people) (Sánchez, 2013). Consistent with entrepreneurial cognition theory, this finding on ability scripts coheres with the view that the identification and recognition of opportunities in specific industry contexts are critical metrics for determining the success of an entrepreneur (Ardichvili et al., 2003; Pauli, 2014).

8.2.1.2.2. Incubator manager's perspectives on the contribution of scripts to TBI processes.

Since TBI management often manages and regulates incubators through the development of incubation models, processes, the development of selection criteria and values, their views regarding the extent to which their incubatees employed scripts to support the TBI process were deemed more compelling than that of the incubator sponsors. "Business process methodology," "business clinic processes" and "revamping the existing incubation ecosystem" were codes that emerged from data on incubator management's perspectives, and these are elaborated on in subsequent sections.

a. Business process methodology

It is interesting to note that although the question was directed at deployment scripts for business incubation, participants tackled the question from a venture creation and business development perspective as both incubators supported incubatees and spinouts. Participant 11, a senior executive manager of incubator A, projected a unique line of thought by highlighting how sequencing programme activities constitutes a variant of scripts for shaping incubatees' or entrepreneurs' behaviours:

> *As an incubator, we are supposed to be giving the people the script and that is what our programmes are doing. If I look at our 8-week design thinking course, that is a script that deals with how to go through a design thinking process to understand the real customer need, understand a genuine business proposition, test the prototype, get feedback, iterate". So, the role of business incubators is to provide the script - providing people with the methodology to run their idea through because we have that experience. [...]. If you think of the real product that we are selling, a startup cylinder as some sort of product, then the product that the business incubator sells is the script, the business process, and the mentoring along the way* (Participant 11).

This senior executive manager of incubator A conceived scripts as comprising the business process methodology such as locating customer needs, developing a business proposition, and testing prototypes, which the incubator rendered to incubatees. Therefore, the scripting offered in the incubation process was integral to venture creation, which constitutes a temporal sequence of events and activities that unfold when entrepreneurs create new businesses (Liao & Welsch, 2008; Muñiz-Avila, Silveyra-Leon & Segarra-Perez, 2019). It is clear from the conception of incubation as scripting that this incubator supported the development process model to venture creation – one that is a descriptive and conceptual model founded on the additive combination of events that facilitate the development of ventures through an emphasis on a linear cause and effect phenomenon (Liao et al., 2005; Muñiz-Avila, Silveyra-Leon & Segarra-Perez, 2019). This can be contrasted to the activity-based model where venture creation is conceived as a unitary process in which milestones, the frequency, and timeframe of venture creation activities are emphasised (Liao & Welsch, 2008; Muñiz-Avila et al., 2019).

b. Business clinic processes

When asked whether his incubatees employed scripts to make business incubation decisions, participant 12, a middle-level manager affirmed that:

> *I would say they [i.e., incubatees] have used scripts very well because as they join the incubator, there is something that we call "business clinic processes." These are short-term sessions that assist the entrepreneurs to identify the business opportunities, evaluating opportunities, exploiting opportunities, taking business decisions, identifying the target market for their products* (Participant 12).

In conceiving one script as comprising incubatees' involvement in training on incubation processes, this partially resonates with entrepreneurial cognition theory which conceives scripts as mental maps relating to establishing contacts, relationships, mobilising resources and assets, which are critical to the incubatees' engagement in venture decision making (Mitchell et al., 2000; Urban, 2015). The role of scripts in the identification, evaluation, exploitation of business opportunities including taking the product to the market, suggests that venture creation is a consequence of ability scripts – which are examples of entrepreneurial cognitions (Mitchell et al., 2000). The scripts outlined by participant 12 are indeed ability scripts, which comprise venture diagnostic scripts and ability-opportunity fit scripts. Venture diagnostic scripts relate to the ability to understand venture potential including the components that need to be synergistically combined to bring the venture into reality (Krueger, Reilly & Carsrud, 2000). Ability-opportunity fit scripts relate to entrepreneurs' capacity to generate customer and venture value through combining human expertise, raw materials, and products (Urban, 2015). The finding that business incubation processes shape the application of scripts contradicts the proposition in this study that incubatees' cognitions drive incubation processes.

c. Revamping the existing incubation ecosystem

Contrary to the previously mentioned middle-level manager's narrative on incubatees' deployment of scripts in the venture creation process, the senior executive manager of incubator B's response to how these incubatees used scripts when making their business incubation decisions was somewhat negative:

> *I cannot answer that question because we have not gone through a proper process of incubating those incubatees if at all they are in a good incubation programme. Their use of*

scripts depends on support services and mentorship, the type of incubation programme that these incubatees are on, and the infrastructure available to them. Therefore, the new incubation programme we are proposing will be associated with the university's technology transfer office, the fabrication laboratory, the product development facility. So those resources will be made available to them through the support that we give them. So, it depends on the incubation programme at hand as to what sort of infrastructure and support services they have (Participant 8).

This narrative demonstrates that the senior executive manager was dissatisfied with the existing TBI process. He was not convinced it met the standards and precepts of an authentic incubator. This narrative contradicts the claims of his subordinate who praised the TBI and expressed the capacity of business incubation processes to nurture the development of scripts. The scepticism about the quality of services provided by the incubators, which invariably shaped incubatees' capacity to apply their scripts resonates with Bakkali et al.'s (2014) view that human resource management structures must constitute the focus of an incubator as business incubation's performance relies heavily on the quality of support provided to incubatees. The divergence of opinions between senior and middle management could be interpreted differently. First, as the failure of the vision and business practices proposed by senior management to filter through to lower echelons of incubation structures. Second, this polarity of views in incubator B could be a consequence of the differences of opinions between middle management and this senior executive manager. If ability scripts include the capability to assess conditions and potential of new ventures, to draw on and apply lessons learnt in a variety of ventures and to see the need for and carry out some creations of value by matching opportunity and capability, hence a gain in self-efficacy in making the venture creation decision (Urban, 2008), then the polarity of views regarding the role of scripts in shaping incubation and business development decisions could stem from the different vantage points these staff stood in the organisational hierarchy. **Proposition: The extent of awareness of incubation staff regarding the extent of use of scripts by incubatees partly depends on these staff's psychological and locational proximity to incubatees.**

8.2.1.2.3. Incubatees' perspectives of the role of scripts in TBI processes

The study also explored incubatees' use of scripts and how they employed them in their incubation process. "Taking sequential risks," "unconventional decision making," "securing resources for startups," and "scheduling production factors, customer access and assistance" were codes that emerged from incubatees' narratives on this matter. These are elaborated on in subsequent sections:

a. Taking sequential risks

When requested to explain whether and if so, how he applied scripts, participant 19 highlighted the role of expert scripts in mitigating risks:

When I solve business problems using scripts, I start from the consumer side and work my way back. I first start with solving consumer problems and work my way back to the business side. The whole business is built around that sequence, then after-sales. We must use it extensively. Scripts keep us on track, they ensure that we are taking risks sequentially and partially (Participant 19).

Another incubatee observed that:

So, the way we use scripts to identify opportunities is something like when I go to see customers, I always ask who they can recommend us to who would also like this product, which is just one sentence at the end of the conversation. Which means I might get another customer, so this helps identify sales and market opportunities. This is somewhat risky as we would not know whether traveling to the next customer would result in them buying the product (Participant 21).

It could be inferred that from a venture creation perspective, scripts are instrumental in solving different customer "pain points," taking risks and providing referrals to new customers. These narratives identify with willingness scripts – mental maps which support incubatees' commitment to venturing. These emphasise conversion of thoughts into actions about seeking opportunities (Krueger & Brazeal, 1994) and pursuing venture opportunities (McClelland, 1961) thereby allowing entrepreneurs to reduce risks as these scripts diminish uncertainty (Krueger, 1993; Urban, 2015). The capacity of scripts availed by incubators to keep incubatees on track suggests that scripts facilitate the development of a mental compass that directs incubatees towards on-task activities and deliverables that create and capture value for the firm. Therefore, scripts allow entrepreneurs to make sense of new situations presented to them drawing on previously stored knowledge (Cohen & Levinthal, 1990) and impacts expertise in new venture formation (Mitchell, Mitchell & Mitchell, 2009) judging from risk taking, searching for customers and solving customers' problems.

b. Unconventional decision making

Participant 1 highlighted that the experience which entrepreneurs amassed during their incubation process emboldens them to use expert scripts more creatively. For example, he emphasised:

I think scripts help a lot. I used to work with some guys that had their own company that makes yeast and uses it for making beer and selling it. So, the script gave them the ability to make decisions that they would not have ordinarily taken. Based on their experience and the processes they have gone through before; they were not afraid to try new avenues (Participant 1).

Participant 21 also emphasised making unique decisions:

The use of scripts has helped us make unique decisions about accessing new networks that we would not ordinarily access or those that are difficult to access. We strive to see if our current clients can put us in touch with someone who might help us fix our problems. For instance, if we have a software problem we do not know how to solve and we talk to this *client and ask them "who do you know that I can communicate with in your current network or stakeholders who can solve this software challenge"* (Participant 21).

One infers that scripts allow the exploitation of social-material contexts, which enables incubatees to explore networks that facilitate complex problem solving. This line of thinking coheres with ability scripts which encompass an entrepreneur's capability to judge the potential of new ventures, the ability to draw on and apply prior experience, including the ability to envision the necessity of a new venture and execute it by creating value through aligning an opportunity to one's capability (Urban, 2015).

c. Securing resources for startups

When asked about the value of scripts in incubation contexts, Participant 9, 21 and 22 highlighted the efficacy of using expert scripts:

> *If they work well, scripts should be offering your business the opportunity to increase revenue or decrease expenses […]. So, if incubation tenants are good at that, if business incubators are good at creating the right scripts and leading people through the revenue generation process, then the outcome of that will be securing the resources for startups to grow and opportunities for more startups to flourish* (Participant 9).
>
> *One of the routines for our business which we could call a script is sourcing of finance for the business. We do have many people looking into our finances to help us see where there's gaps which can alert us if we are going to have a negative cashflow next year in March. We request our financial advisor to assess our cash flow on a regular basis to establish if we can get someone to lend us money in advance for that time. So, this has been helping us to go through the sequence of forecasting cash flow problems and accessing new injections* (Participant 21).
>
> *Regarding access to market resources, one of the scripts or routines has normally been that we send out an email before the agricultural season or at certain times of the year, which we know our clients are starting to do their budgeting to make sure that they might take us into account when they do their budgeting. So, for one of our products, we know they do budget for in April each year. So, every time I send out this letter or email, which is my routine, it helps us to make sure that we get more business going forward because clients include us in their financial planning* (Participant 22).

The exploitation of scripts in cashflow forecasting and budgetary cycles resonates with the view that scripts are integral to structuring of entrepreneurial actions, especially the acquisition and allocation of resources, exploiting untapped resources in ways that build the potential of the enterprise (Bird, 1988; Akinci & Sadler-Smith, 2012).

When requested to explain how he used scripts to access more clients he explained:

> *Our use of script is more complicated than just sending out emails to get more clients. Clients make some investigations to see that if they are going to pay for our product, they ask someone in the area who used our services and say: "I see you used them. How were their services?" If we do not do well on those, our marketing efforts will not be fruitful. So, we put much effort for*

> *the customers in delivering quality products and then subsequently we send out emails that if the referrals ask any question around the area, we know that they will get a good answer say "yes, anytime you use them, they have good customer services" and hopefully that is the case. That is our script* (Participant 23).

These narratives are indicative of a minimalist approach and service-based perspective to incubation. The training of incubatees in scripting contributes directly to cost recovery and revenue generation (see Participant 9) on the one hand and increases the number of customers through referrals (see Participant 23). These narratives concentrate on arrangement scripts, which emphasise that entrepreneurs must concentrate on marshalling resources, venture networking, and application of venture-specific skills to grow their ventures (Urban, 2015).

d. Scheduling production factors, customer access and assistance

When asked about the different areas where they applied business scripts, Participant 21 and 22 elaborated their response as follows:

> *Scripts are an important part of the business. Our application of scripts starts with mapping out a recipe. So, we always know we do not need to rediscover things. This means we always know that even though the first grapes are harvested starting end of October, we need to start preparing technology, labour and machinery in September so that is one form of a script. But I must repeat that we always know that we first reach out to the customers in Limpopo who are out of reach, reach out to customers in Northern Cape and then use the Western Cape customers because they were our last stop as they are the closest to the wine farms. So, our scripts are based on previous years' experience notes and grouping certain customer aspects* (Participant 21).
>
> *One example of a script would be what we would do if a customer phones us and says they have got a problem. So, all our technicians in our company know that they start out by first trying to figure out if they can solve the problem remotely without going to their farm. If not, they need to go step two and see if there is someone close by that might assist. Still if not, then that is the only time a technician will go out to the customer's farm but everyone in the company knows that's the script. We do not just rush out with our car when there is a problem and drive out to the customer. So, these script forms are just rules and basic processes within the business. And if you add someone from the streets to your company and they read the manual in the script, they will fit in like a glove and hopefully they will do the work perfectly without figuring out intuitively this is what you need to do and stick to that* (Participant 22).

The organisation and scheduling of factors of production, the sequencing of customers to reach out first (Participant 21), and the coherent structuring of call outs to address recurrent customer queries (Participant 22) cohere with the view that entrepreneurs depend on scripts to alert them to the sequence of business events and behaviours in real-life situations (Abelson, 1981; Pryor, Webb, Ireland, & Ketchen, 2016). The diversity of scenarios in which scripts can be enacted further support the view that, facilitated by signals or cues enacted in past scenarios, scripts can be adapted to suit a wide range of situational experiences involving entrepreneurial ventures (Pryor et al., 2016). Moreover, in situations frequently experienced, scripts may be enacted unconsciously and automatically as the active processing of information by entrepreneurs would not be warranted (Gioia & Poole, 1984; Pryor et al., 2016). **Proposition 1: The availability of situational cues that trigger memory of prior events where specific appropriate behaviours were enacted enables incubatees to develop scripts applicable to specific entrepreneurial activities and situations in future. Proposition 2: Recurrent activities enable the development of scripts by activating situational cues that resurrect previous behaviours applied unconsciously in prior similar activities. Less frequent activities necessitate the development of new scripts due to the absence of familiar situational signals that invoke memory stored in mental schemas.**

8.2.1.2.4. Innovation champions' views on the role of scripts in incubation processes

Only one innovation champion discussed sufficiently the use of scripts and the rest did not express their opinions on the matter. As such, the only codes presented and discussed under innovation champions' views are "market-based factual decisions" and "resource mobilisation" as elaborated in the next segment.

a. Market-based factual decisions

In his response to the question on whether incubatees supported by his fabrication facility employed scripts including how they employed them, his response emphasised a business process methodology as an instance of script implementation:

> *To influence the technology business tenants or entrepreneurs' script development, our fabrication facility will start with the initial production. Then the market will say 'yes' or 'no' we want more of this product or service. Now tenants must decide to expand their businesses through [commercialised] production but they must do that based on facts and confirm all things empirically. People will say yes it [the business] is going well […] but it is a curve that is going up and down all the time. That is what I can say on the scripts.* (Participant 2).

Our inference here is a reliance on a business process methodology involving initial production, market research, confirmation of the need for a product, and then massive production based on quantities demanded by the market to fulfil market needs. Although scripts support a serial, developmental and outcome-based entrepreneurial process leading to product commercialisation (Liao et al., 2005), to the contrary, venture creation is a non-linear, iterative, and feedback-based process in real practice (Bhave 1994), in which entrepreneurs take actions and decisions to different degrees, in a different order, at different times (Muñiz-Avila et al., 2019). To the extent that literature acknowledges the limited research conducted on the venture creation process in emerging country contexts (Liao, et al, 2005, Muñiz-Avila et al., 2019), this study contributes to venture creation by clarifying the role of scripts in entrepreneurial processes, especially those sanctioned and facilitated by incubators.

b. Resource mobilisation

When requested to explain the scenarios where scripts were applied in his business operations, participant 23's response focused on attracting investors:

> *Well, there are some routines I have developed -a script or logical type of routine at a certain phase of my business. However, when that did not serve me well anymore, I adapted and coped with a new situation and I learned new routines. That is how I build my experience. So, how, and in which areas of business operations? I would say, in attracting investors, the way we approach investors and what we do to do that. We would ask for letters of intent or letters of support from other stakeholders that are credible such as the business incubator. So, I want credibility, and I think part of my routine, is to show credibility of my business to potential investors, and then through that attract funding or attract business partners. That is how I developed my routine as an entrepreneur* (Participant 23).

It can be inferred that building credibility with external investors necessitated the incubatee to develop a script. This involved seeking legitimation from established structures such as incubators to earn the credibility of potential investors. This view resonates with the observation that nascent entrepreneurs tend to exploit arrangement scripts pertaining to venture networking to mobilise resources for their startups (Urban, 2015). This speaks to the relevance of such scripts in determining the optimal ways of exploiting business resources ranging from financial, human and technological resources critical to the success of the business (Corbett & Hmieleski, 2017).

8.2.1.3. Heuristics

Heuristics or shortcuts were another individual factor that was deemed to affect TBI. Also known as shortcuts, heuristics denote simplifying strategies which entrepreneurs use in making judgement-based decisions (Randolph-Seng et al., 2015). Heuristics entail simplifying complex decision making by shortening long, rational processes to accelerate the pace of making decisions. Since entrepreneurs and incubatees are often confronted with complex, uncertain environments in which they are expected to make decisions (e.g., based on incomplete, imperfect, or competing information and data) drawing on their prior experience and expertise in making complex, judgement-based decisions, they may resort to shortcuts to arrive at such decisions. The subsequent sections discuss views of different stakeholders on incubatees' use of heuristics in incubation contexts. These views are elaborated upon in subsequent sections.

8.2.1.3.1. TBI sponsors' perspectives on the role of heuristics in the TBI process

As TBI sponsors' philosophy, values, and views have the potential to indirectly shape incubation models, activities, and processes, it was critical to investigate these stakeholders' views regarding whether incubatees situated in incubators employed heuristics and whether such use impacted their engagement in the entrepreneurial process. "Use of unsanctioned service providers," "certification and material development processes," and "rational scientific and business decision making" were the codes that emerged from incubation sponsors' narratives. These are captured in subsequent sections.

a. Use of unsanctioned service providers

The study investigated incubator sponsors' views on whether and how incubatees and entrepreneurs that these sponsors supported employed heuristics including how such use affected TBI processes. The response of the senior executive manager of a public funding agency was comprehensive:

> *Incubatees do use shortcuts quite often and it is not their fault. It is because we are a government agency that follows government processes and requirements. For example, when funding technology entrepreneurs for say R200 000, we tell them that because they are still in the youth programmes, we cannot give them direct funding. So, we say get hold of service providers and they bring quotations, and we will fund them, but these service providers must be on our central supply database. So, innovators will take shortcuts, they will find suppliers whom they have been working with or who have been doing work for them and submit this for payment even though they are not registered on the supply database. So, they do take shortcuts to fast-track the process of accessing funding. Then we tell them that, unfortunately, this is government funding, public money that must be well accounted for, and that they must follow normal processes. So, there are many shortcuts, but this is not their fault because they are finding cheaper ways to get their work done* (Participant 14).

The incubatees' selection of service providers they previously contracted who are not on the government database suggests that incubatees employ simplifying strategies to expedite complex entrepreneurial decisions relating to procurement and securing funding. However, such shortcuts' non-compliance with government regulations borders on subversion of procedures, which culminates in their being denied government funding. To the extent that novice entrepreneurs are confronted with increasing rivalry, information overload in the face of high time pressures (e.g., in tender bidding processes) and meagre resources compared to corporate managers, these factors make them more susceptible to using heuristics when making their entrepreneurial decisions (Nouri, Imanipour, Talebi & Zali, 2017). The loss of funding opportunities arising from inappropriate use of heuristics cohere with the view that the application of heuristics may lead to liabilities, such as overreliance on decision-making shortcuts that have worked in the past (Ucbasaran et al., 2009) but which may be irrelevant and ineffective for the current situation. This view recognises that using heuristics to select the best optimal decision is challenging due to the decision maker's limited knowledge of (1) all possible alternatives; (2) the consequences of implementing each alternative; (3) a well organised set of preferences for these consequences and (4) a lack of computational ability to compare consequences of decisions and to determine which one is most preferred (Operations Research Society of South Africa, 2002).

b. Certification and material development processes

Participant 14, the senior executive manager, also elaborated on another way that heuristics are employed by incubatees:

> *Another area where entrepreneurs or incubatees must not take shortcuts is product certification because any technology we put out there must have the necessary certification. We cannot put products developed in South Africa out there without the necessary South African Bureau of Standards (SABS) certification or if it is a medical product without medical control certification. So incubatees and entrepreneurs do understand that there is no shortcut in terms of protecting the intellectual property, they know that for them to make financial claims, they must put their products through certification. So, the shortcut they make is getting suppliers or getting consultants to assist them, but they cannot take shortcuts in other decisions like product development and certification* (Participant 14).

It can be inferred that the incubatees and entrepreneurs' appropriate application of heuristics is contextual and seemed restricted to hiring sub-contractors and consultants for those activities they were incapable of implementing on their own. Although cognitive heuristics are credited with enabling entrepreneurs to fast-track decision making and diminishes their perception of risk, which explains entrepreneurs' pursuit of risky ideas and ventures (Busenitz & Barney, 1997; Simon, Houghton & Aquino, 2000; Barbosa et al., 2007), heuristics may not be ideal for activities that require more reflective and rigorous decision making such as product development and certification. This finding contributes to the limited scholarly work on the use of heuristics in venture creation research (Sadler-Smith, 2015) and in negotiating complex, unpredictable, and precarious situations to make decisions on risks and benefits associated with choices (Slovic et al., 2002).

c. Rational, scientific and business decision making

The view of one middle-level manager regarding whether incubatees and entrepreneurs his private financing organisation funded employed heuristics and for what purpose was unclear:

> *I am not sure what that question is implying but, in our context, most entrepreneurs have not had formal business training. One could be a good motor vehicle mechanic, the next thing they set up a workshop to fix cars right? So, the decisions he makes are not informed by any formal business science per se. I would think that is more the norm to just make these shortcut decisions that may not be based on sound business logic* (Participant 15).

The incubatees and entrepreneurs that the private financier supported lacked sufficient business experience to make concrete decisions informed by rational and scientific methods. That said, one could also argue that despite the lack of formal training (even though there is no one-size-fit-all training), such nascent entrepreneurs could identify specific common problems of customers, which they could internalise and apply in future complex scenarios- that is *availability heuristics*. For instance, availability heuristic describes the proclivity of entrepreneurs to make judgements about the possibility of outcomes based on how easily they recall relevant and related cases (Tversky & Kahneman, 1973; Nouri et al., 2017). However, whether this scenario of fixing cars implied that heuristics were used or not was unclear. However, if one assumes that failure to employ rational and scientific business methods implies engagement in non-rational cognitive processing, then this finding buttresses the view that heuristics as instantiations of non-rational decision-making are often ideal for uncertain and complex conditions. In this instance, heuristics guide effective and efficient decision-making (Busenitz & Barney, 1997; Mitchell et al., 2007; Grichnik, Smeja & Welpe, 2010).

8.2.1.3.2. Incubators' perspectives on the role of heuristics in the TBI process

The study also sought the views of incubator management on the contribution of incubatees' use of heuristics to their engagement in TBI processes. The codes relating to incubators' perspectives on this issue were "entrepreneurial experience and challenging work" and "automation of processes." These codes are elaborated in subsequent sections.

a. Entrepreneurial experience and challenging work

When the senior executive manager of incubator A was asked whether and to what extent incubatees and entrepreneurs employed heuristics when executing TBI processes, his response was somewhat negative:

> *I disagree with the statement that incubatees employ heuristics as these heuristics are developed through years of challenging work. For instance, heuristically I know how to put together a debt deal and how to put together bond financing. It is not because I am just trying it but because I have spent years developing those heuristics. So, I think for good entrepreneurs, if they have built a good skill set in, say, software, hardware, sales, or whatever, then their heuristics are strong, and they can rely on them to decide because they have put time and effort into building those heuristics. If I do not know how to start building a software company, my heuristics will be poor because I do not know how to do so. So, heuristics play a role, but some heuristics are honed through experience and hard work really (Participant 11).*

The use of heuristics by incubatees was believed to be contextual and circumstantial. Such use depended on the level of experience of the incubatees, with more coherent heuristics being developed through years of hard work and experience. The view that heuristics applied in the entrepreneurial process in business incubation contexts are acquired through experience buttress the notion that these are learned mental shortcuts that entrepreneurs employ to ease processes of idea generation and decision making under complex and uncertain conditions. Their use is ideal when there is insufficient time or data to apply typical managerial analysis techniques (Tversky & Kahneman, 1974; Busenitz & Barney, 1997; Gemmell, 2010). This acquisition of heuristics through experience is supported by Fernández, Liñán, and Santos (2009) who view the practice as efficient rules coded by learned processes - rules which explicate why and how potential entrepreneurs make choices, arrive at decisions, or resolve problems when confronted with complex issues with incomplete information.

b. "Automation of processes"

While the senior executive managers of incubator B claimed that the heuristic-TBI process relationship could not be ascertained due to the faulty design of the incubation programme (see, for example, participant 8 above), some of their subordinates shared a different view of heuristics. They claimed that their incubatees automated certain processes to speed up decision making. Participant 12, middle-level manager of incubator B, highlighted that:

> *Yes our incubatees employ heuristics. They have limited on resources, and they use technology to compete with larger corporates working in their sectors. So, they employ heuristics such as using standardized templates to generate electronic quotations for recurrent customers instead of generating a new quote by hand every time the client makes an enquiry about a product. All technology startups have started out with using technology and automations to speed up the conclusion of sales and shorten the time needed to make deals* (Participant, 12).

Consistent with the planning fallacy (a type of heuristic bias), in which entrepreneurs tend to associate positive results with their interventions and attribute adverse outcomes to external factors beyond their control (Nouri et al., 2017), our inference is that the electronic generation of invoices to recurrent customers is perceived as internal intervention that increases efficiency of the firm by expediting sales deals.

8.2.1.3.3. Incubatees' perspectives on the role of heuristics in TBI processes

Since incubatees were often the primary participants in relation to incubation activities, their perspectives regarding whether they employed, how they employed heuristics including their role in the incubation activities were critical to grasping entrepreneurial processes. The codes developed from their narrative ranged from "modification of certified products and different value proposition," "automatic reminders to debtors" and "switching to crowdfunding and endorsements." These views of heuristics are elaborated in the next sections.

a. Modification of certified products and different value proposition

In his explanation of how he applied heuristics in the incubation process, participant 19 alluded to heuristics that he applied to hardware modifications:

> *For instance, when developing a modification on an already certified hardware, the consideration could be – do I recertify that, or do I still have changes in the pipeline? Do I implement those changes in the short term and wait for the long term to go and recertify my device? I need to spend money and time to certify, and I cannot certify every version* (Participant 19).

Sharing the same sentiments, participant 1 employed a similar strategy:

> *We do software or hardware development. When we develop some products, we look at work we have done already and use the same product for a different value proposition or a different application. It reduces the investment or capital we need. So, it takes less time, but we reduce the build-up of technical debt at the end of the day* (Participant 1).

Some improvisation such as modifications of previously certified products and using the same product for a different value proposition were among the heuristics small technology startups employed during incubation and beyond their startup stages. These adaptations and reconfigurations constitute what Amabile (1983) calls cognitive styles involving the capability to perceive new meanings in concepts or objects ("breaking the perceptual set"). These views resonate with the notion that entrepreneurs are different from managers as entrepreneurs who operate startups apply unique heuristics to assess and validate opportunities they encounter in the environments (Busenitz & Barney 1997; Lowe & Ziedonis, 2004). The unique ways in which technology entrepreneurs applied heuristics resonate with the observation that past experiences of entrepreneurs may tweak the given opportunities that entrepreneurs perceive in particular technologies (Roberts, 1991; Shane, 2000). **Proposition: Although the intensity of use may differ between experienced and nascent entrepreneurs due to differential experience levels, both apply heuristics to their entrepreneurial craft and activities depending on the availability of context-relevant situational cues to draw on in enacting these heuristics.**

b. Automatic reminders to debtors

Another example of the application of heuristics emerged from one incubatee who was requested to explain his application of this type of entrepreneurial cognition:

> *Through the experience we have gained in business we have learned to make our processes shorter and more efficient. For instance, if a client has not paid his bill within one month, we used to print a statement, send it via post and that would cost us money in terms of printing. Now, with the same software that we used to print out statements, we have commanded it to say "if any customer has not paid within 30 days then automatically send out the statement to the customer via the system." This is one example of a shortcut we are using - allowing time previously spent on printing and mailing to be devoted to other activities* (Participant 21).

The deployment of technology to ease workload resonates with claim that entrepreneurs typically deploy heuristics routinely to simplify their decisions, tasks and obligations (Brannon & Carson, 2003; Makings &

Barnard, 2019). Heuristics support high performing processes by enabling entrepreneurs to improvise and focus on tasks at hand, saving time, allowing for increased flexibility and rendering some guidelines on how they must respond to future events (Bingham et al., 2007).

c. Switching to crowdfunding and endorsements

When interviewed on whether and how he employed heuristics in his business development activities, one incubatee from incubator A emphasised crowdfunding:

> *One area where we have used heuristics is sourcing of finances. Originally, we used to contact a funder with a letter of introduction via email, request an appointment with the programme officer or manager and then request for a donation or any form of funding support. Now we have shortened the process of sourcing finances by using social network platforms like LinkedIn. That is a shortcut that we use to solve financial challenges or to attract partners* (Participant 21).

Another incubatee also noted:

> *A familiar way of sourcing finances that we used was pitching our business proposal to credible institutions. We would not ask them for finances but rather their support by putting their company name on the letterhead and then use the letter as an endorsement when applying for funding elsewhere. We would build a relationship with them, and they would say, they support our company because of this and that. That support letter and relationship established will be part of the briefing package and our pitch to the investors will speak to that to build credibility. Now we just pitch directly with little need for that* (Participant 22).

Given the importance of developing competencies for wielding strategic resources to create strategic advantage for firms, heuristics serve as critical instruments for building a strong financial base for firms. The appropriation of heuristics is a strategic resource for managing cashflows, increasing access to funding, improving liquidity and building networks with investors or finance-related networks (Makings & Barnard, 2019). **Proposition: In view of the diverse portfolios (finances, deal negotiation, customers and product development) that entrepreneurs routinely deal with, developing a sophisticated heuristics foundation to draw upon would expedite these processes.**

8.2.1.3.4. Innovation champion's view on the role of heuristics in TBI processes

The study solicited the views of innovation champions regarding the incubatees' use of heuristics in TBI process. "Automated data systems" was the only code derived from the examination of raw data comprising a response from an innovation champion and this code is elaborated next.

a. Automated data systems

In his explication of how heuristics facilitate business development processes, the role of technology in facilitating business operations was apparent:

> *I think companies that we work with are using technology to make things better. Many startups' are moving away from paper-based business processes (e.g., completing deposit slips at the bank) to using applications (scan and tap e.g., QR code and tapping technologies) to save time, make processes more efficient and get digitalised processes. Most companies that we support are looking for new processes they can automate. You see these processes being applied to collecting big data such as the use of automatically generated data, big data analytics and artificial intelligence rather than sending data to data analysts which takes time to process and develop statistical reports* (Participant 23).

He elaborated that:

> *From a vineyard perspective, the use of sensors and actuators to log specific data entry points is a new heuristic compared to the past where farmers and data scientists would do data collection in the field manually, or they would probably use a sensor, but that sensor would not log the data or automate the electronic backup. Data scientists and researchers would then come to these sensors and read those data centres and do it manually. But some companies are now using technologies such as automated data systems, things that can improve efficiency within the wine yard for collecting data. Other things such as automatic invoicing by these companies seems to make the billing process simpler, shorter and more efficient* (Participant 23).

One senses that entrepreneurs and incubatees are appropriating and exploiting latest state-of-the-art technologies to support data generation, synchronisation, and integration that informs intelligent decision making in the entrepreneurial space. As such, coordination, planning and integration heuristics (Alspaugh et al., 1999) enable repetitive observations that assist entrepreneurs in generating new insights based on past and present information, enhancing competitive advantage of firms through knowledge-creation and decision-making capabilities and solving ambiguous problems (Makings & Barnard, 2019).

8.2.2. Perceived entrepreneurship capabilities

Apart from the entrepreneurial cognition theme, another concept explored under individual factors was perceived entrepreneurship capabilities (PEC). The term has been understood differently by scholars. Despite its various characterisations as combination of an entrepreneur's perceptions and entrepreneurship capabilities (Tardieu, 2004) or entrepreneurial perceptions and capability (Edelman & Yli-Renko, 2010) or perceived capability and entrepreneurship (Tsai, Chang & Peng, 2016), the current study adopts Luong's (2015) definition of PEC as an individual's perception of her knowledge, skills, and experience to start a business and operate it successfully. Therefore, PEC becomes an entrepreneur's evaluation of their capacity to engage in the entrepreneurship process successfully. From the analysis of data on the PEC theme, two main categories were generated: entrepreneurial knowledge, and business management experience and skills. These are discussed in subsequent sections.

8.2.2.1. Entrepreneurship knowledge

The category entrepreneurial knowledge was presented and discussed from the perspective of different stakeholders. The views of these stakeholders are presented and discussed consecutively in subsequent sections, starting with public and private sponsors of TBI.

8.2.2.1.1. Incubator sponsors' perspectives on incubatees' entrepreneurship knowledge

Incubator sponsors' perspectives were sought regarding the entrepreneurial knowledge of incubatees. The view expressed by the sponsors emphasised: "levels of entrepreneurial training" and "financial literacy" as the main codes, which are presented and discussed consecutively in the next section.

a. Levels of entrepreneurial training

The study sought to examine whether incubatees had some entrepreneurial knowledge when they decided to have their businesses incubated. The general sentiment was that most incubatees that sought funding from external funders came with little knowledge. As the senior executive manager of the public funding agency observed regarding their levels of entrepreneurship knowledge:

> *Okay, almost zero to none. These entrepreneurs come in at the early stages of the entrepreneurial process and some do not have businesses, some do not have entrepreneurial knowledge. We take them through entrepreneurial training. So, we assist startups at three levels: At the level of technology, level of the market, and in terms of business readiness. So, regarding how ready they are in terms of business, we have several levels that we will assist them in terms of technology business readiness according to those levels, ranging from one to nine. So, at the early stage, we emphasise the knowledge of registering a company where there is very little knowledge* (Participant 14).

This demonstrates that incubatees undergo incubation and seek support from incubation sponsors to bridge their knowledge gaps. The need to access training systems and securing support from top management (Chi & Sun, 2013) and the possibilities of unlearning and reorienting the startup founding teams into a multifaceted learning system (Zahra & Wright, 2011) are reasons why entrepreneurs participate in business incubation processes. The general lack of entrepreneurial knowledge among incubatees necessitate the provision of entrepreneurial training in broadening entrepreneurs' range of business management competencies. For instance, providing entrepreneurial training and business management workshops augments the business experience and cognitive, social, and business management abilities for increased entrepreneurial self-efficacy (Wilson et al., 2007; Kirkwood, 2009; Camelo-Ordaz, Diánez-González & Ruiz-Navarro, 2016). It is precisely for this reason that this funding agency provided various training opportunities for entrepreneurs to adequately equip them for effective engagement in business development.

b. Financial literacy

When the middle-level manager of a private national financial institution was asked the same question, the response was ambiguous:

> *It is too broad a question to answer because knowledge itself is so vast that you cannot pin it down and be specific to say it is this or that. However, I can say we focus on what we think is critical in our business ecosystem for these entrepreneurs to overcome their challenges. One of these things is financial understanding which most entrepreneurs lack* (Participant 15).

Even though knowledge of financial information (especially that provided through accounting and bookkeeping systems) provides information to facilitate financial decision-making and investment controls (Burns & Scapens, 2000; Bagieńska, 2016; Oosthuizen, 2018), the lack of financial knowledge was a challenge for entrepreneurs and incubatees during their incubation. One expression of lack of financial knowledge is entrepreneurs and technology startups' limited knowledge of the diversity of funding sources available to fund their businesses, which often compels them to rely on personal funds, financial support from family and friends (Madichie, Mpiti & Rambe, 2019; Baah, 2020). This limited financial knowledge often manifests in the paucity of knowledge of how private lending works (Scanlon, Scanlon & Scanlon, 2019) and asymmetrical information about finance and lending (Lash, 2008) and the lack of a strong credit history, a lack of financial statements to demonstrate revenue streams (Atiase & Dzansi, 2019).

8.2.2.1.2. Incubators' perspectives on incubatees' entrepreneurship knowledge

The views of incubators regarding incubatees' level of entrepreneurial knowledge were also solicited as prior knowledge on opportunities explains differences in entrepreneurial behaviours (Cacciolatti & Lee, 2015), and knowledge asymmetries explain variations in the competitive advantage of firms (Barney, Ketchen & Wright, 2011; Hatakka, 2015). The codes derived from the data of incubators regarding entrepreneurial knowledge of incubatees were "exploiting serial entrepreneurs' knowledge," "business mentorship," and "background knowledge of technological businesses". These issues are discussed in the sections below.

a. Exploiting serial entrepreneurs' knowledge

The study inquired about the entrepreneurial knowledge of incubatees who were enrolled in TBIs. When asked about whether incubatees had entrepreneurial knowledge and experience, the senior executive manager of the incubator A reported:

> *Not a lot. Most of them, especially those within the university are coming from a scientific research background or do have some technical background. I mean, one of the things we are working on is getting more serial entrepreneurs into the incubator because if you do something once, you are going to be okay at it. However, if you do it 10 times, you are going to be much better at it. So, we need to be finding more people that have entrepreneurial experience, and then we can pair them with people who do not* (Participant 11).

The fact that most incubatees in TBIs had technical and scientific knowledge but lacked entrepreneurial knowledge is backed by empirical research. Khalid, Gilbert and Huq (2010) highlight that although incubatees are technically oriented, they often lack entrepreneurial knowledge and business skills. They exhibit gaps in knowledge of preparing business plans, knowledge of preparing bankable and grantable documents, and business idea pitching skills. For this reason, drawing on the resource-based view, the incubator serves as an intermediary between the incubatee and multiple stakeholders that provide specialised capabilities, competencies, and skills in entrepreneurship and business management through mentorship, training, coaching, and consultancy services. To the extent that the resource-Based View postulates that incubators need to explore and exploit their internal superior resources and capabilities to optimise their competitive advantage (Barney, Ketchen & Wright, 2011; Scott, 2014), incubatees also need to gain the knowledge and capabilities to deploy their resources effectively (Hatakka, 2015). As such, the strategy of pairing serial entrepreneurs possessing business experience with nascent entrepreneurs and startups was deemed to facilitate knowledge spillovers and skills transfers needed by incubatees.

b. Business mentorship

The view on the lack of entrepreneurial knowledge of incubatees was also affirmed by the senior executive manager of incubator B when he was interviewed on the university's incubation programme:

> *I suppose those will be mentorship aspects they must receive from an incubation programme regarding how a venture is supposed to be created, understanding the business prescripts around running an enterprise, having the right business case, and understanding the various business cycles. But importantly, I think having the right business case is important to having a bankable business to source funding for your venture* (Participant 8).

The paucity of business knowledge among incubatees explains why incubators strive to bridge the knowledge gaps between incubatees and the incubation environment. As literature aptly suggests, incubators render entrepreneurs with vital knowledge resources to bridge institutional voids and institutional distances between diverse stakeholders through institutional brokering (Tracey & Phillips, 2011). Moreover, incubators serve as intermediaries for the intensified transfer of knowledge through entrepreneurial mentoring and learning. This resonates with Somsuk, Wonglimpiyarat & Laosirihongthong (2012) who argue that new startups located in incubators often benefit from the knowledge, capabilities, and resources that incubators provide and this contributes to both incubators and incubatees gaining a competitive advantage over their competitors. Therefore, addressing the knowledge deficits of incubatees remains one of the prime concerns of incubators.

c. Background knowledge of technological businesses

The middle-level manager of incubator B reiterated the paucity of entrepreneurship knowledge in the incubatees admitted into the incubator:

> *I think on a scale of ten I would say normally five [out of ten] because some are fresh students who have theoretical and background knowledge of their technological businesses. Others are new SMME owners who have not worked much or gained much entrepreneurial experience. They have not mastered how to deliver without glitches or to hold the bull by its horns. So, I would say their entrepreneurial knowledge is five on average. It is only when we channel them through the incubator when they can realise the weaknesses that they have. These are weaknesses they must work on to gain that entrepreneurial knowledge or even enhance it to a level where they will operate independently without being assisted* (Participant 12).

The concentration of incubators on imparting knowledge on incubatees is a clear acknowledgement that knowledge of the entrepreneurial domain and entrepreneurial experience have a strong positive influence on entrepreneurial success, especially the volume of market opportunities identified and exploited (Lockett Hayton, Ucbasaran, Mole, & Hodgkinson, 2013). Moreover, the constitution and diversity of knowledge in entrepreneurial teams exert a positive effect on startup growth via opportunity identification and exploitation (Lockett et al., 2013).

8.2.2.1.3. Incubatees' views on their entrepreneurial knowledge

The views of incubatees regarding the knowledge they possessed contributed to the following codes: "limited entrepreneurial knowledge," "external knowledge acquisition," and "incubator as a source of knowledge." These codes are deliberated in subsequent sections.

a. Limited entrepreneurship knowledge

When incubatees were quizzed about their levels of entrepreneurial knowledge upon their admission into TBIs, the majority professed that they had no to limited entrepreneurship knowledge even though some had entrepreneurial role models who inspired them. For example, Participant 9 highlighted:

> *I would not say I had prior knowledge even though I would read about my favourite entrepreneurs such as Elon Musk, Thomas Edison, and the stories of the Carnegies. But I honestly did not have the requisite knowledge of entrepreneurship then* (Participant 9).

While the narrative of little entrepreneurial knowledge of incubatees was pervasive, books and podcasts about entrepreneurship seemed to be the common strategies some entrepreneurs employed to acquire theoretical knowledge about entrepreneurship. For instance, Participant 19, an incubatee from incubator A, asserted that:

> *I read widely about entrepreneurship, and I listened to podcasts to understand the skills that we are going to need. However, I only had two years of entrepreneurial experience when I joined the incubator* (Participant 19).

One infers that even though books and podcasts could have rendered theoretical knowledge, the practical know-how on entrepreneurship was delivered by the incubator. This narrative about incubatees augmenting their theoretical knowledge with practical knowledge resonates with Hausberg and Korreck (2020) who argue that the effectiveness of the co-generation of knowledge depends on entrepreneurs' awareness of their deficiencies in startup knowledge, competencies, and resources so that they can fully benefit from incubators with regards to closing those gaps. This implies that incubatees must initiate the diversification of their knowledge sources if co-production of knowledge with incubators is to happen.

b. External knowledge acquisition

Since most entrepreneurs had limited entrepreneurial knowledge, some resorted to seeking mentorship from external organisations. Participant 20, an incubatee from incubator B, professed how the paucity of entrepreneurial experience and knowledge compelled her to be groomed and mentored by external sponsors:

> *I did not have any entrepreneurship knowledge as none was provided by my incubator. We do not experiment with entrepreneurship at this university, and we are not so fond of doing entrepreneurial experiments, especially in my faculty. So, I would not say I had even 10% of knowledge. However, I was later mentored by [name of international aid agency mentioned]. They are exceptionally good at business development and marketing plan development. At the same time, I was doing my MBA, so I had three things happening simultaneously, which would result in something good regarding developing my business knowledge. So, I did learn entrepreneurship from these avenues, but not from our university incubator* (Participant 20).

The claim about the lack of entrepreneurial training from the TBI is shocking as incubators are ideally designed to facilitate the provision of such training. It also sharply contradicts middle-level managers at incubator B's narratives about availing diverse forms of training in entrepreneurship and business management to their incubatees. Normally, incubator management must harness their knowledge, experiences, and opinions to impart knowledge, skills, and expertise through mentorship, training opportunities, and advisory services (Yamockul, Pichyangkura & Chandrachai, 2019). Furthermore, they must train their incubatees to execute and integrate scientific and entrepreneurship research and technologies from their universities to develop and improve their products and/or services (Yamockul et al., 2019).

c. Incubators as a source of knowledge

Participant 18, another incubatee from incubator B, acknowledged that she joined the programme precisely to acquire entrepreneurial knowledge and bridge the information gaps she had: "*I had little entrepreneurial knowledge. That is why I was eager to be part of incubation and the information that I got improved my knowledge*" (Participant 18). Another incubatee remarked: "*Before I joined the incubator, I was working on a business that belonged to a family member. That was the only entrepreneurial knowledge that I had*" (Participant 9).

This was also echoed by another incubatee, participant 19, from incubator A:

> *But then I guess the time we signed up to the incubator, with Jonathan [pseudonym], our co-founder having left for two years, then I had two years of experience before I signed up for incubation. I got some knowledge through some courses that the incubator gave. There is one that helped me with business accounting and financial planning* (Participant 19).

The fact that participant 18's utterances regarding the source of her entrepreneurial training contradicted that of participant 20 (despite their belonging to the same incubator) demonstrates that incubatees experience the training that TBIs provide differently and incubatees gain entrepreneurship knowledge from different sources. The variations in sources of entrepreneurship knowledge among incubatees upon admission demonstrate the importance of incubators' identification of the different stages of the entrepreneurial life cycle for each entrepreneur during the screening process to customise their training needs. This is not surprising as one of the main purposes of incubators is to assist incubatees to overcome the risk of startup failure by availing a diverse range of resources. By its very nature, business incubation accelerates the successful development of startups and fledgling companies by providing entrepreneurs with targeted support, resources and services (Kathleen, 2006; NABI, 2010; Khorsheed et al., 2014). TBIs are deemed to provide incubatees with intellectual capital, which ranges from knowledge of entrepreneurship and business management, institutionalised databases, knowledge of IP, patents, trade secrets, and industrial designs. **Proposition: The effective acquisition of entrepreneurial knowledge by incubatees depends on incubators' ability to develop credible and effective screening criteria, emphasising incubatees' current level of knowledge based on their stages in the entrepreneurial journey. Proposition: The effectiveness of training and development programmes depends on incubation staff's knowledge of the training needs of incubatees, including their capacity to build on prior knowledge of entrepreneurs**

based on their stages in the entrepreneurial life cycle.

8.2.2.1.4. Innovation champions' perspective of entrepreneurial knowledge

The views of innovation champions regarding incubatees' level of entrepreneurship knowledge were also considered in this study. Since some innovation champions did not express their opinions on this matter, "business exposure" was the only code that emerged from one innovation champions' narrative. This code is discussed in the subsequent section.

a. Business exposure

The study results established that although some incubatees lacked entrepreneurship knowledge, they had sufficient entrepreneurship exposure. Entrepreneurial exposure involves access to entrepreneurial activities that come from existing entrepreneurs through role models, "shadowing" the entrepreneur, having entrepreneurial family members or prior work experience in an entrepreneurial firm (Hsu et al., 2017). Entrepreneurial exposure is distinguished from entrepreneurial knowledge which describes the instrumental knowledge required for the launching and development of entrepreneurial ventures (Mitchell et al., 2000; Scuotto & Morellato, 2013). This distinction can be inferred in participant 2's utterances:

> *I think when business tenants decide to have their business incubated, they come with various levels of knowledge. For example, entrepreneurs that have worked in large corporations understand the process of bringing products and services to the market, the different steps to do that and they understand the business processes. However, some incubatees with corporate background only have business exposure but lack entrepreneurship knowledge and experience* (Participant 2).

This narrative suggests even though some incubatees had some experience of working in corporate organisations, they lacked sufficient knowledge to operate their startups effectively and efficiently. Entrepreneurial experience denotes the experience derived from entrepreneurial situations and contexts relating to opportunity exploration, resource mobilisation and engagements with customers, suppliers and developers (Lee, Lee & Pennings, 2001; Boso et al., 2018; Peng, Zhou & Liu, 2020). While the different levels of experience of incubatees resonate with the view that incubators often select incubatees based on their experience, competencies, the novelty of their business ideas, and the entrepreneurs' personality (Halabisky & Potter, 2019), this innovation champion's narrative did not distinguish between incubators and accelerators. This is because incubation tenants admitted into incubators tend to have little knowledge, experience and exposure while tenants of accelerators are entrepreneurs who have prior knowledge, exposure, and experience (Casasnovas & Bruno, 2013; Cohen, 2013; Madaleno et al., 2018) as some of them are serial entrepreneurs. The entrepreneurs in accelerators would have operated some businesses successfully, graduated from incubators but have encountered some challenges with scaling up, realising business growth, and pivoting broader economic impact. One gets a sense of a hierarchy of knowledge levels that different entrepreneurs have depending on their level of prior exposure and experience in entrepreneurship. **Proposition: The incubator's development of clear selection criteria is instrumental in availing services tailored to suit incubatees' varying levels of knowledge and experience based on their prior exposure to entrepreneurship activities.**

8.2.2.2. Business experience

Apart from entrepreneurial knowledge, the other category explored under perceived entrepreneurship capabilities theme is business experience. The views of different stakeholders were sought concerning this category, and these are presented and discussed in sections below.

8.2.2.2.1. TBI sponsors' perceptions of incubatees' business experience

The codes that emerged from the views of TBI sponsors regarding the business experience of incubatees were "limited business experience," and "lack of awareness." These are elaborated next.

a. Limited business experience

To establish whether the business experience had any bearing on incubatees' decision to participate in TBI processes, incubation sponsors were requested to describe the level of business experience that incubatees and entrepreneurs had at the time they were admitted into incubators. The senior executive manager of a public funding agency reported that:

> *Regarding the business experience that they have, I can say that on an annual basis we support about 200 individuals or companies in our funding programmes. Of these 200, I would say we will probably support 30 startup business founders that already have experience of running their business as most startups do not have experience of running their businesses. Some individuals we have supported have run businesses and failed as they made some mistakes. In terms of experience, I think maybe 15% of our innovators have business experience but the majority do not have business experience and we need to put them into incubation processes. We also have mentors that take them through mentorship relating to business processes* (Participant 14).

The limited business experience of incubatees resonates with the activation phase of an incubation ecosystem, which comprises few startups with limited business experience and that are confronted with resource gaps (Acs, Szerb, Autio & Lloyd, 2017) as was the case with the university incubation ecosystem of university B. However, the variations in business experience among incubatees affirm the reality that incubators may need to adjust their admission criteria to accommodate these entrepreneurs with such diverse experience levels (Halabisky & Potter, 2019). Consistent with entrepreneurial ecosystem theory, such prevalence of heterogeneous stakeholders fits well with the theory's focus on a diversity of actors interacting formally and informally in an entrepreneurship ecosystem (Mason & Brown, 2014).

b. Lack of awareness

When the researcher inquired from the middle-level manager of a private financial institution about the business experience possessed by the incubatees and entrepreneurs during their business development programme, the answer was ambiguous:

> *Your question is challenging to answer because it supposes that we knew these entrepreneurs before they join the programme. Yet, we know much about them when they are in the programme. It is only when we go along that we pick their challenges. So, at a point, before they join the programme, we would not have a way of knowing* (Participant 15).

The fact that the private financier personnel only realised the entrepreneurial experience and associated challenges of entrepreneurs when there are already in the business development programmes could be indicative of the complexity of selection itself. Due to the absence of universally acceptable standard protocols incubators must use in evaluating applicants (e.g., large data points) during screening, much information on entrepreneurs' capabilities and motivations is ambiguous and subjective and hence difficult to assess (Ahmad, 2021). Alternatively, such lack of knowledge suggests lacklustre selection criteria and a lack of a coherent incubation model. This means that the process focuses on just having business ideas and not prior experience. When such ambiguity persists, the assessors rely more on heuristics and biases to judge potential incubatees suited for admission (Ahmad, 2021). This is because whether the incubation model is "picking the winners," "survival of fittest," "idea-focused," or "entrepreneur-focused" or combinations of these (Bergek & Norrman, 2008), the incubator still holds onto an idea of the entrepreneurial qualities of entrepreneurs if it has coherent selection criteria. This is because normally, the viability of the idea, entrepreneurial qualities, and market dynamics are all implicated in the coherent selection process, regardless of the differences in emphasis of the approaches applied (Hausberg & Korreck, 2020). This private institution's lack of knowledge of the business experience of entrepreneurs contributes to the following propositions. **Proposition 1: The purpose and selection criteria of incubators could delineate new entrepreneurs with ideas from those with in-depth experience to support of successful incubation. Proposition 2: The provision of a pre-incubation training phase covering a clear duration (e.g., 6 months to a year) would sufficiently prepare new incubatees for incubation and differentiate tenants with ideas from those that are incubation ready.**

8.2.2.2.2. Incubator management's perceptions of incubatees' business experience

The views of incubator management about their incubatees' level of business experience were solicited.

The codes that emerged from data ranged from "entrepreneurism-academia schism," "limited entrepreneurial experience" and "technological experience." These codes are discussed next.

a. Entrepreneurism-academia schism

Apart from the significance of business knowledge, the study inquired from incubation management about the level of business experience that incubatees possessed when they were admitted. The response of the senior executive manager of incubator A to this enquiry was negative:

> *Historically, most entrepreneurs had no entrepreneurial experience. So, when you think about technology transfer or university-backed incubators, academia is far from entrepreneurism because it is the opposite. Academia is tenured, it is in the university environment, it is very different. So, most entrepreneurs have not had entrepreneurial experience. They are coming from an academic background, and they have never worked in a corporate organisation. They have never been part of the business, they have never had any business experience, let alone entrepreneurial experience. So, most of their business experience is very low, but that will change over time* (Participant 11).

This narrative is unsurprising as it backs established literature on the vulnerability of incubatees and prospective entrepreneurs regarding insufficient experience, limited resources and capabilities, and lack of credibility (Shepard, 2017) when they join incubation programmes. Given that incubators and accelerators are often created to overcome these challenges, Shepard (2017) employed an anecdote of an incubator in a hospital that supports the life and growth of ailing infants to resemble the role of incubators in resolving entrepreneurship inexperience and overcoming skills deficiencies to promote growth of the incubatees. However, the characterisation of the academy as anathema to entrepreneurial pursuit (e.g., tenured positions, the university's disciplinary focus, rewarding individual effort) seems to contradict public discourse on university-based entrepreneurial ecosystems where universities support innovation-driven growth-oriented enterprises (Fetola, 2018; Cowell, Lyon-Hill & Scott Tate, 2018). Universities are also ideal sites for entrepreneurship due to their linkages to geographically localised knowledge spillovers (Rocha & Sternberg, 2005; Delgado, Porter, & Stern, 2010), their support for triple helix relations, and spinouts and local startups (Bone, Allen & Haley, 2017). Perhaps, the resources gaps, a lack of coherent mechanisms for knowledge exchanges where personal achievement in research excellence is prized over collaboration in R&D, and institutional voids in supporting entrepreneurial pursuits could explain the gap between academia and entrepreneurism, with regard the realisation of entrepreneurial pursuits.

b. Limited entrepreneurial experience

The incubatees' lack of entrepreneurial experience was also echoed by the middle-level manager of incubator B when asked about how much experience incubatees had when they joined the incubator:

> *Normally, it is zero because we are focusing on startups that have not operated before. The entrepreneurial experience is zero because in some cases they have not sold anything or conducted business operations, they are only starting. That is why when they join the incubator, we also assist them to register the businesses. For them to run effectively, they must register, have a business name, operate as an independent entity that is registered, and make money. So, during the incubation, we teach them how to: register a business, get the first client, render services and conduct meetings with the clients* (Participant 12).

It is clear from this narrative that entrepreneurship experience would be lacking among incubatees and incubation serves to close these experience gaps. Since incubatees often lack entrepreneurial experience, it is not a coincidence that the supply of knowledge resources such as mentors, experts, master classes, and networks topped the list regarding the value of incubators and accelerators from incubatees' perspectives (Lange, 2018).

c. Technological experience

Although some participants emphasised a lack of business experience, others possessed technical experience even though this did not necessarily translate into entrepreneurship experience. Participant 12, the middle level manager of incubator B, observed:

> *In many cases, some incubatees have the technological know-how, particularly if they are students from the engineering and IT discipline. They normally have the technological know-how but then how to put that technological experience into business knowledge to generate commercial outcomes becomes a challenge. In most cases, we have students who do not know about the product, but they know much about the technical stuff they are doing. They neither have the business know-how nor how to engage or connect that technology that they have with a product, connect it with the market or with the business* (Participant 12).

This view on academic entrepreneurs' possession of technological experience through their exposure to the frontiers of technological developments in their disciplines is echoed by participant 17, a middle-level manager at incubator B, when asked about what experience incubatees have upon their admission into the incubator:

> *Incubatees' experience in our context matters as they are subject matter specialists actively involved where technology resides. They are quite clued up on what is happening in the technological space. So, they are also able to guide us [i.e., incubator staff] in terms of opportunities as they see the gap that is in the market. I can say that their technical experience is quite critical* (Participant 17).

While participants 12 and 17's narratives converge around incubatees' possession of technical experience, they differ in the sense that while participant 12 emphasised the incubator's role in availing business knowledge to incubatees, participant 17 views technically experienced incubatees as sources of knowledge that incubators can draw upon for support. The challenge of technically and technologically experienced scientists was overcoming the "valley of death" of innovations through translation of their creative and innovative ideas into commercialised products, services, and solutions. This notion, as narrated by Participant 12, consolidates Khan's (2017) view that a lack of commercialisation expertise in universities is a critical bottleneck encountered by founders of technology startups operating at universities. This is because such founders are experienced technical and scientific specialists with limited knowledge of entrepreneurship and business operations (Khan, 2017). These views somewhat concur with participant 11's aforesaid view on the yawning gap between academia and entrepreneurism.

8.2.2.2.3. Incubatees' perspective on their business experience

The views of incubatees were also elicited regarding their level of business experience. The codes that emerged relating to the business experience category ranged from "experience from entrepreneurial failures," "inadequate family business experience," "training programmes" and "industry experience." These are elaborated in the next sections.

a. Experience from entrepreneurial failures

When asked about the level of entrepreneurial experience he had upon his admission into the incubator, participant 1 emphasised upskilling as the information technology business field necessitated quick adaptation to rapid technology advancements:

> *To be honest, gaining experience in the technology business is quite tough. The baseline must be there in the entrepreneur. You can develop your skill and expand your knowledge even though experience comes with time, unfortunately. What is important is that many IT companies will start, close and start again and they will learn from previous experiences* (Participant 1).

This creates the impression that background experience together with continuous learning from entrepreneurial failures is integral to the accumulation of entrepreneurial experience. This buttresses the view that lack of sound commercial experience and knowledge often leads to startup failure (Khan, 2017) as much as entrepreneurial failure could contribute to entrepreneurial learning and the acquisition of new experiences. Hatakka (2015) affirms that entrepreneurs such as owners of startups often possess different experiences of both entrepreneurial success and failure including the learning that could arise from these experiences.

b. Inadequate family business experience and training programmes

The researcher inquired about the entrepreneurial experience that participant 3 had at the time of her admission into the incubator. This participant highlighted that despite being raised in an entrepreneurial family, she lacked the requisite business experience and skills, which explained her decision to participate in training programmes rendered by the Small Enterprise Development Agency (SEDA):

> *Even though I grew up in a family of entrepreneurs, there was nothing that I had acquired regarding business experience. So, I had only participated in SEDA training programmes. But then it was challenging because the same year I was registering my business, I was studying at university. So, I am learning as I am growing* (Participant 3).
>
> *I guess you pick different business experiences up along the way. I got some through some courses that the university incubator A gave. There is one that helps with business account planning. I guess some of that training I had, some I learned just through experience. Some of that I learned through some courses they taught us in the incubator* (Participant 1).

It can be inferred from participant 3 that exposure of entrepreneurship through family businesses may not sufficiently equip new startups with the experience desired to effectively engage in entrepreneurship. The logic is that individuals must be directly engaged in business strategies and on-task activities that make entrepreneurship a reality. This contradicts the view that children of entrepreneurial families acquire the experience of mentorship from their parents (Kim et al., 2006, Mokgosi, 2017). It is simply a conjecture that background provides sufficient learning opportunities that prepare young entrepreneurs for business startup careers (Van Auken, Fry & Stephens, 2006; Tarling, Jones & Murphy, 2016). While participant 1, from incubator A, did not mention family role models as a source of inspiration for the acquisition of business experience, he saw training as instrumental in closing experience gaps (see foresaid excerpt in this section).

c. Industry experience

Participant 18, from incubator B, complemented participant 1 by pointing to a distinction between entrepreneurial experience and industry experience:

> *When I was incubated, I had more industry experience than entrepreneurship experience. I was also having a fair share of industry-related skills, and the incubation assisted more on the entrepreneurial experience more than the skills* (Participant 18).

The narratives above demonstrate that some incubatees who possessed industry experience lacked entrepreneurial experience. Yet some incubatees combined diverse entrepreneurial experience such as task-specific human capital with industry-specific human capital. Task-specific human capital describes experience related to entrepreneurial tasks of starting up and managing entrepreneurial firms (Zarutskie, 2008; Barreira, 2015) while industry-specific human capital emphasises experience acquired in a particular job or industry that contributes to enhanced productivity on the job (Barreira, 2015). Therefore, there is no one-size-fits-all when it comes to the nature and complexity of experience incubatees had when they encountered incubation processes. For instance, while some student entrepreneurs alluded to diverse experiences or specific types of experience, some did not have experience at all. Both participants 1 and 20 professed that they did not have any solid experience at the time of joining the incubator: *"No, not at all."* (Participant 1) and *"No experience worth mentioning."* (Participant 20).

8.3. INSTITUTIONAL FACTORS THAT AFFECT TECHNOLOGY BUSINESS INCUBATION

Apart from individual factors that affect TBI, the study also explored institutional factors deemed critical to the success of TBI. Insights into the institutional factors influencing the effective participation of different stakeholders in incubation programmes were gathered. Participants explained that broadly the incubation incentives and support regime of incubators and incubation sponsors ranged from **intellectual capital**, **physical capital,** and **social capital**. These capital forms as they relate to TBI are elaborated in the sections below.

8.3.1. Physical capital

Physical capital are assets used in the production processes and these are manufactured by humans (Johnson & Quance, 1972). In the context of incubation, physical capital takes the form of physical infrastructure availed by incubators such as office space, internet connection, telephones, boardrooms, conference halls, storage space, and product development technology stations. These issues are elaborated in the sections below.

8.3.1.1. Physical resources

Since we were acutely interested in the resources that incubators availed to incubatees to realise TBI, the question on physical resources (e.g., offices, co-working spaces, laboratories) was not posed to the incubator sponsors as they were not directly involved in routine operations of incubatees. The question was posed to stakeholders in the university incubation ecosystem who were directly involved and were acquainted with the resources availed in the incubation ecosystem. The views of incubators are discussed first, followed by those of incubatees, in subsequent sections.

8.3.1.1.1. Incubator management's perspective on provision of physical resources

Regarding the provision of physical resources, the codes that emerged from incubator management's narratives were "co-working spaces and virtual incubation," and "well-furnished offices" and these are elaborated in subsequent sections.

a. Co-working spaces and virtual incubation

In response to the question on what forms of physical resources his incubator availed to the incubatees, the senior executive manager of university incubator A highlighted that:

> *We have a big co-working space where people can have offices or hard desks. Since we are part of the university, entrepreneurs can go and use some facilities (e.g., shared spaces) at the university as well. It is important to have a physical presence. It helps us to build the community. It helps to be face-to-face with entrepreneurs and clients even though I do not think it is the key thing now as we are doing much of our activities virtually because of the Covid 19 pandemic. However, having a physical space does help* (Participant, 11).

Since co-working spaces relate to the provision of physical space, the narrative above is discussed in conjunction with the well-furnished offices subject below.

b. Well-furnished offices

When the same question of physical resources availed by the incubator was posed to the university incubator B's middle-level manager, the response was affirmative:

> *The physical resources we normally give them are office space, electricity, and water, which are free of charge. Most offices that they operate in are well-furnished even though not all the incubatees have access to well-furnished offices and furniture to operate from. We also subside their costs in terms of telephone calls, printing, and internet connectivity. When they join the incubator, they have those facilities that they can leverage on for the success of their businesses* (Participant 12).

Even though there were striking similarities in the range of services offered by university incubators B and A, university incubator A complemented the provision of physical resources (physical incubation) with virtual incubation, which was not the case with university incubator B. The finding on the provision of physical resources gels well with the view that incubators often provide basic infrastructure such as office space, share spaces, and access to the internet especially at the startup and early venture stages (Startup Promotion for Entrepreneurial Resilience [SUPER], 2015). These findings also further buttress evidence on the role of incubators in providing quality infrastructure and office facilities (e.g., computers, internet, telephone, fully furnished office, etc.) at highly subsidised rates (at about 75% of the market rate) (Maital, Ravid, Seshadri & Dumanis, 2008). The successful bridging and organisational roles of incubators manifests in acquisition of physical resources and better integration of venture development activities with surrounding environment (Bank et al., 2017; Mian, Klofsen & Lamine, 2021). However, even though physical interaction is still important in building business networking communities, the Covid 19 pandemic disrupted the role of physical spaces in supporting incubation, allowing the hybrid model to transcend the binaries between physical incubation and virtual incubation. The hybrid model provided by university incubator A transcends the dichotomy between physical and virtual incubators established in incubation literature (Bøllingtoft & Ulhøi, 2005; Von Zedtwitz & Grimaldi, 2006; Schütte, 2019). However, the success of virtual incubation further challenges the vitality of physical incubation and physical administration in supporting incubation processes, as widely reported in incubation literature (Mian, 1996a; Chan & Lau, 2005; Bergek & Norrman, 2008; Mian et al., 2021).

8.3.1.1.2. Incubatees' perspectives on the provision of physical resources

The perspective of incubatees was sought to corroborate evidence availed by incubators regarding the physical resources they availed to incubatees. "Offices render structure to business operations," "augmenting access to social networking and intellectual resources", and "dilapidated offices" were the codes that emerged from incubatees' narratives concerning the category "physical capital." These codes are presented and discussed consecutively in subsequent sections.

a. Offices render structure to business operations

Regarding what physical resources the incubator availed to incubatees, including whether such resources facilitated the incubation processes in any way, some participants noted that these afforded their businesses a more coherent structure of operation, increased credibility, and gave strategic direction to these firms. For instance, participant 18 highlighted:

> *The moment I get into my office, I know the activities and tasks I must execute. This is unlike working from home, where I would do work only when clients requested me to hold meetings with them. Otherwise, there would be nothing that I will be doing. But once I get to the office and I have nothing that I am busy with, then I will think of marketing, visiting potential clients, working on a funding proposal. So, it has impacted my business operations in a positive manner* (Participant 18).

The physical office gave a coherent structure to business operations and this resonates with literature on the importance of physical infrastructure in successful startups. The provision of an office or a large, modern factory depending on the business activities, is a priority for incubatees at the seed stage of business incubation (Intellecap, 2012). There is growing literature that demonstrates that business premises (i.e., physical office in a specific location) give greater legitimacy to the business formalisation process (Ghani & Kanbur 2013) and facilitates access to customers (Karki, Xheneti & Madden, 2020).

The proclivity to have business premises deviates from the common narrative that some entrepreneurs deliberately pursue informal settings (e.g., remote working and using homes as business premises) as a strategy for managing competing home and family responsibilities (Chant & Pedwell 2008), ameliorating risks regarding business locations regulated and dominated by men (Adhikari, 2011) and eliminating exposure to formal institutions (Bennett, 2009) such as tax authorities and requirements for conforming with labour legislation (Small Business Institute, 2021). From an institutional theory perspective, the fact that incubators often shaped institutional processes of incubatees through their policies, strategies, activities, and norms could explain the drive towards business formalisation by incubatees. The argument for an office (a pre-Covid pandemic argument) may not cohere with the Covid 19 pandemic period, where most entrepreneurs adapted to working from home because they could no longer draw clear boundaries between working and non-working hours. Moreover, working from home could be ideal for some entrepreneurs, who despite the meagre rental fees charged by incubators, may see them to be exorbitant. **Proposition: The type and size of the startup and motivations of entrepreneur determines the physical locations (i.e., whether an entrepreneur operates from an incubator, online, from home, rents a space in the mall) of their business.**

b. Augmenting access to social networking and intellectual resources

To gain insights into whether physical resources were availed to incubatees and the value of such resources for TBI, the study explored what physical resources incubators provided and their associated benefits. Participant 9 reported:

> *The provision of physical resources helped with harnessing some social capital and some intellectual capital because with the intellectual property I acquired there, I have managed to develop my business. I started from learning to self-teaching whilst I was there with the resources that they (i.e., incubator B) provided me such as free Wi-Fi, telephone, an office, and meeting rooms* (Participant 9).

From an Entrepreneurial ecosystem perspective, one senses a clear cross-fertilisation and reconfiguration of different resources as access to one resource facilitated the consumption of other resources. Physical capital availed by the TBI enabled access to intellectual capital. This finding resonates with Wonglimpiyarat's (2016) observation that the purpose of the university business incubator (UBI) is to provide an integrated one-stop-shop of services such as office space, equipment, mentoring services, and other administrative supports to assist the formation of new ventures.

c. Dilapidated offices

While the provision of an emporium of services is conceived as the duty of a dedicated incubator, the quality of resources availed must be of a respectable standard. Compromising the quality of infrastructure may contribute to the underutilisation of such infrastructure. This was evident in Participant 20 who was discontented with the basic infrastructure provided by her incubator: *"We (i.e., incubatees) did not take the office spaces because their offices looked so run down. So, we did not even use them, unfortunately* (Participant 20). This narrative resonates with literature that suggests that just like venture capitalists, technology incubators are mandated to improve the quality of resources they provide to increase the legitimacy and accessibility of such resources and services (Avnimelech, Schwartz & Bar-El, 2007). This understanding coheres with the institutional theory perspective, which emphasises strategies institutions deploy to gain legitimacy for their existence in the face of their stakeholders. This finding on run-down infrastructure further buttresses the observation that severe constraints in resources create conditions that are detrimental to the growth of technology businesses and the commercialisation of business strategies (Gans & Stern 2003; Mosey, Guerrero & Greenman, 2017).

8.3.1.1.3. Funders' perspective on the role of funding in incubation processes

While office space and equipment offered by incubators constituted one of the codes that emerged from the physical capital category, the other code that emerged was financial resources. This code was discussed from the perspective of incubator sponsors, incubators, and entrepreneurial champions. The researcher sought to investigate the extent to which incubatees' access to financial resources and incentives facilitated the development of their startups through incubation processes. The codes developed from incubator sponsors narratives include "infrastructure grants" and "financial and non-financial support" and these are elaborated in sections below.

a. Infrastructure grants

In a focus group discussion on the contribution of funding to incubation processes, Participant 10a, a middle executive manager of a public funding agency, submitted that:

> *Our agency [name provided] provides much funding support, and with those funds, incubators can buy assets to support entrepreneurs in the innovation system. Then there are institutions like the Department of Trade and Industry (DTI) and Trade Investment at KwaZulu Natal that provide infrastructure grants support that can pay for equipment, technology, and machinery to support entrepreneurs. What [name of agency provided] is doing in the [place mentioned] innovation ecosystem is mainly about inclusivity, because we acknowledge that the ecosystem itself is very strong even though there is room for improvement. In terms of funding, they are one of the strongest regarding funding innovation. So, to tap into what has been achieved in [place mentioned], we have seen different players coming under the [place mentioned] network, committing their infrastructure, and their financial resources, for the benefit of people in the previously disadvantaged areas*.

The provision of entrepreneurial finance was seen as critical to availing other resources vital to bringing the business into existence and for the viability of the business operations (Owers & Sergi, 2019). As such, infrastructural grants extend the current body of venture financing literature, which has emphasised venture capital (Avnimelech, Schwartz & Bar-El, 2007), entrepreneurs' friends and family, bank financing, angel investment, Initial Public Offerings (IPOs) (Owers & Sergi, 2019) as sources of entrepreneurial finance in advanced economies. Since venture financing, angel investment, IPOs and bank financing are less dominant in developing countries where markets are undercapitalised and incubatees lack collateral, infrastructure grants are a justifiable intervention for supporting innovation ecosystems and incubation from a Market failure and institutional theory perspective. Government intervention in the economy is ideal when markets failure is exhibited by market undercapitalisation, incubatees' information symmetries relating to viable funding options for startups, the risk-averse behaviours of private financial institutions in financing small business startups, which creates funding gaps in the market (Mallett, 2019).

b. Financial and non-financial support

When asked about the funding sources availed to incubatees and SMMEs to support business incubation, the senior executive manager of a public funding agency highlighted that:

> *The incentives we give are financial and non-financial. The financial incentives we provide entrepreneurs and incubatees are grants for their business plans, and for them to get the certification of their products, to get intellectual property, to get the documents registered with Companies and Intellectual Property Commission (CIPC). So, these grants will enable them to start their businesse*s. *Our agency can pay for technology business equipment. We have in our agency several technology stations - technology platforms that are all over the country. However, to access other equipment, incubatees can go to their parent university. Incubatees do not have to buy their 3D printer for example. They can get services of a 3D printer plus an engineer at their university* (Participant 14).

The participant elaborated that the recipients of these financial incentives and support utilise these resources to gain access to technology infrastructure. The narratives above demonstrate that public infrastructure grants bridge the market gaps precipitated by market imperfections and institutional dysfunctions often ignored by the private sector. As Storey (2005) highlights, using market failure theory, governments often intervene in the economy in situations where social returns exceed private returns (e.g., in specific industries or in response to social exclusion or unemployment) such that the private sector may not conceive the value of providing certain SMME support. However, it remains unclear whether government grants serve to overcome these perceived externalities or bridge perceived information asymmetries of incubatees (Mallett, 2019). Overall, this agency largely funded the ideation, business development, and not the high growth phases of the business – consistent with the entrepreneurial stages that are supported by incubators.

8.3.1.1.4. Incubator management's perspectives on the role of funding in incubation processes

The views of incubator management were also elicited regarding the role of funding in incubation processes. The codes developed from incubator narratives were "incubator funding," and "funding needs a functional structure". These are detailed in subsequent sections.

a. Incubator funding

It was vital to establish the role of funding in incubation processes from the perspective of the incubators themselves as literature emphasises its significance (Avnimelech, Schwartz & Bar-El, 2007; Gómez, 2016, Wonglimpiyarat, 2016). In response to the question on the physical resources that the incubator provided to incubatees, finance did not feature in the senior executive manager of university incubator A's narrative: "*We do not give direct funding to incubatees* (Participant, 11). Although it is not the main function of incubators to render direct funding to incubatees, funding remains a fundamental requirement to startups' success. For instance, Gómez (2016) highlights that due to scarcity of funding, entrepreneurial universities may need to take a proactive role in securing funding to legitimise the social and economic benefits of incubation and entrepreneurial activities, facilitate knowledge spillover and technology transfer from the academy to incubatees. Therefore, the entrepreneurial universities can serve as mediators and brokers of access to funding for incubatees.

b. Funding needs a functional structure

To establish whether funding had a role to play in incubation processes and activities, the incubator staff were asked to describe the contribution of finance to their actions, processes, and activities. In his response, the middle-level manager of incubator B emphasised the significance of institutional structures in regulating the financial operations of incubatees:

> *Funding that is provided without an institutional structure such as a technology business incubator has never been used fully to develop the businesses. On the contrary, funding that comes from the government via [name of public funding agency mentioned] and other government entities that has been channelled through the university incubator has yield results because I have seen startups flourishing when there is a structure on how to spend those funds* (Participant 12).

The claim about the appropriate and effective deployment of funding when there is an institutional structure such as an incubator that provides business operation models and mechanisms for channelling funding to intended activities coheres with cohesive isomorphism, a concept that institutional theory associates with rules, norms, procedures for regulating behaviour and conduct (Cobb, Wry, & Zhao, 2016; Zhao & Li, 2019) of incubatees. The spending behaviours, actions, and conduct of incubatees, especially their performance metrics such as financial budgets, business plans with revenue streams and projections, cost breakdowns, and growth strategies can be imposed by incubators to regulate and facilitate the venture development progress of incubatees. In addition, this would enable the close monitoring of their sustainability and success. Zhao and Li (2019) observe that individual formal and informal institutions shape entrepreneurial activities by availing entrepreneurial opportunities, normalising behaviours, and enabling and constraining the entrepreneurial actions of entrepreneurs. The risk of incubatees misappropriating or misusing funds can be eliminated by incubators' strict growth models and funding controls, which guarantee greater chances of realising incubation success.

8.3.1.1.5. Entrepreneurial champion's perspective on funding

The entrepreneurial champions were individuals who had distinguished themselves as leaders in advancing entrepreneurship by developing and implementing curricula programmes on entrepreneurship, creating academic spinoffs from their cutting-edge research, successfully mentoring nascent entrepreneurs or being recipients of the Vice Chancellors' award on entrepreneurship. The study solicited entrepreneurial champions' perspectives on the contribution of funding to the incubation process. Participant 13, an entrepreneurial champion in university ecosystem B, bemoaned that the financial disbursements for the acquisition of technology equipment create a sense of dependency among incubatees.

> *When incubation sponsors give cash as grants without any obligation to pay back, entrepreneurs will develop a dependency syndrome. This can be contrasted with a loan they must pay back; you know. This will then be inculcating accountability as entrepreneurs know that they will pay back. Of course, equipping entrepreneurs will also mean that the financial burden is not only on academic entrepreneurs alone* (Participant 13).

Since a loan is a form of debt financing that limits incubatees' cashflow due to capital and interest repayments, the risk of penalties arising from not meeting repayment obligations, (Ballesteros-Ruiz & Cardenas -del Callisto, 2019), may impose financial discipline on incubatees. To the contrary, while infrastructural grants do not impose contractual obligations of repayments, they may have relaxed performance metrics as the assumption is that the money is deployed for it intended purposes. Therefore, compared to loans, incubatees may prefer grants due to their flexibility even though these may be difficult to secure on a competitive basis.

8.3.2. Social capital

Apart from physical capital, another category generated from the incubator incentive and support regime theme was social capital. To refresh memory, social capital denotes the aggregate of resources linked to the possession of a durable network of institutionalised relationships of mutual acquaintance or recognition (Bourdieu, 1985). It comprises the resources that are inherited, deposited, or acquired through mutually beneficial collective associations, affinity to incubation networks, and reciprocal social relationships developed during and post interactions among dyads, small groups, and collectivities in the incubation ecosystem. The following sections describe the views of multiple stakeholders regarding the contribution of social networks to TBI, starting with those of TBI funders.

8.3.2.1. Funders' perspectives on networking

The researcher sought to establish the social networking resources availed by the incubator sponsors to incubatees and entrepreneurs in general. The codes that emerged from the social capital category ranged from "social networking and partnership opportunities," "firm growth opportunities," and "networking and funding events," and these are elaborated in sections below.

a. Social networking and partnership opportunities

When requested to explain how business and social interactions between her public funding agency, incubators, and incubatees were established, the response was elaborate:

> *On the formal level, we develop formal relationships with them. So, we formalise a relationship with their TTO based on a particular funding instrument or several instruments with them. So, through the relationship agreement, that is one way. The other ways we would interact are through networking conferences, events, and exhibitions where we will identify particular partners. All our partnerships are formalised and we interact with these startups, companies, and incubators under the collaborative funding agreement that can happen through different mechanisms such as face-to-face deliberations. We set up a meeting or it could happen via conference exhibitions or through an introduction by other partners. In terms of international relations partners, such collaborations are facilitated through the International Resources unit that is at the Department of Science and Innovation that establishes and manages international relationships. Since we are an implementing agency of the department, we introduce and implement that relationship through the agency based on the agreement* (Participant 14).

Collaborations, partnerships, and agreements between funding agencies, incubators, and startups are deemed fundamental to sharing of entrepreneurial experience and knowledge located at diverse phases of the venture creation process (Pettersen, Aarstad, Høvig & Tobiassen, 2016). These institutional arrangements are critical because, despite the different technologies that new startups emphasise in various markets, these startups all undergo similar critical phases: technology development, production, and sales and marketing (Pettersen et al., 2016), processes that necessitate the development of similar networking mechanisms to fulfil.

b. Firm growth opportunities

Participant 14 also elaborated on the benefits for startups that arise from their access to various social collaborative relationships and partnerships:

> *So once the incubatee has access to our agency's networking support, their business grows in leaps and bounds. They are now able to access customers and funding from multiple sponsors. So, after entering our programme of networking support, the incubated business will be taken from zero to 100% in less than six months* (Participant 14).

Access to lucrative markets with customers, mutual moral and emotional support from networks (Cottingham, 2016; Pettersen et al., 2016), capability for delivering value to customers, sharing and requesting generic resources (Solano & Rooks, 2018) comprise the prime benefits of providing social capital to entrepreneurs. The benefits contribute to growth opportunities of new startups. The provision of diverse networking resources by a sponsoring entity can increase the chances of business growth, success, and generation of economic benefits for startups (O'neal, 2005; Alzaghal & Mukhtar, 2017).

c. Networking and funding events

The same question on the social and business networking opportunities that the private sponsor availed to entrepreneurs was also posed to one middle-level manager of a private funding institution. The response was affirmative:

> *We do invite entrepreneurs to relevant business networking and funding-related events. You would appreciate that we are a financial institution, so most of these entrepreneurs are not necessarily bank clients and they do not have to participate in these programmes as investor conversations might easily become a conflict of interest. However, we provide information on other funding sources that would be most appropriate to the stage or needs of the business* (Participant 15).

Therefore, business networks were forged through funding referrals and investor conversations suited for the entrepreneurial stage of the business. Nair and Blomquist (2019) argue that the facilitation of collaborative platforms and shared spaces enhances the co-creation of ideas, open innovation, and greater stakeholder interaction. These collaboration outcomes promote the scalability of business ideas and entrepreneurial actions by proactive teams, which serve as key business failure prevention and management strategies during incubation.

8.3.2.2. Incubator management's perspectives on networking

The study also solicited the views of incubator management regarding the role of social and business networking in TBI. The codes generated from their narratives relating to social capital include "broadening the network base," "service networks" and the "legitimacy of grant applications" and these are elaborated in subsequent sections.

a. Broadening the network base

When requested to explain what role his incubator played in facilitating TBI, participant 12 highlighted that it exposed incubatees to external networking with government departments, which enhanced their network base:

> *Collaborative networking events are important. I have worked with Small Enterprise Development Agency, National Youth Development Agency as well as other government stakeholders. When they have collaborative meetings and networking gala dinners, they normally send me invitations which I distribute to our startups. It is after these meetings when startups network and grow their databases of connections. Networking sessions do not only happen at the incubator, but if the government is running these social networking activities, we normally send our incubatees there, and that is where they build their networks from* (Participant 12).

Apart from the development of their networks through incubator referral networks, Participant 12 also reinforced the narrative that social networking opportunities create convivial spaces for the incubatees to network amongst themselves, share experiences, and enrich the intellectual resources of the incubation and innovation ecosystem.

> *Social interaction between the incubatees tends to expose them to one another in terms of the same services they are offering. So, it allows companies A and B to have services networks among themselves, and share mentors and experiences* (Participant, 12).

Taken together, participant 12's narratives demonstrate that while incubators may have different offerings to support business and personal networking among incubatees, these opportunities collectively contribute to collaborative and personal learning. Hansen et al. (2000) and Williams & Tsiteladze (2016) reiterate that facilitating inter-firm engagements, linkages with external partners and rendering access to incubation networks that the incubator provides directly or indirectly facilitate tenants' business and technological development, through the exchange of valuable information, partnerships and markets. Incubators' provision of social networks to incubatees becomes a "light touch" introduction into commercialisation. This subsequently bridges gaps in entrepreneurial resources through funding and other networked support for translational research and prototype development (Etzkowitz, 2021).

b. The legitimacy of grant applications

When asked to explain whether social networking resources played a role in TBI processes, participant 17, a middle-level manager in incubation B, elaborated that the incubatees sometimes harnessed the incubator's brand as a lever for accessing financial resources during their funding applications:

> *We have a very strong brand as [name of incubator stated] and by extension our university. Therefore, when a grant application is made by an entrepreneurial entity (i.e., an incubatee) under our wings and the application is associated with the incubator and university, then it carries weight in the entity's favour. We have several agreements [i.e., Memoranda of Understanding] with other external institutions such as the public and private sectors. In some instances, we have practices like A models [i.e., best practice models] and stuff, so we leverage on those relationships with outside partners when sourcing opportunities for our incubatees. So, it works in that sense* (Participant 17).

Precisely, incubator staff projected institutional brand recognition and brand significance as critical cogs for articulating the financial cause of their incubatees drawing on the pre-existing partnerships forged with the public and private sectors. Drawing on a resource-based view's postulation of organisations as a cohesive constellation of heterogeneous resources and capabilities (Barney, 1991; Teece et al., 1997) one could argue that the incubator and university's social recognition and legitimacy constituted the social capital deemed critical to accessing funding opportunities by incubatees. Therefore, consistent with institutional theory, such social recognition facilitated access to financial resources necessary to business incubation and technology commercialisation (Chen, 2009). Drawing on institutional theory, the incubator and university's possession of a good brand served as a veritable intellectual capital resource that facilitated the goodwill and legitimacy of funding applications of incubatees operating under the auspices of the incubator. Therefore, networks availed by incubators do not only provide avenues for accessing large supply chains and consulting opportunities but also legitimise the commercialisation of research and venture founding activities (Etzkowitz, 2021).

8.3.2.3. Incubatees' perspectives on social capital

To appreciate the role of social capital in TBI, the views of incubatees were also considered. The codes that emerged from incubatees' transcripts that were aligned to the social capital category included: "affinity to an ecosystem", investor meetups," "networking resources" and "information exchanges" and these are elaborated below.

a. Affinity to an ecosystem

When asked to explain why he joined university incubator A, participant 19, emphasised a demand and supply-side approach in which he sought social affinity and business networks but also provided support to the incubation ecosystem:

> *We joined [name of incubator A cited] for business networking and being part of an ecosystem because we were older. I mean; am 45, my co-founder is 48, the other one is turning 40 now. We have finance, extension networks and we stepped up our advisory panel at the beginning. So those typical incubation services were not a need for us, we joined only for business networking to be a part of an ecosystem. When we apply for membership, we saw it as a way of supporting the ecosystem but also in return for us to get access to the ecosystem* (Participant 19).
>
> *The incubator has assisted us tremendously with social networking. I cannot overstate the importance of what they provided us. We have a wide range of social networks ranging from financiers, business partners, investors and financial analysts. They availed access to hardware, software and accounting specialists. There is much networking support, which is very important. So those are the range of social networking resources they provided us. For example, my business cards are made at the incubator currently, and we met the people who are running our finances in the incubator. I would say the success of our business is through social networking. 95-98% of our social networking came from the help we got through incubation* (Participant, 21).

The supply-side approach from the incubatees advanced in participant 19's narrative, contradicts the popular narrative that startups are experience a paucity of resources and are incapable of performing optimally (Ries, 2011; Cohan, 2012) without incubation support. The same narrative partly debunks the notion of the deficiency syndrome of incubatees that necessitate incubators' mediation to sustain startup development through the provision of diverse resources (Hackett & Dilts, 2004; Bollingtoft & Ulhoi, 2005; Götsén & Pettersson, 2016). While the business networking availed to participant 21 demonstrates knowledge sharing and synergy among incubatees (Colombo et al., 2006; Williams & Tsiteladze, 2016) and possibilities for time and cost reduction in accessing networking resources and partnerships (Hansen et al., 2000) afforded by incubators, participant 19's experience is qualitatively different. It presents an insightful contribution that besides joining incubation to access resources, other incubatees join to provide their peer startups with business networks and for belonging to an entrepreneurial and innovation ecosystem. **Proposition: The success of incubatees in generating the expected incubation outcomes partly depends on the nature and quality of business networks (e.g., resources shared, frequency and intensity of interactions) and incubatees' commitment (e.g., time, resources and effort invested to the network) to be affiliated to innovation and entrepreneurial ecosystem.**

b. Investor meetups

In response to the question on what networking resources the incubator rendered to incubatees, participant 1 emphasised a supply-side approach from the incubator's side:

> *The incubator provided training courses, pitching and meet-up events where entrepreneurs could meet other stakeholders such as investors and other incubatees even though you can argue about how those things work* (Participant 1).

He elaborated by pointing to the demand-side approach for the incubator's side as well:

> *In most cases, if there are new developments in the technology space, I inform the incubation management for practical consideration and they put it on social media platforms to increase visibility and uptake by other incubatees. On the other side, they let us know about pitching events, courses and webinars, and other events that they are holding from their side* (Participant 1).

It can be inferred that although incubators availed networking and entrepreneurial development opportunities in the form of low-cost activities such as referral services, pitching events, investment seminars which are instrumental to tenants developing contacts and collaborations (Sa & Lee, 2012; Williams & Tsiteladze, 2016), the other view not fully articulated in literature is that incubatees bring a broad range of technological innovations and knowledge that has a bearing on incubator strategies, practices and activities. **Proposition: The depth of knowledge and expertise of incubatees may have a bearing on the TBIs' incubation strategies, practices, programme and activities.**

c. Networking resources

When requested to explain the resources availed by incubator B to its startups, participant 9 emphasised business networking resources:

> *As I said, everything kept falling into place once I got incubated from the incubator. That led me to do well in the accelerator part of the South African Breweries (SAB) Kickstart Ignite initiative when it was hosted at the university. Before that the incubator was virtually incubating us. This led me to win the SAB Kickstart Ignite first prize. They provided a wide range of networking resources because from that initiative, we [i.e., incubatees] got access to our igniters, our startup schools, and the Global Cleantech Innovation Programme. So, I guess by default, just being in the incubation space helped to launch me into spaces that helped me build my networks because even the 15 agricultural technology entrepreneurs that I was a part of, I am still in touch with most of them today* (Participant 9).

This narrative resonates with the view expressed in literature that incubators facilitate collaboration and social capital development at individual and collective levels through providing social networks, connections, and structures that increase incubates' access to strategic resources and knowledge relationships critical to realising their incubation goals (Bollingtoft & Ulhøi, 2005; Beausoleil, 2012). Therefore, incubators availed and pivoted collaborative networks and partnerships for the assimilation of entrepreneurial knowledge, the transfer of skills, and the creation of avenues for increased visibility and wider recognition of incubatees' activities.

d. Information exchanges

Social networking resources also facilitated the exchange of information among incubatees themselves. As Participant 18 highlighted:

> *You find out that in the incubator, somebody is doing marketing or graphic design, then you just exchange ideas. Even though I do construction engineering, I need a graphic designer who will do my company logo, a marketer who will market my business- that is marketing. It was through those networking sessions that I managed to network with peers in other fields and sectors* (Participant 18).

Therefore, the incubator facilitated the exchange of network resources and the selection of affinities by incubatees. As the literature suggests, through the provision of physical spaces (e.g., offices, co-working spaces, and laboratories), incubatees are availed with situated contexts for socialisation and networking (Böhringer; 2006; Götsén & Pettersson, 2016). By availing diverse incubatees in proximity to each other, incubators create internal networking opportunities for knowledge exchange. Through socialisation and business networking, startup founders are afforded platforms for fostering embedded relations, creating synergies, and developing social capital for enhancing entrepreneurial success (McAdam & McAdam, 2006) and the advancement of communities of practice. **Proposition: Developing incubation selection criteria that accommodate entrepreneurs from various specialisations would be productive for cross collaboration, co-service provision and co-creation of knowledge than admitting entrepreneurs within the same line of business.**

8.3.3. Intellectual capital

For this study, intellectual capital describes the knowledge and capability of a social collectivity such as an organisation, intellectual community, or a professional community of practice (Nahapiet & Ghoshal, 1998). Intellectual capital may manifest in knowledge, databases, IP, patents, trade secrets, trademarks, and industrial designs. Intellectual capital comprises three main components: **human capital** (e.g., employee competence, know-how, work-related knowledge, innovativeness, and education), **structural capital** (e.g., cultural knowledge, team spirit, copyrights, trademarks, patents, internal databases, management processes), and **relational capital** (e.g., brand reputation, strategic alliances, customers, licensing agreements and distribution channels) (Seetharaman, Low & Saravanan, 2004; Çalhan, Akdağ, & Öter, 2020). The views of different stakeholders regarding intellectual capital as a concept constitute the focus of discussion in the sections below.

8.3.3.1. TBI funders' perspectives on intellectual capital

The codes that emerged from funders' perspectives on intellectual capital were "practical orientation of management training," "non-financial incentives" and "innovation capabilities" and these are discussed in sections below.

a. The practical orientation of management training

The sponsors of TBI were requested to highlight what intellectual support they rendered to new startups. The response of the middle-level manager of a private financial institution that funded incubators A and B was broad and general:

> *Our business support programme is based on our assumption of what gaps do these entrepreneurs have in terms of skills. So, our programme focuses more on business management challenges such as business decision-making and marketing. We deliberately shy away from using descriptors used in academia by producing those that are more practical to align with the needs of the entrepreneurs. So, what we might call sales and marketing, we can give it a different phrase to make it practical so that the entrepreneurs do not approach it from an academic point of view because we do not believe that there is much value in repeating what is offered in academia for the business environment* (Participant 15).

Therefore, sales, marketing, and business management knowledge are at the centre of intellectual support this private sponsor availed to entrepreneurs in his business development programme. The strong practical and entrepreneurial focus of the programme resonates with the clarion call in the management literature for founders of startups to assume multiple managerial roles of a practical nature. These include an entrepreneurial role (e.g., seeking opportunities, being change agents, and exploiting opportunities), being disturbance handlers (e.g., taking corrective decisions, handling disturbances), and being resource allocators (Mintzberg, 1980; Rashid, 2019). The strong practical orientation of the intellectual capital rendered was critical to founders' transition from theoretical training to practical problem-solving in their businesses.

b. Non-financial incentives

The researcher also inquired about intellectual resources that funders of TBI provided the incubatees. In her response, the senior executive manager of a public funding agency characterised intellectual capital as non-financial incentives:

> *We also provide entrepreneurs with non-financial grants such as supporting business development, training on how to pitch their ideas to funders, and training on developing a fundable business plan, how to take their products to the market, and set up proper businesses. Some entrepreneurs do not know how to register a business, register a*

cooperative, file for tax returns, conduct financial planning, set up the company policy, and deal with the recruitment of human resources. So, we have a business policy package and we take them through training so that when they start their business they already have the instruments that they need (Participant 14).

Despite the striking similarities between this senior executive managers' narrative and that of the middle-level manager in a private financial institution outlined above (see participant 15's narrative in the previous section) regarding the provision of business development training, the senior executive managers' narrative closely consummates business incubation compared to the business development training offered by the private financial institution. The private funder's focus on sales, marketing, and decision-making seems to mirror business management in general compared to rendering support in terms of innovative idea pitching, developing bankable business plans, business plan development, business venture creation, taking products to the market, filing for tax returns, developing company policy and business development. As property-based structures offering mediation, buffering and bridging resources (Amezcua et al., 2013), TBIs must have well defined business models and value addition service packages for their incubatees (Mian., 2021). Despite the differences in strategic and operational foci of public and private incubators, the capacity to offer services that add value to incubatees while meeting their strategic imperatives is the fundamental litmus test for relevance, survival and competitiveness of incubators. **Proposition 1: The capacity of an incubator to offer superior targeted services tailored to suit the entrepreneurial development needs aligned to different development stages of the tenants is the hallmark of the uniqueness of an incubator. Proposition 2: Incubators that strive to provide services misaligned to the requisite skills set of their staff will be setting their incubatees and themselves for entrepreneurial failure.**

c. Innovation capabilities

When asked about the social capital resources availed to incubatees by incubation sponsors, one incubator sponsor emphasised the quality of the resources offered in these programmes. Participant 10b reiterated the following in a focus group:

Successful incubation and incubation outcomes depend on the innovation capabilities that are there [in the incubator], the innovation actors that are there, the resources that are availed by sponsors, you know, the knowledge that is there (Participant 10b).

Generating effective incubation and incubation outcomes necessitates the development of rigorous mentorship programmes and state-of-the-art workshops. The emphasis on innovation capabilities resonates with literature that highlights that innovation capabilities enable firms to bounce back from challenging and adverse business environments (Teece, 2012), contribute to the resilience of startups and sustaining business continuity behaviours (Lin & Wu, 2014; Panda & Sangle, 2019).

8.3.3.2. Incubator management's perspectives on intellectual capital

The codes that emerged from incubator management's narratives relating to the role of intellectual capital in incubation processes were "knowledge transfer," "technical and scientific knowledge" and "business management knowledge." These are elaborated in the sections below.

a. Knowledge transfer

It was also critical to establish what incubators provided in terms of intellectual resources and the value of such resources for incubatees' acquisition of knowledge of the incubation processes. Participant 11, the senior executive manager of incubator A, rendered some insights into intellectual resources which the incubator provided:

> *We have different incubation programmes, where we have experts and mentors. We also have our programme facilitators and the university itself. So, there is much access to facilities and human capital the incubatees need. This is particularly important for incubatees' knowledge of incubation processes. I mean, the knowledge transfer, and being able to go to experts and mentors and learn more is particularly important. It helps the incubation process and is important to the entrepreneurial process. Availing intellectual capital through knowledge transfer and consulting with experts, mentors, and learning more is important. It helps the entrepreneurial and the incubation process* (Participant 11).

The use of knowledge transfer in the incubation process tallies with Conicella's (2013) view that intellectual capital constitutes the prime resources critical to supporting activities such as R&D during incubation which extends the knowledge boundaries of firms in incubation and science park contexts. The availability of incubation staff who served as experts, mentors and facilitators providing specialised knowledge, expertise and skills to incubatees consummates the resource-based view, an inside-out view of firms. The theory characterises startups from the perspective of their internal resources and capabilities, which explain variations in firm performance including their capacity to generate value among individual firms (Penrose, 1958; Talaja, 2012; Atiase, Dzansi & Ameh, 2021). The fact that incubators supplied these intellectual resources of VRIN (i.e., which are valuable, rare, inimitable, and non-substitutable) calibre on incubatees' behalf to maximise their competitive edge over rival firms (Barney, 1991) buttresses the view that these resources and capabilities must be internally generated within the constrained boundaries of the organisation (i.e., incubators themselves).

b. Technical and scientific knowledge

The senior executive manager of incubator A affirmed the enrichment role that incubators play by augmenting and complementing the technical and scientific knowledge that incubation tenants bring with business knowledge:

> *Most founders are very technical as they are engineers and scientists. They need some business knowledge as they do not know how to go to market, how to find their customers, and how to fund their business. So, they come to us for that assistance* (Participant 11).

The commitment of business incubators to support the development of intellectual capital, especially business knowledge, is a testament to the reality that intellectual capital constitutes intangible assets that serve as sources of wealth as it increases chances of business success through increasing the capacity of firms to compete with their rivals (Çalhan, Akdağ, & Öter, 2020). The fact that incubatees were experienced scientists resonate with the thinking that founders of technology-based startups are often experienced specialists in their scientific and technical fields even though they possess limited business knowledge (Khan, 2017).

c. Business management knowledge

Narratives on using incubators to facilitate the smooth routine operations of the business were common. For instance, participant 17 emphasised that their incubator assisted incubatees with the documentation required to source and sustain external funding.

> *We [i.e., the incubator] assist with grant proposal writing, and sometimes we do the application on incubatees' behalf so that when the funds come, they come to us for that particular project. We also help them with reporting and meeting the milestones and the deadlines based on funders' stipulations. So, we assist them with the corporate admin support they need in the business so that they will focus more on driving technology and the services that they render every day* (Participant 17).

This excerpt further demonstrates that although the incubatees could have had some specialised discipline-based knowledge, they lacked the business knowledge to run businesses successfully. Since it is the responsibility of incubatees to learn from their failure in grant proposal writing and project milestone development, incubators must provide opportunities for incubatees to learn from these experiences to ensure that they have broad competencies and skills to tackle business development challenges upon their graduation from incubation programmes. As McAdam and McAdam (2008) aptly observe, the significance of incubation programmes depends on their tailoring to the distinct hurdles encountered by tenants in various stages of their entrepreneurial life cycle. This view coheres with the characterisation of TBIs as property-based initiatives designed to avail tenants with a constellation of value-added services such as capital, business support, opportunities for networking, professional services, and university resources based on TBIs' value proposition (Mian et al., 2016; Lamine et al., 2018). **Proposition: The distinctiveness of incubation mechanisms of TBIs lies in the richness of entrepreneurial learning opportunities they avail to incubatees.**

8.3.3.3. Incubatees' perceptions of the role of intellectual capital

The views of incubatees on the role of intellectual capital in facilitating and constraining incubation processes were elicited. The codes extracted from incubatees' transcripts relate to "legal support" and the use of "diverse specialised services" of the incubator and these codes are elaborated in sections below.

a. Legal support

In terms of the intellectual support afforded by incubators, participant 20 emphasised legal support that facilitates the transfer of the copyright of her thesis from her previous university to her startup:

> *The incubation of our startup would not have progressed to a spinout if they (i.e., TBI B) had not given us the legal support to get the intellectual property [i.e., from her doctoral thesis completed at another university). So, through the incubator's assistance, we (i.e., the spinout) managed to get the IP from this university, and they released it for us. Without the incubator' support, we would not have spun out* (Participant 20).

The founder whose business was a spinoff from incubator B had recently completed her doctoral thesis with a highly reputable university, which has retained copyright of her thesis as required by the Intellectual Property Rights Act and Intellectual Property Laws Amendment Act 28 of 2013. Incubator B was instrumental in negotiating the transfer of copyright for some key value propositions, prototypes, and ideas employed in the creation of the startup. This demonstrates that incubators assist incubatees through the conversion of theoretical knowledge into applied research and the commercialisation of research outcomes.

b. Diverse specialised services

When quizzed about whether the incubator provided intellectual capital and whether such provision contributes to the realisation of business incubation, Participant 20, a founder of a spin-off company, complained about the quality of services rendered by incubator B:

> *So ideally, if I could choose an incubator at that time (i.e., when her business was incubated), for sure I would have chosen one that meets certain parameters. For example, I would pick one that provides facilities such as physical infrastructure, co-spaces for pitching business*

ideas, marketing opportunities, and one that gives my business greater visibility. I would choose a facility that makes provision for its incubatees to make phone calls. I would not say my incubator offers me any of those services. I also need a place where there is peer mentorship, one where there is an incubator here, and another one there and we can compare their activities and services. You know, this allows for the peer learning experience of incubates. We did not have anything like that. So, from that perspective, you cannot say it (the incubator) was incubating us. They were giving us services remotely from where we were, there was no systematic way of doing things. It looks like it was one-way traffic - we ask and we get advice, if we do not ask, we are not advised. So, it was not proactive from their side (Participant 20).

The incubatee's request for an ideal incubator with marketing channels, networking, and peer mentorship opportunities, including possibilities for comparison of technical services provided by different incubators, could be symptomatic of the minimalist perspective to resources provision availed by incubator B. While ad hoc, need-based provision of services drawing on a one-way, supply-side approach by the incubator could have been ideal for the service-oriented nature of this incubator, this seems inconsistent with the claim about this incubator being a one-stop-shop availing a diverse range of services. Consistent with institutional theory, stakeholders in possession of certain skills can reflexively perceive the limitations of the institutional arrangements availed by institutions and mobilise resources to stimulate institutional change (Rao et al., 2003; Eberhart & Armanios, 2020). The spinout founder's deployment of resources to access her copyright at another institution is an example of the TBI's harnessing of bridging resources to steer change from an incubatee to a spinout. Entrepreneurs can exploit contradictions (e.g., the one between the TBI's meagre resources and its readiness to support incubatees with accessing copyright) between practices inherent within institutions to steer system changes (Creed et al., 2010).

8.3.3.4. Innovation champion's perspectives on intellectual capital

The researcher also sought the views of innovation champions regarding the role of intellectual capital in supporting incubation processes. The only code developed from their transcripts was "technical competencies," and it is elaborated in sections below.

a. Technical competences

When asked to describe interactions that unfolded between the fabrication facility management and the incubatees, an innovation champion who was a senior executive manager of this facility insinuated some symbiotic learning exchanges between these participants that enhanced mutual transfer of knowledge and abilities in the incubation ecosystem:

Our role is to support and enhance the incubatees and entrepreneurs' existing knowledge,

> *skills, and experience with our knowledge, skills, and experience and to ultimately develop a very good, nice product* (Participant 2).

Similarly, when asked to relate his interactions with other colleagues and incubatees who collaborated with the fabrication facility, Participant 16 described how his affiliation was instrumental in accessing technical training in this facility:

> *In this fabrication facility, I was learning how to program electronics. I am a civil engineering trained person, but I was learning electronics. I was learning 3D printing, smart farming, water management, and crop systems, something out of my comfort zone* (Participant 16).

Although management and staff from this facility had high scientific and technical expertise in 3D printing, laser and cutting technologies, industrial product design, medical implant products, and smart farming, these competencies had to be complemented by entrepreneurs' existing knowledge, skills, and experience in other areas. This narrative premised on learning by doing, where incubatees experiment with new fields and techniques, is a fascinating yet effective approach compared to the supply-side of incubation emphasised in institutional theory literature (Hansen et al., 2000; Calzi, Dezi, Schiavone & Simoni, 2014; Zhao & Lee, 2019). The literature emphasises incubators gaining legitimacy from its stakeholders (e.g., incubatees, venture capitalists and government agencies) by offering a range of services to its incubatees. That narrative projects incubators as monopolies of knowledge – a position contested in the aforesaid findings. Consistent with the Knowledge spillover theory, these exchanges and collaborations between innovation champions and incubatees constitute a shift in attention from individual startups and resource endowments availed exogenously (e.g., through incubators) towards individual entrepreneurs' knowledge that can be generated through knowledge spillovers between themselves and other actors in the incubation ecosystem (Acs, Audretsch, & Lehmann, 2013).

8.4. ENVIRONMENTAL FACTORS THAT AFFECT TECHNOLOGY BUSINESS INCUBATION

This section explores the environmental factors affecting technology business incubation. Specifically, it focuses on the dynamism or hostility of the incubation ecosystem which manifested in selected factors such as the national entrepreneurship policy, regional funding policies for SMMEs, regional innovation culture, and the legitimacy of incubation processes from the perspective of different stakeholders. The next section presents and discusses the first dimension of incubation ecosystem dynamism namely, national policy on entrepreneurship relative to business incubation.

8.4.1. National entrepreneurship policy

Several national policies in South Africa emphasise entrepreneurship and therefore, to avoid confusion on the policy in question, stakeholders were expected to relate to any specific policy they were acquainted with. While some participants highlighted their awareness of a specific policy on entrepreneurship and expressed its shortcomings, some did not have any such knowledge. The next section discusses incubation funders' perspectives on the role of national policy in supporting or constraining TBI.

8.4.1.1. Funders' perspectives on the contribution of national entrepreneurship policy to TBI

The "localisation of national innovations," "inclusivity in development," "social transformation and capacity building," "facilitation of SMME development," "tender-based orientation to incubation" were the codes that emerged from TBI funders' narratives. These codes are discussed consecutively in the sections below.

a. Localisation of national innovations

To establish the extent to which the favourability or hostility of the incubation environment affects TBI processes, the researcher sought incubation funders' views on how national policy on entrepreneurship facilitated or constrained incubatees' incubation processes. Participant 10a, a middle-level manager of a public funding agency, reiterated the following in a focus group discussion:

> *The Department of Science and Innovation (DSI) established the National System of Innovation whose purpose is to strengthen regional innovation ecosystems that support incubation and business development. This means that there is a regional context or geographical reach that the national landscape of innovation must address. So, you will probably find that the same principles that apply at the national level regarding innovation ecosystem and supporting business development, also applies at the regional level. The innovation ecosystem we have adopted at the regional level comprises various players which are knowledge generators such as universities, the industry, government, and civil society. We are trying to create and encourage partnerships that are credible at the regional level to support socio-economic development through innovation at local levels* (Participant 10a).

It is clear from the excerpt above that national policy on developing innovation ecosystems is instrumental in developing and supporting regional innovation, supporting regional socio-economic development, which consequently drives incubation and business development. This view on the decentralisation of the national system of innovation to regional and local levels resonates with the imperatives of the White Paper on Science, Technology, and Innovation (2019), which seeks to enhance the culture of innovation at societal levels through social and grassroot innovation and supporting local transformation processes to uplift the marginalised groups. The active role the government plays in steering innovation ecosystems through their funding mechanisms and coordination of partnerships contradicts the functioning of ecosystems elsewhere. From an entrepreneurial ecosystem theory, entrepreneurs and executives of successful IT companies located in Silicon Valley, US, exploit their financial muscle and technical prowess in creating innovation ecosystems and prototyping their innovative activities at regional and local levels (Williamson, 2018; Syed & Magd, 2020). Put differently, because of their resource munificence, these entrepreneurs and IT firms have more capacity and dominance in steering the nature, shape and size of innovation ecosystems with little government intervention. Although the replication of national strategy on innovation at regional and local levels could be sensible in the region where incubator A was located (large metropolitan area with wealthy, successful serial entrepreneurs), this strategy might not have worked for the region where incubator B was located (where a nascent innovation ecosystem was beginning to be established). This is because while the location of incubator A is marked by a highly unequal society and the visibility of innovation and knowledge transfer from the academia to society (four universities with distributed campuses), making a redistributive approach to innovations desirable, the region where incubator B was located had limited pockets of innovation and limited knowledge transfer unfolding from the two universities in the province to communities and industries. **Proposition 1: Due to differences in resource endowments and success of innovation ecosystems across South African regions, replicating best practices of the national system of innovation at regional and local levels may not work across regions. Proposition 2: A one-size-fits-all approach to employing innovation policy to galvanise and synergise local economic development (e.g., through incubation) may not work across regions as contextual circumstances vary widely.**

b. Inclusivity in development and social transformation

When asked to explain whether national policy on entrepreneurship plays a role in supporting incubation, the respondent in this discussion group said:

> *You may be aware that startup innovation is an outcome of interactions. So, one of the critical elements of the national system of innovation is that a successful innovation ecosystem depends on interactions among key players. So, within the [i.e., region when incubator A is located] network, the government is trying to build a network, but we acknowledge that [location mentioned] is a very advanced ecosystem. They have capabilities and their industry is operating at an advanced level compared to other innovation ecosystems* (Participant 10b).

He elaborated:

> *So, this network is about taking advantage of the existing ecosystem there and including those who were previously excluded in the innovation landscape and integrate that system for all people. What is lacking in that region is inclusivity. The region is isolated somewhere in the world enjoying all the benefits in terms of science and technology while groups in the townships are struggling. So, the challenge is creating value through socio-economic development given the socio-economic challenges that we are facing. I think we must acknowledge that ecosystems are different, especially innovation ecosystems. We have*

various ecosystems and various levels of development. Probably in the [name of province mentioned] you would find that you have another networking platform (Participant 10b).

Although innovation ecosystems drive incubation processes and activities, for this public funding agency, creating incubation programmes and activities was not the immediate goal but promoting innovation ecosystems, socio-economic development and greater social inclusivity. The detailed narratives above demonstrate the capacity of national policy to indirectly shape incubation by creating a conducive environment for incubation to thrive. This view is consistent with the White Paper on Science, Technology and Innovation's (2019) emphasis on generating local innovation ecosystems that promote greater inclusivity through the building of more linkages across the system of innovation where businesses would thrive. The National Development Plan (2010) also emphasises greater inclusivity through increasing investment and innovation among SMMEs in the marginalised rural and peri-urban areas.

c. Inclusivity through capacity building

One response to the question on the role of national policies on entrepreneurship in promoting incubation processes emphasised the fostering of capacity building in communities through physical and virtual incubation. In response to this query, the senior executive manager of a public funding agency explained:

> *Although creating some localised innovation spaces has been the mainframe of Small Enterprise Development Agency (SEDA) when they were creating these incubators, what [name of her national funding agency mentioned] has done is to create a new programme since last year called The Living Lab Programme where we create physical infrastructure in the communities where individuals live. These communities can walk in, innovate, incubate, and they can leave the lab with market products and business skills. This is a national project that is shaping the incubators. Another example, there is a strong move [i.e., by the government through her funding agency] towards digital incubators -those incubators that are dealing with digital skills. There are some strong indications of virtual incubation in government policy such as National Policy on Science, Technology and Innovation as well as SMME development policy. In other words, you do not come into a physical space, but rather sit in the comfort of your own home and you get all your skills and if you need office space, you rent it based on the hours used. So, all these different policies are shaping the incubation processes* (Participant 14).

Therefore, capacity building in local communities manifests in the creation of physical infrastructure for business skills transfer, market product development, and acquisition of digital skills. This finding resonates with South African government's commitment to the entrenchment of human capabilities through the expansion of innovation and research infrastructure, strengthening of human skills, as well as the advancement of a science-literate and science-aware society (White Paper on Science, Technology and Innovation, 2019). This finding also coheres with some initiatives unfolding in other emerging economies. For instance, it resonates with the contribution of the Indian government policy to fostering an entrepreneurship and innovation culture, where creating an inclusive society in the State of Gujarat was one of the key imperatives (Akiwatkar & Bhati, 2016).

The staff of another public funding agency also reiterated the role of national policy in supporting human capacity building, which indirectly supported incubation processes. For example, Participant 10a specifically mentioned the critical role that the Department of Science and Innovation (DSI) plays in strengthening the entire national system of innovation:

> *I will talk about one of the DSI mandates, which is to strengthen innovation ecosystems. They support that at various levels such as human capital development and provision of R&D incentives and that is what we are doing with the regional innovation support programme. So, this programme is one of the DSI's programmes that originates within the [name of research council mentioned] to strengthen the regional innovation ecosystem. What the DSI is trying to achieve is to strengthen regional innovation ecosystems, which means that there is a regional context or geographical reach it is striving to achieve* (Participant 10a).

One infers that although incubation services were not the intention of this research council and DSI, human capital development and provision of R&D incentives that support innovation ecosystems could invariably facilitate spillovers into incubation in cases where such interventions are accessible to incubators and incubatees. Such a focus on human capital development as a driver of innovation ecosystems, which would indirectly affect incubation ecosystems, is at the heart of generating a balanced distribution of well-trained workers in critical sectors of the national economy (National Advisory Council on Innovation, 2019).

d. Facilitation of SMME development

While the effect of national policy on incubation processes was somewhat inferred in the aforesaid narrative, the senior executive manager of a funding agency was more incisive and categorical on this matter:

> *National policy is extremely important. I think it is widely recognised by the Department of Small Business Development, the Department of Trade and Industry, the Technology Innovation Agency (TIA) and the Department of Science and Innovation that incubation processes are extremely important. So, there is a policy around SMME development and incubation which many government departments have embraced. We have a White paper on Science, Technology, and Innovation, the one that prompts innovation and asks for mechanisms to facilitate SMME development and incubation at local levels, asks for support to areas where you will not necessarily give support. It means that we now need to create areas where innovators can come in and get support for SMMEs and incubation processes* (Participant 14).

One senses that the wider institutional establishment in government departments appreciates business incubation, judging from the broad policies, strategies and processes designed to support SMME development and business incubation. This strong focus on SMME development, incubation, and provision of support at local levels resonates with the Department of Trade and Industry's commitment to SMME development through its signing of a collaborative agreement with an obligor to provide a full suite of Product Lifecycle Management (PLM) software to the Council for Scientific and Industrial Research (CSIR) to support SMME development through the various product lifecycle stages (Industrial Policy Action Plan, 2018/19 - 2020/21). That said, these initiatives have not translated into the development of a swathe of SMMEs in both regions where incubators A and B are located, notwithstanding the comparatively higher numbers of incubatees in incubator A than B.

e. Tender-based orientation to incubation ("tenderpreneurs")

Regarding the role of national entrepreneurship policy in supporting or undermining incubation processes, one of the middle-level managers of a private national institution (i.e., a private bank) that funded incubators A and B observed that:

> *We understand that entrepreneurs are part of society, right? As such, when they join our programme, they reflect societal norms and perceptions. For example, the general perception is that entrepreneurship is necessarily about either being able to get contracts or tenders from government departments or big companies. You will find a tender-based orientation to incubation to put it blankly. So, then you need to help them change their perceptions of what a business is - an independent entity, which is feasible, viable, and sustainable. Those are some of the challenges that they (i.e., incubatees and SMMEs) were experiencing. I am sure that you are aware of the effect of the broad-based black economic empowerment (BBBEE Act) especially on black entrepreneurs* (Participant 15).

Therefore, incubatees from incubators A and B exhibited a "tenderpreneurship" mentality where the sustainability and viability of their startups were tied to their political connections in government departments offering them tenders. This finding gels well with the conception of a 'tenderpreneur' as a South African entrepreneur who marshals political contacts to secure government procurement contracts (i.e., 'tenders'). This characteristically is in exchange for extending favours or benefits to politicians or public servants in government bureaucracy (Piper & Charman, 2020). As such, the term "tenderpreneurship' carries negative connotations of corruption, nepotism, and patron clientelism arising from the subversion of tender procedures in favour of undeserving tender applicants, thereby supporting informal and/or political affiliation (Piper & Charman, 2020). This constitutes an abuse of the preferential policy of BBBEE, which targets black emergent entrepreneurs (including incubatees) for government tenders and contracts, to cushion their businesses from historical disadvantages imposed during the Apartheid regime. **Proposition: While incubators may accommodate different incubatees' conditions by**

pursuing different incubation strategies (e.g., poor growth strategy, or pro-poor strategy involving financially supporting incubatees with sub-optimal performance) depending on their goals, imperatives and resources endowments, the pursuit of good business principles (e.g., feasibility, viability, and sustainability of business) must form the cornerstone of all business incubation practices and processes.

8.4.1.2. Incubator management's perspectives on the role of national policy in supporting TBI

The study sought to establish the university incubators' perspectives on how national entrepreneurship policy affected (or did not affect) incubatees' involvement in TBI in South Africa. The codes that emerged from incubator management's transcripts were "invisible and ineffective policy," "TBI KPIs and shift to applied research," regional systems of innovation" and "shortcomings of national policy." These are elaborated in the sections below.

a. Invisible and ineffective policy

In response to the question on the contribution of national entrepreneurship policy to TBI of incubatees, a senior executive manager of incubator A observed that:

> *Maybe I have not been here [in South Africa] long enough to say what impact it has. However, I have never heard of that policy. So maybe it is not doing enough. I guess, if it were doing a really good job, surely, I would have heard of it, but I do not know it* (Participant 11).

While this senior executive manager's lack of awareness of the national policy could be surprising, it must be understood in context as he was an expatriate who had been recently appointed (was just 7 months in this new position). Therefore, his grappling to understand the effect of national policy on TBI was understandable. However, a lack of knowledge of policy among business players (e.g., entrepreneurs, business incubators) together with the prevalence of excessive regulation and "red-tape" in terms of business legislation, were highlighted as major drawbacks of doing business in South Africa that collectively explained the nation's poor ranking (i.e., 82nd globally) on the Global Entrepreneurship Index (Matjhabeng Local Municipality Local Economic Development Strategy 2019; World Bank 2019).

The senior executive manager of incubator B also professed ignorance when he was asked to explain the role of national entrepreneurship policy in shaping TBI processes:

> *Do we have a national entrepreneurship policy? I am not aware of it. Maybe, we have something like that, something along those lines? Yeah, that is a tricky one because I know one on innovation policy, yeah. I know that there is a policy promulgated by the Department of Science and Technology but a national entrepreneurship policy, I am not aware of*

anything. In my view, there is nothing. I only know of Entrepreneurship Development in Higher Education (EDHE) (Participant 7).

Although the EDHE constitutes an initiative of Universities South Africa in collaboration with the Department of Higher Education, Science and Technology (formerly Higher Education and Training) to promote entrepreneurship development at the 26 national public universities, it is not a national policy promulgated by the government and gazetted as an Act of Parliament. This lack of awareness was surprising given the prominence of national policies that cover entrepreneurship and SMME development. For instance, the National Small Business Act (NSBA) of 1996 as amended in 2003 and 2004, provides a clear framework for the development of entrepreneurship in South Africa and the different ways through which SMMEs contribute to socio-economic transformation and local economic development.

Moreover, the White Paper on the National Strategy for the Development and Promotion of Small Businesses of 1995 also renders a broad framework for the support of SMMEs including how they could contribute to the national economy. In addition, the Preferential Procurement Policy Framework Act 5 of 2000 sets out the guidelines and principles of transparent, fair, and equitable procurement of goods and public contracting (i.e., tendering) for government departments and agencies by small, micro, and medium enterprises. Lastly, the Broad-based Black Economic Empowerment Act 53 of 2003 also stipulates strategies for mainstreaming black-owned businesses in the economy. It renders funding strategies for such businesses and reiterates support systems from the government available for such businesses.

b. TBI KPIs and shift to applied research

When the same question on the role of national entrepreneurship policy in shaping TBI processes was posed to incubator B's staff, different viewpoints were raised:

> *Well, national entrepreneurship policy is shaping university business incubation because now we have several KPIs (i.e., key performance indicators) that we [i.e., the TBI] need to achieve around business incubation. I mean national policy is also shaping our university in terms of research because now, we are trying to shift our research from just a focus on publications to also focusing on solutions and innovations for the market* (Participant 8).

The focus on creating key performance indicators for university incubation such as having spinoffs, creating jobs, supporting R&D, and the commercialisation of products demonstrates a shift from basic to applied research that focuses on solving complex societal problems through the commercialisation of innovations. This finding coheres with De Jager, Mthembu, Ngowi, and Chipunza's (2017) view that the generation of a cohesive and effective entrepreneurial ecosystem that drives social and technological innovations for socio-economic development is a function of the capacity of an entrepreneurial university to transition from basic research to applied innovative research.

c. Regional systems of innovation

When requested to explain the role of national entrepreneurship policy in facilitating or constraining TBI, participant 8's response was elaborate:

> *National policy has influenced our university's vision of wanting to be a technology-inclined university addressing socio-economic needs through an innovation ecosystem. I mean, that perspective is ingrained in the university's vision and is guided obviously by the national policy. But now, the policy landscape is changing, I mean if you look at the White Paper on Science, Technology, and innovation, it is shifting focus from what is called the national system of innovation to regional systems of innovation. This means that the government is looking now at devolving institutional arrangements and funding instruments for innovation to the regional and local levels* (Participant 8).

Although the White Paper on Science, Technology, and Innovation (2019) does not emphasise business incubation per se, it targets issues that have some relevance for startup development. These include deployment of public procurement by SMMEs as a conduit for deepening innovation, rendering greater support and collaboration among startups in the SMME sector and supporting the commercialisation of publicly funded intellectual property. The policy also seeks to augment the spatial footprint of innovation as well as deepening support for social and grassroot innovations (White Paper on Science, Technology and innovation, 2019). Therefore, the support for regional and local systems of innovation complements the South African government's vision of promoting greater inclusion through revitalising township economies, increasing SMME productivity through supporting women and youth-owned businesses (Cabinet Lekgotla, 2019).

8.4.1.3. Incubatees' perspectives on the role of national entrepreneurship policy in promoting TBI

The views of incubatees were sought regarding the contribution of national entrepreneurship policy in advancing (or constraining) TBI. The codes that emerged from their data related to awareness of policy or lack of awareness of the policy. The codes aligned to awareness of policy included: "incubatees' innovation and national funding," and maintaining "standards of compliance." These are elaborated in sections below:

a. Incubatees' innovation and national funding

When one incubatee from incubator A was requested to explain what role national policy on entrepreneurship played in the incubation of his business, his response concentrated on the generation of innovative ideas:

While incubator A is an outcome of national policy on entrepreneurship, I would say innovation in the incubator is not that strong and those innovations are not direct consequences of national policy. The exploitation of innovation or innovative ideas that enable my business to identify and exploit market opportunities comes from an innovation platform created in the region and not from national policy on entrepreneurship. There are no national policies that assist us in identifying and exploitation of market opportunities. There is little from national policies that helped us to identify, exploit and reach more market opportunities (Participant 21).

Another incubatee emphasised funding opportunities for his business:

We are contemplating to participate in an event organised by the Department of Trade and Industry (DTI), which we have applied for three times and have not succeeded. So hopefully we can succeed this year. Should we succeed, we will take number B and then we will say that yes government policies helped us to gain more market opportunities in Europe. Currently, there are little financial resources channeled through national policy. But these other softer attributes such as the fact that we are startup with less than R10 million revenue means that we do fall into B level four, which is also an advantage. So, we can say government policy has helped us in business development by establishing links to a British company that wants to get business from us. In terms of recruitment and appointment of staff with the right skills we have not really produced that much. In terms of looking for new market opportunities, if the Department of Trade and Industry can help us to get to this this event in Germany, we will have accessed foreign market opportunities. So, we hopefully can get these business development benefits from a policy perspective (Participant 22).

These narratives demonstrate that, while national policy on entrepreneurship was not instrumental in generating innovative ideas per se, the policy could contribute to technology startups through enabling accessing foreign markets for sale of technology goods. Consistent with institutional theory, the finding on the incapacity of national policy to shape innovation capabilities of startups resonates with the concept of institutional voids, which describes environments in which existing institutions and policies are incapable of or insufficient for guiding and supporting specific entrepreneurial behaviours (Mair, Marti & Ventresca, 2018) such as business incubation practices and processes. However, the claim that national policy is contributing to internationalisation coheres with the view that a strong promotion focus in national policy is instrumental in gaining foothold in overseas markets (Santos & Garcia, 2018).

b. Standard of compliance

Incubatees' perspectives on the role of national entrepreneurship policies in promoting TBI were solicited. Participant 18, highlighted the institution of a standard of compliance as one of the positive outcomes of national policies targeting entrepreneurship to support the pursuit of startup business operations:

In the construction sector, the Construction Industry Development Board (CIDB) has a standard that I must comply with. I managed to get myself a CIDB level and when I apply for a tender or work contract, I submit my level which is part of the selection criteria for the appointment of a contractor. Compliance is every important. I mean you must be in *good standing with the Department of Labour, your Unemployment Insurance Fund (UIF) and your Compensation for Occupational Injuries and Diseases Act (COIDA) must be in order* (Participant 18).

Although none of the entrepreneurship policies are mentioned, one can infer that the policy that emphasises CIDB level, UIF, and COIDA combined could be Broad-Based Black Economic Empowerment (BBBEE) policy as it stipulates the preferential treatment of previously marginalised groups (e.g., black, Indian and coloured entrepreneurs) in the procurement of government services provided the emerging contractor (i.e., the startup) meets certain CIDB level and BBBEE scorecard criteria (Broad-Based Black Economic Empowerment Amendment Act, 2013). **Proposition: Conformity to a set of tending stipulations (rules, norms and obligations) guided by industry specific laws must be aligned with BBBEE principles (e.g., fairness, transparency, accountability and competitive practices) which contribute to economic growth.**

8.4.1.4. Entrepreneurship champions' view on the role of entrepreneurial policy in supporting TBI

Only one entrepreneurial champion expressed an opinion on this matter. He emphasised the complexities arising from the politicisation of policy as the main challenge facing incubation processes and his view is elaborated in the section below.

a. The politicisation of entrepreneurship policies

Overall, the effect of national entrepreneurship policy on TBI was not always desirable. For instance, Participant 5 lamented the risk of politicisation of entrepreneurship policies:

> *The challenge or weakness of some of the entrepreneurship policies, initiatives, or government agencies that render resources to entrepreneurs is that allocations are done at the highest political level, you know. As such, these policies get politicised by politicians when directing the allocation of resources* (Participant 5).

This politicisation of government policies, programmes, and agencies through resource allocations mechanisms by government departments presents a perpetual risk to the materialisation of TBI. For instance, the political goal of empowering socially marginalised groups could be prioritised at the expense of the feasibility of projects. This may scuttle the advancement of innovative ideas from non-designated racial groups as emphasis on historical disadvantage is amplified at the expense of technical soundness of projects. This view on the politicisation of the national policies on entrepreneurship strikes the chord with certain policies (e.g., BBBEE policy 2013, Preferential Procurement Policy Framework, 2000) which have been criticised for breeding "tenderpreneurs" through subversion of tender procedures and corruption. For instance, Shava (2016) laments the persistent fraud, dishonesty, and corruption in BEE procurement systems in South African government and municipalities. These fraudulent activities involve startups and SMMEs as contractors and consultants despite loud calls for ethical conduct in adjudicating and implementing contracts. Such politicisation deviates from the vision of the White Paper on the National Strategy for the Development and Promotion of Small Businesses of 1995 which provides a broad framework for transparent and equitable support to SMMEs including how they could contribute to national employment, economic growth, and poverty reduction. Perhaps, the prevalence of unsustainable levels of corruption and unethical behaviours fuelled by these policies explains why most SMMEs have struggled with transitioning into large enterprises.

b. Lack of awareness of policy

In tandem with participants who expressed dissatisfaction with entrepreneurship policy, some highlighted their lack of awareness of national policies and their actual benefits. For example, participant 20 highlighted that:

> *We did not encounter any national policy that affects our involvement in incubation. I did not even know that this policy exists* (Participant 20).

> *I am not that familiar with that national entrepreneurship policy (laughed)* (Participant 1).

This lack of knowledge speaks to the view that benefiting from institutional resources availed in the incubation ecosystem (e.g., knowledge of provisions of national policy and the national, regional, and local incentives and resources they provide) may not be automatic as it requires the incubatees to exhibit and tap into the knowledge of the institutional resources, incentives and contextual benefits availed in the system (Mitchell et al., 2002; McAdams & Pals, 2006).

8.4.1.5. Innovation champions' views on the role of entrepreneurial policy in supporting TBI

Regarding innovation champions, the only code that emerged from the role of national entrepreneurship policy in promoting TBI was the "ease of doing business "and this is explained in the section below.

8.4.1.5.1. Ease of doing business

When requested to explain how the institution of national policy on entrepreneurship has facilitated or obstructed TBI, participant 23's response was lukewarm:

> *National policy on entrepreneurship is quite important in creating an enabling framework, the guidelines and the rules of the game for business operations and for opening up opportunities for farming businesses. Although it is difficult to take national policy and makes it work well, the role of national policy is to streamline entrepreneurship strategies and processes thereby making it easier for entrepreneurs to enter the business space. Entrepreneurs want ease of entry into business through business guidelines or acts and those things have been put in place. I think nowadays, it is easier to start a business in South Africa. The only thing that is a challenge*

> *is accessing funding that is not always free. I think from a policy perspective, we must make it easier for businesses to start, easier for business to access funding, to have a host of funding and investment opportunities. So, I think the Ministry of Small Business Development has not engaged with these issues enough and even though there is some improvement in terms of easiness of starting businesses* (Participant 23).

This participant presents an interesting picture of national policy removing barriers to entry thereby promoting the ease of doing business on the one hand, and incapacity of national policy to tackle the complexities of accessing finance and investment opportunities on the other. In triple helix relations between government, universities and industry that make commercialisation of innovations of startups possible, the role of government is to create an enabling environment and ease the conditions of doing business, support collaborations through policy and provide funding mechanisms for startups to enhance entrepreneurial development (Rusk, 2017). This policy is yet to be fully leveraged by the state.

The lack of public funding to support startups partly validates Carrete and de Faria's (2019) observation that access to financing in developing economies is constrained by the limited government budget devoted to R&D and startup innovations, a lack of proven record by nascent innovators and academic entrepreneurs to qualify for innovation funding, lack of expertise to develop funding proposals for submission to public funding agencies.

8.4.2. Regional SMME Funding

Apart from national entrepreneurship policy discussed extensively in previous sections, the incubation ecosystem dynamism theme also comprised regional funding for SMMEs category, and this concept is discussed extensively from the perspective of the diverse participants of the study. The next section discusses the perspectives of funders regarding SMME funding availed at the regional level.

8.4.2.1. TBI funders' perspectives on the contribution of regional SMME funding to TBI

The "optimisation of funding through incubation," "strengthening regional innovation ecosystems," resource munificence" and "ad hoc and incoherent funding instruments" were the codes that emerged from raw data of TBI funders, and these codes are presented and discussed consecutively in sections below.

a. Optimisation of funding through incubation

Those participants holding a positive view of the impact of regional funding for SMMEs on TBI processes claimed that innovative entrepreneurial projects are usually strongly funded by public and private national agencies. Judging from the senior executive manager of a public funding agency's response to the question on the role of regional funding for SMMEs on the fostering of incubation processes, the incubatees with innovative business ideas had the proclivity of securing funding than their counterparts:

> *There is much funding available and accessible to startups although funding often targets incubation and innovative ideas. However, funding has been cut off this year (i.e., the year 2020) because of COVID 19. There are institutions such as SEDA that have more than 100 incubators and they are exploring the Living Lab as an innovative concept. There is innovation funding and we optimise TBI when we provide public funding* (Participant 14).

This finding on the availability of funding to support innovative SMME activities coheres with the 2017 South African SMME Access to Finance Report that affirms the availability and accessibility of funding for problem solving-oriented innovations as one of South Africa's feats in supporting technology entrepreneurship (FinFind Access to Finance Report, 2017). The provision of entrepreneurial finance to support the incubation process and new startups, the determination of sources from which funding must be secured, how funding contracts must be structured are inevitable questions in harnessing regional and local financial resources to create new business startups and scale up their viability (Owers & Sergi, 2019).

b. Strengthening regional innovation ecosystems

When asked about whether and the extent to which regional funding for SMMEs contribute to TBI in incubators A and B, participant 10a, a middle-level manager of a research institution that funded science and innovation research development, highlighted the following in a focus group discussion:

> *We must clarify that we are funding innovation ecosystems in [name of region stated]. We (the organisation stated) have been allocated special funding from the Department of Science and Innovation (DSI). It is their initiative that has been hosted at (their organisation mentioned) and this project is managed by (their organisation mentioned) for implementation on the DSI's behalf. What we are doing with [name of region stated] is not to support the incubation per se, but it is part of building an innovation ecosystem rather than the incubation ecosystem. So, Jimmy (pseudonym for the co-participant in the focus group) can explain what we are funding because we must split the [their organisation mentioned] - DSI equation, then split the incubation ecosystem out of the innovation ecosystem because what we are funding is the innovation ecosystem* (Participant 10a).

In responding to the same question, his colleague elaborated in the same focus group that:

> *One of the key mandates of the Department of Science and Innovation (DSI) is to strengthen innovation ecosystems. You are aware because there is always a mentioning of the national system of innovation (NSI). So, the DSI provides funding to strengthen the entire national system of innovation – so that is a holistic approach they are employing. However, they provide funding to support innovation at various levels including human capital development and R&D incentives. So, now, what we are doing with the regional innovation support programme – which is one of the DSI's programmes that our organisation was required to implement, is aimed at strengthening the regional innovation ecosystem and not incubation per se. That said, incubation is part of the innovation ecosystem even though innovation ecosystems and incubation ecosystems are two distinguishable activities* (Participant 10b).

The provision of financial support for the innovation ecosystem through national and regional and structures does not buttress the view adopted by the Entrepreneurship ecosystem theory that entrepreneurial ecosystems (which are components of innovation ecosystems) comprise dynamic socioeconomic structures enabled by individual-level actions (e.g. entrepreneurs, innovators, venture capitalists and university academics) (Spigel, 2015) designed to enable the distribution of resources through the generation and operation of startups (Acs et al., 2014: 479). The funding instruments were driven by governmental structures and state implementing agencies and not individual entrepreneurs or individual incubators per se. Therefore, even though these funding institutions were members of the entrepreneurial ecosystems and supported the allocation of resources towards productive activities but not direct support to the generation of innovative high growth ventures (Autio & Levie, 2017), these were not individual actors but institutional actors. **Proposition: The decentralisation of the development of the innovation ecosystem (from national system of innovation to regional levels) facilitates some resource (e.g., knowledge transfer, skills and financial resources) spill overs that indirectly benefit the incubation processes through indirect access to these resources.**

c. Resource munificence

Regarding his public funding agency's provision of regional funding to SMMEs, participant 10a reiterated in a focus group discussion that:

> *We used to fund the incubation activities in the country at the [name of science council stated]. At that time, we created the first three incubators in the country that were formalised. Currently, the Department of Small Business Development is still pumping out money to grow the incubators* (Participant 10a).

One senses the prevalence of resource munificence at the national level even though there is no specific mention of regional funding, which could insinuate a concentration of funding at the national level. However, he elaborated that a special funding package was also availed to fund grassroot innovation:

> *The grassroots innovation component at the DSI is funded through another programme. It is currently being managed at [name of the funding agency indicated]. They have a special set of funding to fund grassroot innovation at the township level* (Participant 10a).

Overall, the narrative of resource munificence was not supported by incubatees at the grassroots who complained about insufficient resources at the regional level (see the section on incubatees' perspectives). However, the capacity of national policy to support the creation of grassroots innovations finds expression in the creation of incubators (e.g., Free State Incubator) and science parks (e.g., Free State Science and Innovation Park) at regional levels to ensure the decentralisation and localisation of innovations (SEDA, 2019; SEDA, Free State Science and Innovation Park Project Initiation Document, 2019).

d. Ad hoc and incoherent funding instruments

The views of the middle-level executive manager of a private funding institution were inconsistent with those of the staff of public funding agencies that supported incubation initiatives of incubators A and B. When requested to explain whether regional funding by funding institutions to SMMEs affects or does not affect business incubation programmes that his institution funded, he highlighted:

> *Your question seems to draw a correlation between whether an entrepreneur gets funding from an agency and their participation in an incubation programme – the link of which I do not find because it is independent of their funding opportunities* (Participant 15).

One interprets that regional public SMME funding of incubation processes was independent of the private funding initiatives availed to incubation programmes to support entrepreneurs and startups. Therefore, there was a lack of synergy in funding opportunities as they related to university-based TBI programmes. One would argue that despite the prevalence of public and private funding mechanisms through which incubation and business development activities could be supported, these funders did not liaise and collaborate to ensure the greater economic and social impact of funding availed.

8.4.2.2. TBI management's perspectives on the role of regional SMME funding in incubation processes

The views of TBI management were also solicited regarding the role of SMME funding availed at regional level in incubation processes. "Harnessing incubation structures to access funding," "localisation of skewed funding instruments," and "laissez-faire vs incubator regulated approach" were the main codes that emerged from raw data relating to incubator's perspectives regarding this matter. These are elaborated in the sections below.

a. Harnessing incubation structures to access funding

When requested to describe whether regional funding for SMMEs affected TBI, Participant 7, recounted how R1.1 million was secured at a particular university with the help of the technology transfer office (TTO):

> *"A total of R1.1 million was secured from the Water Research Commission under the water technology demonstration programme - an initiative of theirs and the Department of Science and Innovation. The incubatees applied for the funding with the help of the TTO at the university* (Participant 7).

Similarly, Participant 12 affirmed that: "*We received funding from South African Breweries (SAB), under the programme called SAB kick start, and the incubatees and startup businesses have managed to succeed"* (Participant 12).

Although funding was availed to the incubatees and the incubators, in the case of the incubatees, this constitutes national funding as it was availed by a national funding institution (i.e., National Water Commission). In the latter case of SAB, it was regional funding provided by a private player and the provision of this funding contributed to the success of the incubatees. The entrepreneurial success of firms that received funding coheres with the view that entrepreneurs who access financial resources irrespective of levels (e.g., national or region or local levels) to support their startups often exhibit success in the generation of increased income streams, employment opportunities, and reduction of poverty among low socio-economic groups (Dzansi & Atiase, 2014; Atiase & Dzansi, 2019).

b. Localisation of skewed funding instruments

The study also solicited TBI management perspectives on how SMME funding in their respective regions affected their engagement in TBI processes. The senior executive manager of incubator A professed that:

> *Yeah, regional SMME funding is one of the missing links in the ecosystem. There is not much funding in this region. Also, South Africa is a small market from a venture capitalist perspective. There are few government grants and there is not much in terms of development finance. The lack of SMME funding in this region makes incubation difficult* (Participant 11).

The lack of regional funding was presented as a major constraint for the effective operation of incubators and incubatees at local levels. While the paucity of venture financing and development finance were logical observations, this perspective was inconsistent with the range of funding instruments availed by several government departments in South Africa at national levels. One could infer that these funding instruments did not cascade to the lower levels where they were most needed by incubators and entrepreneurs. The need for greater funding at the grassroots buttresses the calls for greater inclusivity in funding among the marginalised groups through availing capital necessary to increase the depth of entrepreneurial activities (Helmes, 2006; Khavul, 2010). Hierarchical organisations coupled with complicated resource provisions (e.g., complex funding mechanisms) are deemed to stifle technology commercialisation and the development of technology-based enterprises (Cetindamar & Bayham, 2019).

In response to the question on how funding from regional bodies (i.e., regional SMME funding) impacted or did not impact business incubation processes, a senior executive manager of incubator B concurred with the sentiments of senior executive manager of incubator A:

> *That is where the problem is because the policy that focuses on the region has just been established now. It is only now that the White Paper on Science, Technology, and Innovation was promulgated. It was effected last year (i.e. 2019) so this is new. However, the Department of Science and Technology still must work on the 10-year Innovation Plan to inform that new White Paper to see how funding can be localised at a regional level. This is because currently, funding is really at the national level. If you look at where the Technology Innovation Agency is located, it is national level. The same applies to the Small Enterprise Development Agency and the Department of Science and Technology instruments - they are all at a national level and not at local levels* (Participant 8).

This narrative corroborates the perspective of senior executive manager A on the paucity of funding in the regional and local innovation ecosystem which negatively impacts the growth and sustenance of TBI and incubatees. While a lack of funding undermines incubation processes the converse of that notion is also plausible - that access to funding to pursue entrepreneurial goals increases the sustainability of venture creation and sustainable startups (Uddin, Shahbaz, Arouri & Teulon, 2014, Atiase & Dzansi, 2019).

c. Laissez-faire vs incubator regulated approach

The middle-level manager of incubator B was also interviewed on whether and the extent to which regional funding of SMMEs impacted TBI at his university. His response distinguished the impact of funding on the incubatees operating independently from that of those regulated by incubators:

> *Funding plays a big role in the success of all startups and has been a key contributing factor to the success of small businesses. However, the funding provided through the incubation programme has proven to be more positive and measurable than that of SMMEs operating independently because we have had SMMEs who received funding from different entities. Those SMMEs that were not under an incubation programme that received funding from NYDA and private funding agencies did not use it for their firm activities but other things. But when channelled through the incubator such funding yielded more results and success for many startups. For example, we had funding from South African Breweries (SAB) under the programme called SAB kick start. It has run for two years at our university. Simply because the funding was channelled through the incubator, startups managed to expend the funds for business development, and the businesses succeeded in being incubated* (Participant 12).

This middle-level manager elaborated:

> *This (i.e., funding channelled via an incubator) can be contrasted to funding that has been received by startups running independently. I am referring to NYDA because they came to my office to see how best we can work with each other so that if they give funding to startups, such startups must join the incubator so that when they release the funds, they will be focused on incubation processes of the incubator to ensure that funds are used directly to benefit startups. So, funding has always been a key factor in the success of SMMEs but only if harnessed through the formal structure of incubators. However, if it is funding that does not have rules and regulations, then the startups end up using the money for purposes that are not specifically for the business* (Participant 12).

He explained:

> *Yes, funding needs a regulatory structure such as an incubator. If it does not have regulatory structure and performance expectations, to say in six months or one year of this funding period, these are the results we need to see, then that funding is as good as flushed down the drain. This is because many startups end up supporting the business as well as their personal lives with those funds if there is no guidance and the time frame regarding targets and milestones. So, while funding is a good mechanism, it must be managed by a good structure and expectations in form of a business funding contract. That contract can only be exercised through incubation, the only structure where the processes can be implemented. When startups spend the money, they must report on what they have done with the money, how much they spent, and over how long. Those must be results that can be measured* (Participant 12).

Although a laissez-faire approach to regional SMME funding can give startups much latitude in terms of spending allocations and focus areas, such an approach tempts startups to misappropriate and abuse funds, especially the nascent entrepreneurs. On the contrary, channelling funds through an incubator renders a formal structure to activities of incubatees, facilitates the monitoring and evaluation of incubatees' actions and activities against incubation programme goals and activities. Therefore, while research often distinguishes between publicly sponsored incubators that emphasise the realisation of broader socio-economic goals (i.e., job creation, poverty reduction, and social empowerment) from private-independent incubators which target increasing business profitability and private-corporate incubators which target contributions to their mother corporation's strategic goals (Hausberg & Korreck, 2018), this characterisation negates the distinction between funding directed to incubator-regulated incubatees and that channelled to entrepreneurs operating independently.

However, when the question on whether and the extent to which regional SMME funding affected TBI processes was posed to the senior executive manager of incubator A, his response to evasive:

> *Maybe it enhanced the incubatees' involvement or not at all but that depends on whether the SMMEs we indeed incubated and whether they got some funding through the Small Enterprise Development Agency and National Youth Development Agency (NYDA). However, Kgotso (pseudonym) will be more informed because he used to compile reports to the Deputy Vice-Chancellor on these things* (Participant 7).

One infers the lack of awareness of this senior executive manager regarding the association of funding with TBI processes.

8.4.2.3. Incubatees' perspectives on the role of regional SMME funding in TBI processes

Regarding the question on the role of regional SMME funding in TBI processes, most incubatees emphasised certain funding constraints. For example, participant 18 emphasised the challenge of private investors who insist on incubatees having coherent, well-developed business plans as one of the preconditions for securing funding from them:

> *When you need funding, you must go to investors and must have a business plan. However, that is more applicable to someone who is operating a sustainable business than to my engineering and construction business that relies on work contracts. When you do your financial projections, you cannot make some projections based on contracts* (Participant 18).

From an institutional perspective where regulative norms and procedures relating to funding impose "regulative isomorphism" (i.e., expected rules of engagement and conformity behaviours) (DiMaggio & Powell, 1983; Hsu, Maccari, Mazieri & Storópoli, 2018), one would anticipate incubatees operating contract dependent businesses and nascent entrepreneurs without competences in business plan development to experience challenges in accessing funding from such investors. From an institutional perspective, institutional fields regulate the actions and behaviours of institutions located within these fields and they constitute the source of institutional conformity and embeddedness pressures (Zietsma, Groenewgen, Logue, & Hinings, 2017). However, these institutional fields can also facilitate the fostering of an institutional infrastructure in which the embedded actors interact with each other predictably (Hsu et al., 2018).

When asked to explain the contribution of regional funding for SMMEs to enhancing incubation processes, participant 21's response was centred on grants:

> *The [name of region provided] region is known to be offering university and industry-supported grants, which helps to support innovation-based research at the university. That has helped incubation processes tremendously with converting new ideas generated into prototypes or attracting entrepreneurs and startups that provide inputs for generating ideas or better ways of approaching the market* (Participant 21).

As Carrete and de Faria (2019) rightly acknowledge, the inception phase of the venture life cycle comprising the conversion of basic and applied research ideas into a business startup, is normally financed by the university, public funding agencies and private companies as a sunk cost. This stage can be contrasted with commercialisation and growth stages of the business where venture capital, angel investment and private financing become the more dominant forms of funding.

8.4.2.4. Innovation champions' perspectives on the role of regional SMME funding in TBI processes

The views of innovation champions regarding the role of SMME funding at regional level in supporting TBI processes were solicited. "Staggering funding allocations" and "commercial viability" were the main codes that emerged from participants' narratives based on the regional SMME funding theme. These are elaborated on in subsequent sections.

a. Staggering funding allocations

Acknowledging the scarcity of funding, Participant 2 proposed the need to avail smaller funding amounts over the long-term on a sustainable basis than committing large amounts as "quick fixes" that sustain the startups on a short-term basis: "*I think that public agencies should commit less money per annum for five years or so. That way, at least we know that this funding will be available* than commit larger amounts *over the short term*" (Participant 2). The view on committing limited resources yearly to startups is consistent with the common narrative in the literature that the amount of funding and resources committed to organisations have a direct effect on the volume of services, quality of products, level of development of organisations (Frølich, 2006; Rosenbloom, Ginther, Juhl & Heppert, 2015; Irfan, 2020). Based on this observation while committing insignificant amounts could guarantee incubation and venture creation activities in the long term (by spreading small amounts over longer durations), the dilemma is that, for firms at mature stages of their venture creation cycle with established mass production chains, small funding amounts may compromise the quality and volume of products and services availed, thereby undermining their growth potential.

b. Commercial viability

Participant 16's view highlighted the extent of commercial viability as one of the prime determinants of access to regional funding for SMMEs:

> *If what incubatees and entrepreneurs are doing has viability for commercialisation, then funds are there to let them hit the ground running unless they cannot prove the viability of commercialisation. Once you encounter a laudable idea, the money is there to help incubatees get going* (Participant, 16).

The availability of funding to support innovative projects which have commercial viability including the need to provide evidence of legitimate economic and social benefits to be derived from funding finds support from the literature which emphasises these considerations as logical foundations for the disbursement of funding (Gomez, 2016; Baah, 2020).

8.4.3. Regional innovation culture

The other category under the incubation ecosystem dynamism theme was the innovation culture of the region. From an organisational perspective, innovation culture is the extent to which a company is suitable for developing innovations or resists innovation (Aksoy, 2017). Innovation culture captures an interpretive framework or the prism through which employees interpret their contribution to innovations including the commitment of their organisation to the process of innovation (Turró et al. 2014). The innovation culture of a region, therefore, captures the extent to which organisations with specific regions are committed to the pursuit of breakthrough innovations, their receptivity to innovative and creative ideas including their openness to explore and contribute to such innovations. There were diverse views regarding the contribution of the regional innovation culture to TBI. While some participants acknowledged the existence of a culture of innovation in their respective regions, some observed the schism between the innovation culture at the national level and its limited expression at the regional level. These views are elaborated in the sections below.

8.4.3.1. TBI funders' perspectives on the role of regional innovation culture in TBI processes

"Fostering innovation through entrepreneurial training" and a "minimalist perspective of innovation culture" were the main codes derived from incubation funders' perspectives on the contribution of regional innovation culture to the realisation of TBI. These codes are elaborated consecutively in subsequent sections.

a. Fostering innovation through entrepreneurial training

In response to the question on whether regional innovation culture affects or does not affect incubation processes, a senior executive manager of a public funding agency that funded technology innovations noted:

> *A culture of innovation is necessary and recognised in the incubation process. A culture of innovation is necessary to further your business creation process positively. We can stimulate an innovation culture through the training of incubatees and SMME entrepreneurs by public agencies* (Participant 14).

The contribution of the regional innovation culture in entrepreneurship processes is somewhat acknowledged literature. For instance, Abhari, Ascue, Boer, Sahoo, and Zarei (2020) reiterate how knowledge sharing, transparency, and risk tolerance, which are dimensions of innovation culture, mediate enterprise social networks' effects on the performance of firms. Moreover, the role of training by public agencies in supporting incubatees and entrepreneurs is not affirmed in Akiwatkar and Bhati's (2016) study which postulates that although fostering a culture of innovation is instrumental in augmenting manufacturing industries and promoting the growth of SMMEs, the role of capacitating SMMEs through training is reserved to private institutions while the government creates an enabling environment (e.g. provision of basic infrastructure -roads, roads, and water supply) for SMMEs in the State of Gujarat in India. Put differently, although public agencies' availing public infrastructure indirectly fosters an innovation culture which supports the growth of new ventures, training of business startups and SMMEs was deemed to be preserve of private businesses with greater financial muscle to effect these practices.

b. A minimalist perspective of innovation culture

The employee of a private financial institution that sponsored the incubation processes of incubators A and B held a different view on whether and how employing innovation culture could foster (or hamper) TBI processes:

> *I think the concept of innovation itself is too broad and am not sure if I can make a direct link between innovation culture and incubation processes. As I said, we have entrepreneurs in the incubation programme, and we concentrate on helping them to think about the ways they can make their business or product relevant to solving problems in the market. And if by innovation, we mean the ability to identify gaps in the market or in their processes and systems with the view of changing them, then these are the things we focus on. But in its broad sense, it is too stretched to link innovation culture to anything that we do specifically* (Participant 15).

Similarly, participant 14 lamented that innovation is yet to be fully comprehended by business startups and established ventures: "*Innovation is not something that is well understood by many businesses and entrepreneurs"* (Participant 14). One infers that participant 15 interpreted the link between a culture of innovation and TBI through the prism of locating gaps in the market, introducing innovation in organisational processes and systems rather than creating and supporting a well-established tradition and practice of breakthrough innovations in a specific region or organisation. The concept of innovation was misconstrued by entrepreneurs from participant 14's perspective and was conceived from a minimalist perspective by participant 15. His focus on problem-solving does not cohere with a regional innovation culture's preoccupation with organisations' assimilation of transformative change that increases their ability to innovate continually (Verdu-Jover et al., 2018), thereby clearly demonstrating his conservative approach to developing an innovative culture.

8.4.3.2. Incubator management's perspectives on the role of regional innovation culture in TBI processes

"Knowledge spillovers and pockets of innovation," "nascent innovation system" and "barriers to the culture of innovation" were the main codes that emerged from incubator management's narratives on the role of regional innovation culture in supporting or constraining TBI processes. These codes are discussed in the sections below.

a. Knowledge spillovers and pockets of innovation

The senior executive manager of incubator A was interviewed on the role of the culture of innovation of his region in the incubator and incubatees' involvement in TBI processes. In response he affirmed:

> *I think the innovation culture in the region has helped in incubation processes. The [name of province] specifically [name of city] and the Winelands are good hubs for innovation. Having [name of university mentioned] and [name of another universitymentioned] which are world-*

class universities here, is important for building innovation through knowledge spillovers. So, I think the culture of innovation in the region is good even though it is still early and nascent innovation. There needs to be more capital and more probability for business incubation and development to accommodate the different incubatee experiences, but it is a good regional culture overall (Participant 11).

Therefore, innovation culture drove incubation processes, especially where more knowledge spillovers were catalysed by reputable research-intensive universities that also disbursed funds to support the development of startups and entrepreneurs at different incubation stages. The deepening of an innovation culture may contribute to incubators enhancing the capacity of incubatees to overcome the risk of failure through greater tolerance of risk. The culture of innovation facilitates the tolerance of risk because successful organisations appreciate the reality that failure is a natural part of the innovation process (Biemans & Griffin, 2018). The observation that the innovation culture was nascent and supported by two universities on the one hand, the fact that more funding opportunities that accommodated the experiences of incubatees at different stages of their venture life cycle were necessary on the other, points to the importance of diversifying funding sources to enhance incubation and venture development. The lack of diversification of funding options exhibited in the narrative above somewhat contradicts Carrete and de Faria (2019) who emphasise that the inception stages, testing and prototyping, customer base expansion stages of startups are normally financed by the university and companies, insider financing and bootstrapping, and debit financing (e.g., angel investors, venture capital and private equity financing) respectively, pointing to the diversity of funding sources. **Proposition: Transition to mature and sophisticated innovation culture necessitates diversification of funding sources of different stages of the incubation process.**

b. Nascent innovation system

When interviewed on the role of the innovation culture in the region in shaping business incubation processes, the senior executive manager of incubator B emphasised the importance of creating pockets of local innovations:

There is no culture of innovation in this region, so it is incumbent upon the university to establish such an innovation ecosystem. Firstly, starting with the university, we started with having an ideation facility, the fabrication laboratory, product development station, and all these structures supporting local innovations. So, we have started establishing that innovation ecosystem, but it is not fully established because ultimately we want to have a specific area of innovation (AOI), which may be in the form of a science park and innovation park (Participant 8).

One infers that the absence of a regional culture of innovation has contributed to the lack of impressive incubation performance at incubator B judging from the fact that less than 10 incubatees were successfully incubated between 2016-2019. The absence of a culture of innovation undermines possibilities of taking risks, which inadvertently undermines the proclivity of new firms to successfully incubate, pursue new great ideas and sustains the tension of creative talent by host institutions such as incubators (Recker et al. 2016; Abhari et al., 2020).

Participant 12 emphasised some semblances of a culture of innovation at institutions of higher learning:

> *The startups and business ventures find themselves in unique spaces for them to leverage intellectual property that is generated through the university. But outside the university, I do not think that anything is happening in terms of innovation in this region. There is an SMME hub at the corner of St George and Harvey Road, that is [name mentioned] SMME hub. However, if you go there and look at businesses that are operating there, they are selling chips, paraffin, and fast food. So, there is no innovation in their business activities* (Participant 12).

The issue of limited innovation culture in the region where incubator B was located was also affirmed by participant 8: *[Province mentioned] has a very low industrial base and the innovation ecosystem is not established. That makes it difficult for enterprises to flourish* (Participant 8).

Participant 17 concurred:

> *If you compare firms within Cape Town, Gauteng, or KwaZulu Natal, there is much venture capital and private equity within those regions. Enterprises and entities located in these spaces are better equipped and able to tackle innovations. That is not the case within the [name of province mentioned]. I do not think most startups understand what innovation culture is. Therefore, we might not have an innovation culture and obviously, this is exclusion within the university settings* (Participant 17).

To the extent that the innovation culture in a region is a multi-dimensional concept involving a shared traditions, common understandings, values and norms, and a common language which enables interactions among regional actors, the fostering of trust which promotes the exchange of knowledge cooperation, cooperation among firms, interorganisational networking and collective learning, and behavioural routines of firm in support of new ventures and new innovation trajectories (Trippl & Toedtling, 2008), none of the narratives speak directly to possession of an innovative culture. For instance, a lack of an innovation ecosystem, differential levels of ability to tackle innovations and lack of a mutual understanding of innovation all collective signals a lack of innovation culture in the region.

8.4.3.3. Incubatees' perspectives on the role of the regional culture of innovation in enhancing TBI processes

Concerning incubatees' perspectives regarding the role of the regional innovation culture in supporting

TBI processes, “environment germane for innovation,” “improving ways of thinking and business strategies” and the “need for awareness of innovation” were the main codes that emerged from incubatees’ transcripts, and these are discussed consecutively next.

a. Environment germane for innovation

The environment that TBI A was situated supported the innovation synergies through the creation of market opportunities, the rich agricultural base of the region, access to funding opportunities, including universities’ capacity to support knowledge transfer and provide intellectual manpower:

> *There rich innovation culture of our region has created new market opportunities because this region is an agriculturally intensive area. As such, we were able to go to some farms to test our hypotheses or test of the innovation which we are working on. There are also financial resources in the region, which have facilitated incubation through our university incubator. The incubator has also put us in touch with our current investor, so all those things are intertwined. In terms of the recruitment of staff, there are our students who are intelligent people who are studying. Upon their graduation, this helps ease access to trained personnel and provides pathways to new market opportunities. Just the fact that we are from [name of university given] and the promotion of agricultural technology space has a lot to do with our university, we do explore new market opportunities by having that environment of background or that regional background* (Participant 21).

The rich agricultural context for testing innovations, which avails funding opportunities through the incubator, provides a sustained supply of trained innovative personnel and creates new market opportunities collectively signal an environment that is receptive to innovation. As Van Scheers (2019) contends, the recruitment of qualified personnel with relevant skills who can be entrusted with the difficult role of creating new innovative ventures and securing untapped capital bring new resources that enables the firm to take more risks, promoting the growth and internationalisation of firms.

b. Improving ways of thinking and business strategies

Since knowledge sharing is at the heart of innovation culture as it facilitates employees’ positive perceptions towards open knowledge exchange within defined boundaries and promotes continual learning among them (Estrada, Faems & de Faria, 2016), the study explored whether a culture of networking persisted among incubatees operating in this region. Participant 18 affirmed the numerous events she was invited to attend, which enhanced her networking capabilities:

> *Every time I went to business networking forums, I met new entrepreneurs in different trades, and through these forums, I acquired more knowledge. Even though it was not directly related to my business or my industry, it improved my way of thinking about business. It also changed my strategies for conducting and approaching my business* (Participant 18).

The culture of networking created novel ways of thinking and transformed strategies for approaching venture creation. This finding coheres with the view that as a dimension of innovation culture, a culture of networking enhances innovation and business development opportunities by facilitating collective learning processes, enhancing collaborative communication, fostering trust, diminishing uncertainty among firms and facilitating joint problem solving (Trippl & Toedtling, 2008). As Bergek (2019) observes, the capacity to network facilitates knowledge development and diffusion, which deepen the knowledge base of individuals, allowing knowledge sharing among teams to create new combinations of knowledge.

c. Need for awareness of innovation

Some participants stressed the need for awareness of innovation to address the socio-economic challenges within the South Africa context. For example, participant 3 expressed the following sentiments when asked about the innovation culture in her region and its implications for TBI processes: *Unemployment in South Africa and this region is very high. Therefore, if we have more entrepreneurs in the university, it will motivate students to not only focus on their studies but also the feeling of trying innovation* (Participant 3). Therefore, innovation culture assumed an instrumental and normative turn where sustainable innovation was expected to contribute to impactful development outcomes (Godin & Gaglio, 2019) though generating employment opportunities. The lack of serial innovators and innovation role models in the university meant there were limited exemplars to learn from and hence the need to promote greater awareness of innovation.

8.4.3.4. Innovation champions' views on the role of the regional culture of innovation in TBI processes

Regarding the role of the regional culture of innovation in TBI processes, "Fourth Industrial Revolution", "managerial support" and a "lack of a sharing culture" were the main codes that emerged from innovation champions' narratives based on their transcripts. These are elaborated in the sections below.

a. Fourth industrial Revolution

In his explanation of how fostering a culture of innovation enabled the realisation of TBI process, one innovation champion highlighted:

> *In the last few years, we have seen a deepening culture of innovation in this region. We have seen many new innovative ways of conducting businesses, new business models and setting up of new funding connections and so there is a growing innovation culture. Many entrepreneurs are more into new innovations because of the Fourth Industrial Revolution which is the buzzword and are exploiting innovative opportunities derived from working in the innovative space. So, innovation culture is improving venture development as entrepreneurs are thinking about how technology can assist us to work more effectively and efficiently. So, definitely in our space, we have seen an increasing culture of innovation from a regional perspective* (Participant 23).

One senses that regional innovation culture exerts a positive impact on TBI through the creation of new business strategies, business models and new funding models that pave way for the exploitation of innovation opportunities and conducting business in efficient and effective ways. Regional culture of innovation is deemed to support knowledge intensive entrepreneurship involving the conversion of new knowledge (e.g., from R&D, professional and business practices) into new innovations, new business activities and sustainable firm growth (Kastelli & Caloghirou, 2014). As such, the culture of innovation sustains TBI through enabling startups to produce new products, higher added value, innovative ways of producing existing goods and establishing new systems of production (Kastelli & Caloghirou, 2014).

b. Managerial support

Concerning the contribution of a regional innovation culture to TBI processes, participant 16 highlighted that incubator B had embraced a culture of experimenting with new methodologies, practices, and processes routinely:

> *At this university, we try to do new things every day and always applaud innovation. If an academic entrepreneur is a staff member who is doing something of an innovative nature, senior management always highly applauds it. One staff member developed an artificial intelligence-based systems that combines sensors with indigenous knowledge on weather patterns to monitor and predict droughts. Another team developed recyclable bin with sensors for monitoring garbage levels. Yet another team of innovators are using additive manufacturing technologies to develop medical implants for reconstructive surgery. These staff members' names come up frequently in the faculty board, academic and senate meetings. So senior executives encourage innovation* (Participant 16).

This narrative coheres with the entrepreneurial ecosystem theory, which emphasises the importance of university executive management support in the sustenance and survival of entrepreneurial ecosystems. For instance, greater levels of management support are deemed to be critical to startup and incubation success (Bollingtoft, 2012; Soentano & Jack, 2016). This gels well with the view that a culture of innovation thrives when leaders have tolerance for uncertainty and on the contrary, innovative ideas are thwarted in situations where leaders are intolerant to uncertainty (Hostede & Minkov, 2010; Davies & Buisine, 2018). Although no direct reference was made to incubation per se but rather academic entrepreneurship, one infers that innovation culture fuelled by visionary leadership support could have facilitated incubation processes. The context of innovative culture comprised a relatively new university whose senior leadership envisioned transforming the institution into an entrepreneurial university of choice though developing innovation and entrepreneurial ecosystems that embraced academic entrepreneurship (student and staff), product development and additive manufacturing and creating a community of serial entrepreneurs in surrounding communities.

c. Lack of a sharing culture

However, participant 16 lamented the lack of a culture of sharing innovations and knowledge:

> *The main weakness of our innovation ecosystem is we [i.e., innovative academics and researchers] all hold to our creativity at an individual level so much. There is always an issue of "this is confidential …nothing must be disclosed". We always emphasise secrecy without weighing in the real result of this emphasis on confidentiality. We always bit around the bush when explaining our innovations and creativity* (Participant 16).

The culture of secrecy and limited disclosure was reasonable as this participant worked in a digital fabrication facility specialising in additive manufacturing where new products, industrial designs, and patents were at the coalface of their operations and hence the complexity of open sharing of information as these unique production capabilities gave the facility competitive advantage in the region.

8.4.4. Legitimacy of incubation

Over and above national entrepreneurship policy, regional SMME funding, regional innovation culture, the last category discussed under the incubation ecosystem dynamism theme was the legitimacy of the incubation. Since legitimacy relates to social judgement of acceptance, appropriateness, and/or desirability (Zimmerman & Zeitz, 2002), the legitimacy of incubation describes the social evaluation of acceptance, appropriateness, and desirability of TBI processes, models, activities, and actions from the perspective of internal and external stakeholders. The next section, therefore, discusses different stakeholders' perceptions of the legitimacy of incubation, starting with those of TBI funders.

8.4.4.1. TBI funders' perspectives on the contribution of the legitimacy of incubation to TBI processes

"Rejection of suboptimal performance" of public incubators by incubatees and "socially acceptable innovation" by incubatees were the codes that emerged from funders' discussion of the legitimacy of the incubation category. These are discussed next.

a. Rejection of suboptimal performance

The study investigated the role of the legitimacy of incubation in facilitating or frustrating TBI processes. The senior executive manager of the national public funding agency responded to this enquiry in the affirmative:

> *In terms of social acceptance, incubation is widely accepted through the creation of innovation cultures. I have no problem with social acceptance even though we have a problem with some innovative entrepreneurs who say, "I am not getting better benefits and results from this public incubator, so I want to move to another incubator." So, there are many private incubators and some incubatees like to move to those private incubators where they learn more about startups than from public incubators. So that is where you find no acceptance, but with regards to social acceptance from the public, I have not seen that being*

an issue (Participant 14).

Consistent with institutional theory's conception of the legitimacy of incubation as a generalised perception of the desirability and appropriateness of incubation operations such as events and activities (Suchman, 1995), one could argue that some incubatees regard public incubators' operations and activities as inadequate and hence unacceptable and undesirable. This perception of legitimacy is tied to the focal incubator and its professed benefits compared with alternative solutions (Bergek, 2019). The differential performance between public and private incubators contributed to some incubatees' attrition to private incubators where they secured more optimal results in terms of learning which would culminate in profitability, growth and sustainability of their startups. Since legitimacy comprises internal and external legitimacy, comprising social acceptance from the perspective of internal stakeholders and public stakeholders respectively, one could argue that there was limited internal legitimacy of public incubators by the incubatees even though there was external legitimacy of such institutions by the general public.

b. Socially acceptable innovation

The legitimacy of incubation can also be conceived from the perspective of social acceptance of technology. As Participant 14 stressed:

> *Sometimes you discover that a rural community is not familiar with a certain type of water toilet and entrepreneurs want to build that toilet for them. However, anything that replaces water may not be a socially acceptable innovation to some communities. So, for us (i.e., public funding agency), we deal with social acceptance of technology types to improve their acceptance in incubation programmes* (Participant 14).

This views gels well with the Technology acceptance model, which emphasises the conformity of technology to social norms as critical to its social acceptance and wider roll-out in communities. For instance, social normative beliefs were deemed to be significant factors influencing professionals' intention to use health technologies for cataract surgery (Gagnom, Sanchez & Pons, 2006). Since technology legitimacy is understood as compliance with rules and regulations (regulative behaviour), social norms and values (morally acceptable behaviour) and cognitive frames (expected behaviour) (Bergek, 2019), innovative technologies would be questioned if they were to create new problems such as health and environmental related issues or if their economic relevance were contested (Dewald & Achternbosch, 2016).

8.4.4.2. Incubator management's perceptions of the legitimacy of incubation's role in supporting incubation processes

"Social acceptance drives startup success," "hyped social acceptance of incubation," and the "lack of social acceptance" were the codes generated from TBI management's views on the contribution of the legitimacy of incubation to TBI processes. The views expressed under these codes are elaborated on consecutively in the next sections.

a. Social acceptance drives startup success

When asked to explain if a relationship existed between the legitimacy of incubation and TBI processes and activities his incubator participated in, the middle-level manager of incubator B highlighted:

> *The legitimacy of the incubation has been good. Social acceptance of incubation has been the key to the success of many startups. We have many startup companies created by students who had the perception that if they were incubated, their businesses would succeed. So, it means incubation is the way that most entrepreneurs are familiar with. They know that to guarantee the success of their startups, incubation must be the starting point. So, from a social perspective, incubation has been accepted generally and we also have a waiting list for many prospective entrepreneurs and student entrepreneurs who want to enrol in our incubation programme. They have accepted that incubation is the starting point for the success and booming of their young SMMEs* (Participant 12).

Despite this wider social acceptance, there was a disjuncture between such acceptance and incubation performance as this incubator had only successfully incubated nine startups between 2016-2019, raising questions on whether social acceptance culminates in the effectiveness of incubation processes. Information asymmetry relating to good incubators may preclude incubatees from knowing and accessing effective incubators, compelling them to stay in sub-optimally performing incubators.

b. Hyped social acceptance of incubation

The senior executive manager of incubator A's response to the question on how the social acceptance of business incubation influenced (or did not influence) the realisation of TBI processes was somewhat affirmative:

> *There is too much incubation in South Africa. There is a robust industry that exists around incubation, but I do not know if the incubators are having much success. Maybe, the environment is too good for incubation as there is too much government funding that flows through it. There are many different alternative motives that flow through incubation. In many places I lived, there are not that many incubators, but the ones that are there are building good businesses. So, the social acceptance of incubators is too high* (Participant 11).

One infers that although there are robust industries supporting incubation and much government funding is injected into incubation processes, the results are suboptimal. There are multiple competing motives, priorities, and intentions being sought concurrently in these initiatives (see sections on public funders' views on regional innovation culture-TBI relationship). This view on the hyped social acceptance of incubation despite suboptimal results contradicts the public narrative that institutions (e.g., incubators and accelerators) have significantly increased their operations to improve their social acceptance and social desirability (Yusubova & Clarysse, 2016). This desire to optimise incubator operations may not obtain where incubatees lack perfect information regarding the wide range of incubators available and their actual performance.

c. Lack of social acceptance

The perspective of management of incubator A regarding the contribution of the legitimacy of incubation to TBI processes was equally fascinating. The top executive manager of incubator B emphasised the lack of social acceptance of incubation in his response:

> *Well, the legitimacy of incubation has in a sense made us [i.e., TBI management] realise that what we are doing is not incubation, so we started over again. So, it (i.e., legitimacy of incubation) has allowed us to rethink, it made us make sure that we design a proper incubation programme* (Participant 8).

The lack of wider acceptance of the renting model in which incubatees were just given renting spaces with limited incubation support made this senior executive manager acknowledge the limitations of this model. This is because the renting model constitutes the first generation of incubation offering physical space exclusively (Bruneel et al., 2012; Mian, 2016) and this limited support could explain the disappointing incubation performance in incubator B.

8.4.4.3. Incubatees' views on the role of social acceptance of incubation in enhancing TBI processes

"Providing intellectual resources" and "public ambivalence" were the codes that emerged from the incubatees' narratives regarding the social acceptance of incubation. These codes are elaborated on in subsequent sections.

a. Providing intellectual resources

Participant 20 confessed that the legitimacy of incubation facilitated her access to intellectual resources:

> *We [i.e., her spinoff company] could not have signed an agreement with them [i.e., the supplier] because their [i.e., the supplier] nature was beyond the mandate of the university. Nevertheless, we [i.e., spinoff, the university, and supplier] signed the contract between the incubator and the supplier (i.e., service provider) even though the supplier was based in the US. So, the incubator assisted us* (Participant 20).

Similarly, Participant 19's sentiments resonated with Participant 20's views, affirming that incubatees' association with an incubator is deemed desirable by external stakeholders: *I think incubators have a very good reputation and if you put their logo at the bottom of your company website, then it creates a positive effect for your company or brand* (Participant 20). Moreover, Participant 4 contended that funders are more likely to fund businesses through incubation hubs: *There [are] funders or technology-oriented corporations who are willing to fund incubation hubs within the region* (Participant 4). Collectively, the findings relating to accessing funding, business networks and intellectual capital gel with the view that legitimacy facilitates the proper constitution of organisations, which increases startups' access to strategic resources critical to the success of these firms (Zimmerman & Zeitz, 2002). These findings complement the view that the legitimacy of incubators is enhanced through their development of successful operational models, coherent structures, and activities such as business consultancy and network opportunities, which attract startup teams (Yusubova & Clarryse, 2014). However, the overemphasis on providing funding support must not overlook the importance of identifying unsolved problems or new solutions to complex problems as the heartbeat of startup formation (Sharma & Vohra, 2021).

b. Public ambivalence

Some critics were sceptical about incubation for its failure to sufficiently tap into innovators' creativity and innovations. For example, Participant 19 points out:

> *The legitimacy of incubation is not all positive. Some people doubt the capacity of the incubation process to exploits entrepreneurs' ideas sufficiently. However, I do not think this view is widespread* (Participant 19).

This view somewhat contracts arguments based on the institutional theory that the support mechanisms of incubators such as rules and performance contracts render a more coherent approach to reducing uncertainty and risk for incubatees, and thereby accelerate the entrepreneurial process (Guerrero & Urbano, 2012; Mian, 2016). The next section is devoted to innovation champion's views on the role of social acceptance of incubation in enhancing TBI processes.

8.4.4.4. Innovation champion's views on the role of social acceptance of incubation in enhancing TBI processes

When requested to comment on whether and the extent to which social acceptance of incubation contributed to promoting incubation processes, one innovation champion highlighted that:

> *I think we need more from incubators. What we really want in our space, is how incubators can assist businesses to grow, to ascertain new technologies that startups can bring to the market, how incubators can facilitate incubatees to experiment with their ideas and their technology, how they can assist entrepreneurs to understand their specific market segments better. I think incubators can play a more significant role in making sure that businesses*

> *become more successful, which creates more legitimacy for them and their startups. We need more agricultural incubator that just focus on agricultural technologies. And that is something that we've been trying to think more about. I think this is also where the regional policy and the national policy should create strategies of ensuring that this happens* (Participant 23).

It can be inferred that social legitimacy of incubators in promoting incubation processes can be guaranteed if they create more germane spaces for incubatees to develop new technologies, segment their market, exploit their new ideas optimally and specialise in specific industries. Given the agricultural intensive nature of the area where incubators A and B are located, instituting incubators that specialise in agricultural technologies were desirable to increasing the legitimacy of the incubator among the surrounding farming communities. While the focus on technology, experimentation with ideas and market segmentation are largely devoted to pre-incubation (i.e. model development, business plan development, provision of pre-incubation activities), Sibanda (2021) contends that social legitimacy of incubators lie in their capacity to perfectly execute activities in incubatee creation (creating an incubation pipeline, business idea development), pre-incubation, incubation (business development & market enabling) and post incubation (business acceleration) phases of incubatees.

8.5. INDIVIDUAL FACTORS AFFECTING TECHNOLOGY ENTREPRENEURSHIP

This last segment of the chapter discusses the role of the individual, institutional and environmental factors in supporting incubation outcomes especially technology entrepreneurship (TE). As entrepreneurial outcomes of TBI, TE manifests in the formation of new technology startups that foster the *commercialisation of technology innovations* (e.g. increased scale of production, generation of technology goods, products and services), promote a *high growth-orientation* (e.g., through tenant firm's sales growth, employment growth, profit growth and increased capitalisation), *sustained revenue streams* (revenue generation, cash liquidity, increased return on investment) and increased competitiveness of startups and economy (Mitchell, Mitchell & Mitchell, 2009; Kuratko & Menter, 2017), which are the main foci of this study. High growth orientation describes the extent to which a new venture intends to create more than 20 jobs in the next 5 years (Wong et al., 2005; Guerrero, Urbano & Herrera, 2017). Other evidence of TE are greater knowledge spill overs among firms and greater investment in new knowledge industries (Audretsch & Keilbach, 2007; Kuratko & Menter, 2017).

The next section discusses the role of individual factors in supporting TE from the perspective of different stakeholders starting with TBI sponsors. For this study, technology entrepreneurship was understood from the perspective of technology-based firms' capacity to demonstrate *high growth orientation* (e.g. in terms of revenue generation, profit optimisation, workforce recruited and increased market share), *sustained commercialisation of technology innovations and applications* (e.g. increased scale of production of products, and services, number of products and services) and *increases in their financial expenditure* (e.g. capital generation, capital outlays) deployed to technology production processes. These individual factors that affect TE comprise intuitive thinking, heuristics, scripts, and perceived entrepreneurial capabilities. Collectively, the first three concepts are dimensions of entrepreneurial cognition. The section starts with sponsors' views regarding intuitive thinking's role in supporting TE.

8.5.1. Intuitive thinking

The first form of entrepreneurial cognition discussed is intuitive thinking. Since the success of business ventures is attributed to 'instinct' (Mehta, 2013), 'hunch' (Barrow, 2009), or 'gut feeling' (Welch & Byrne, 2001; Sadler-Smith, 2015), the study explored how different participants perceived the role of intuitive thinking in supporting TE. The next section discusses the perspectives of TBI sponsors on this matter.

8.5.1.1. TBI sponsors' perspectives on the role of intuitive thinking in supporting technology entrepreneurship

The codes generated from the views of sponsors regarding the role of intuitive thinking in supporting TE were "drive and passion during opportunity exploration", and "lack of association" and these are elaborated on in sections below.

a. Drive and passion during opportunity exploration

The study explored incubation sponsors' views on how the use of instincts by incubatees and entrepreneurs operating in the incubators they supported affected their (i.e., incubatees and entrepreneurs) realisation of TE:

> *Instincts can be used to incubatees and entrepreneurs' advantage especially when they seek out any opportunities. When we take on any new startup or a company, we avail them with a range of opportunities from other parts of the sector. They employ instincts to optimise the opportunities availed in the ecosystem such as finding new customers, new investment and funding opportunities which contribute to increasing their productive capacities, their revenue base, return on investment and profitability of their businesses. So, they use their gut feelings, and the two words that describe their use of instincts are drive and passion in their search for customers, search for funding opportunities and commitment to improving their routine operations* (Participant 14).

Using instincts to optimise on opportunities implies that entrepreneurs and incubatees employ instincts in their exploration, identification, validation, and to optimally exploit these opportunities availed by sponsors in the entrepreneurship ecosystem. The view of this public funding agency coheres with literature which suggests that the development of cognitive structures such as intuitive thinking are integral to making assessments about opportunity evaluation, the creation, and growth of new ventures (Mitchell et al., 2002; Urban, 2015).

b. Lack of association

When the researcher asked the staff member of a private financial institution about how incubatees and entrepreneurs that his organisation funded and supported employed gut feeling in their pursuit of TE, the response was negative: "*I am struggling to relate the process of them employing instincts when choosing to participate in an incubation programme and achieving technology entrepreneurship. I do not see any connection there*" (Participant 15). This lack of association between intuitive thinking and TE deviates from the narrative that intuition influences entrepreneurs' perception including the evaluation of their entrepreneurial self-efficacy as they are striving to establish new ventures (Kickul et al., 2009). However, staff members of other public funding agencies (i.e., participant 10a, 10b) did not address questions on the contribution of scripts to technology entrepreneurship as they sponsored innovation ecosystem and not incubation processes per se.

8.5.1.2. Incubator management's perspectives on the role of intuitive thinking in supporting technology entrepreneurship

"Science instincts," "potpourri of gut feel and rational logic," "rigorous research and analysis," "objective reasoning" and "technical knowledge and product development teams" were the main codes that were developed from the intuitive thinking category, which is a component of entrepreneurial cognition. These codes are elaborated consecutively in subsequent sections.

a. Science instincts

When requested to explain how incubatees' use of instincts impacted TE especially the development of growth-oriented businesses, the commercialisation of technology applications and outcomes, and the generation of financial outcomes such as profitability of the business, the response was focused on the application of science instincts:

> *They exhibit science-related instincts such as knowing that when they combine enzymes with this molecule, then they might be onto something. Such instincts have a huge impact on the success of their business in terms of generating new technological innovations. From the knowledge that they have in their specific field, they have developed certain intuition regarding that and that has shaped their technology innovations largely because the startups (e.g., those based on use of yeast and enzymes) they build are typically not based on radical innovation. They are not discovering something completely new to the world as other scientists also have access to those mushroom or enzyme research. However, using science instincts inspire them to integrate scientific ideas, which have contributed to the financial*

success their businesses have achieved now. So, this is not an entrepreneurial instinct per se but a science knowledge related instinct. It is the balance or interaction between science instincts, passion and science-based knowledge which drives them into the entrepreneurial space that leads to the commercialisation of their innovative ideas and the income streams that they generate. It cannot be entrepreneurial instincts as they lack entrepreneurship exposure and lack entrepreneurial skills when starting their startups (Participant 24).

Instincts affected our scientists' TE positively to the point that they appreciated the importance of converting their scientific ideas into revenue generating businesses. So, instincts kick in in terms of sensing that this idea if pursed could be a money spinner, but only to that point. Thereafter, they would sense the need for additional skills to push their science ideas further. So, intuitively, our scientists who pursue revenue generating businesses know what to do drawing on their scientific knowledge and experiences, but they do not know how to do it from an entrepreneurial perspective (Participant 25).

Both participant 24 and 25 contended that instincts of incubatees are derived from scientific knowledge and experience they possess regarding the possible conversion of their scientific ideas into technological innovations and revenue generating businesses. For participant 25, the gut feeling to pursue a typical scientific idea into a business startup that generates sustainable revenue streams, is a temporal cognitive endeavour that must be complemented with the acquisition of entrepreneurial skills to be effective. For participant 24, the deployment of scientific instincts compels incubatees to integrate and convert scientific ideas into revenue generating startups. The combining of gut feel with scientific knowledge and skills resonates with the view that when making investment decisions, investors often merge their expertise-based intuition and with formal analysis to develop a more nuanced analysis of their investment decision (Huang & Pearce, 2015). This merging of intuition with knowledge to influence venture startup decisions coheres with the view that intuition lies on continuum of deliberate conscious thought and sub-consciousness (Khatri & Ng, 2000).

b. A potpourri of gut feel and rational logic

Having ascertained TBI sponsors' perspective on how gutfeel could shape or undermine the realisation of TE, it was critical to corroborate this evidence with the perspectives of incubator management on this matter to establish if they conceived it the same way or differently. To this effect, the senior executive manager of incubator B was requested to share his views on the contribution of gutfeel to the generation of TE. The response was somewhat negative:

I think entrepreneurs probably rely on gut feelings too much, but at some point, everyone has to decide on their gut feeling. For instance, when you left your house this morning you had to say "is it safe to go outside, am I not going to get Covid 19 if I go outside." There was a gut feeling that "you know what, I think I'm safe and will go outside today". So, probably every 10% of our decision is gut feeling and 90% is logic and rational. I do not think that is any different for the entrepreneurs' pursuit of TE such as selecting innovative financing options, exploring new markets and commercialising of technology innovations (Participant 11).

The characterisation of entrepreneurship decision making as a complex amalgam of intuition and rational logic seems to cohere with literature that conceives entrepreneurship decision making as an outcome of a continuum ranging from intuitive to analytic thinking styles (Bingham et al., 2007, Kickul et al., 2009). While this literature conceives these thinking styles as binaries, our evidence points to the combination of these styles simultaneously probably suggesting that these polarities have some middle ground.

c. Rigorous research and analysis

This senior executive manager of incubator A elaborated that:

> *I believe that most TE is about really earning an insight. You must work hard to build many great businesses. If you look at Microsoft, Bill Gates was a software developer. He started building codes, and he started building all these codes that gave him an insight into how software works […]. It is about really being a deep expert and it is about using logic, using systems, and rational processes to make good business decisions*. *At some point, everyone must make decisions based on some instincts, but if you ask entrepreneurs how much of your decisions are based on gut feeling or instincts – if they tell you that it is 50% or more, I will tell you that, that business is going to fail. It is not going to work. In your work, if you research whatever it may be and your research study was all based on gut instincts, what do you think your dissertation committee would say to you. They would say go home, your research study would automatically fail. So, the same thing applies to any business. At some point, you would have to decide based on gutfeel, but you better have done much research, a lot of analysis, and logical reasons why you are making those final gut instincts your call. So, yeah, I think it is important that people put the work in and demystify entrepreneurism. That is just a way of building a new business, it is a methodology to build new companies* (Participant 11).

The detailed claims about dependence on logical empirical analysis, the conduct of detailed market research, and gaining deep insights into the working of the phenomenon under study somewhat depart from the view that when confronted with limited information or uncertain situations (e.g., new business opportunities), entrepreneurs depend on personal and consensual schemata (e.g. hunches or gutfeel) to process existing information rather than try and process all discrepant information anew (Urban, 2015). This finding also deviates from the premise that intuition serves as a powerful and valuable cognitive asset for an entrepreneur who can deploy it for making defensible judgements when the information available is insufficient for the task at hand (Blume & Covin, 2011). Therefore, one infers that while a gutfeel may act as a trigger for engagement in entrepreneurial decision making, the actual process of venture creation that gives rise to TE requires more elaborate and rigorous rational thought processes.

d. Objective reasoning

When the views of the senior executive manager of incubator B were elicited regarding the role of gut feelings in facilitating TE, his response corroborated that of the senior executive manager of incubator A:

> *I think the use of gut feeling is not something that incubators would propagate that entrepreneurs must use. Gut feel in terms of what they need to do could be there, but obviously, they need to have certain entrepreneurial traits inherent in them and objectivity is very important in high technology venture creation. The reason we are putting people in a process of incubation is to bring on board the issue of objectivity and remove subjectivity in terms of making entrepreneurship decisions* (Participant 8).

This view contradicts the view peddled in the literature that due to the limited capacity of the mind to process disparate and cognitively demanding information rationally, information can only be incorporated into the long-term memory if it coheres with existing knowledge structures (i.e., the process of intuitive thinking) and discrepant information tends to be ignored or forgotten (Vaghely & Julien, 2008; Urban 2015). In short, the use of gut feelings for fostering technology entrepreneurs was discouraged in the incubator environment as gut feelings were deemed to be associated with subjectivity and hence incongruent with rational decision-making. This finding premised on the “either (intuition) or (rational thinking)” is problematic because, in reality, the literature suggests that founding entrepreneurs may not always easily distinguish between ‘gut feelings’ and equivalent affective responses that may be related to other phenomena or stimuli (Blume & Covin, 2011). This is because the creation and deployment of entrepreneurial intuition can culminate in venture creation decisions that may not have been justifiable based solely on formal analysis of available data, but which leads to the establishment of successful enterprises (Blume & Covin, 2011).

e. Technical knowledge and product development teams

The middle-level manager of incubator B who was directly involved in the running of the incubation programme agreed with the use of rational thought processes:

> In most cases, we advise incubatees and coach them that they must create a team with technological *know-how if they want to run a technological business that will give them great rewards and turnover. Sometimes, it becomes difficult for an entrepreneur who is not a technical person to run a technical business. It requires technical input to assist them in their business. So, that gut feeling to say I can find services myself becomes a challenge. That is why we are availing them with the fabrication facility, product development facility, 3D printing facility. Since creating technological businesses is a whole new ball game, the use of gut feelings may be a drawback. They must have a strong team that has the technical know-how to assist them to scale up the business and make sure that their businesses make some profit* (Participant 12).

One infers that the use of gut feeling hinders non-technical entrepreneurs who strive to operate technological startups to the extent that running technological businesses requires technical competencies they may not have. This view on the irrelevance of intuition in running technology-oriented businesses and realising TE contradicts the popular narrative that intuitive judgements constitute domain-specific evidence of expertise (Hogarth, 2010; Salas, Rosen, & DiazGranados, 2010), which entrepreneurs often activate and implement when they are confronted with situations of uncertainty, dynamism, and pressure in terms of time (Burke & Miller, 1999; Sadler-Smith, 2015).

8.5.1.3. Incubatees' perspectives on the role of intuitive thinking in supporting technology entrepreneurship.

Incubatees were requested to explain the extent to which intuitive thinking facilitated or hampered TE. "Financial projections," fusion of gutfeel and experience," "product and service specifications" and "business process methodologies" were the codes developed from the incubatees' perspectives on the role of intuitive thinking in supporting TE. These are discussed in subsequent sections.

a. Financial projections

When one incubatee was requested to explain the extent to which he employed gutfeel to realise technology entrepreneurship, he acknowledged that:

> *On a scale of one to ten, I would say four because instincts do not play a significant role in financial projections of my business. As an entrepreneur, I believe in fact-based projections of revenue based on my financial records, seeing the numbers that are there. If I choose to rely on instincts that is when I invest in products that will not sell and I loss money. I cannot just use instincts to stock a certain range of products or conduct a certain line of business expecting certain products to sell and generate revenue. Just relying on an instinct that these products might sell, often results in me losing money. So, instincts pay a small role in generating income for the business. So, I use statistical projections and conduct market research than instincts* (Participant 26).

Despite his stronger inclination towards deliberate rational thought when making financial projections, the fact that this incubatee combined rational thought with some instinct supports the narrative that a large component of entrepreneurial behaviour involves "the interplay between rational and intuitive decision making" (Dane & Pratt, 2007: 48). This combination of gut feeling and rational thought in technology entrepreneurship decision making (i.e., investment in products, stocking products and income generation) further buttresses the view that the rational approach to entrepreneurial decision making should be harmonised with intuitive approaches to develop an enriched and integrated grasp of entrepreneurial behaviour (Cunha, 2007; Gillin, 2020).

b. Fusion of gutfeel and experience

There was considerable evidence that gutfeel did not work independently but was neatly integrated with facts and expert experience. When requested to explain the role of intuitive thinking in advancing TE, incubatees' narratives emphasised the fusion of gutfeel with facts and experience:

> *Attaining sustainable technological innovations requires a mixture of gutfeel and the facts in front of me. My gutfeel may tell me that we need to add this feature to the product, or we need to promote this side of the business but at one time I was completely wrong. I thought*

we needed to promote one part of the business completely and then work through market research, but we got so much market feedback against that idea. My gut feeling was completely wrong because when we started asking more questions to our clients, we realised that we are asking the wrong questions. We have a good innovative product. So sometimes, the gut feeling helps you to tweak your product offering a little bit the next time you go promote it, it helps you know what better angle to take. So, I would say it is a gut feeling tweaked with experience that produces a great innovative product offering (Participant 21).

One infers from the narrative that although the gut feel assists with the perfection of an innovative product, it does not work independent of facts derived from consumer market research and past experience of the startup's interaction with customers. He elaborated that:

Regarding the commercialisation of the products, I would say the gut works with experience of research as well. When you increase the cost of a product following the commercialisation process, investors start asking questions such as: where are the numbers that are backing your expansions? So, you cannot just expand for the sake of it, you need to start with a gut feeling to say I have a feeling that if we expand in this direction, it will go well and if we commercialise in this direction, the product will have a large market. And then you get to prove yourself to say well I sold these 10 clouds (i.e., data solutions) and eight out of 10 of customers said yes. So, it is always this balance between your gut feeling and then confirming what your gut feeling is telling you and again. I got it wrong a few times but as I go along, I get it right a lot more (Participant 21).

Product commercialisation was deemed to be a function of gut feeling combined with research experience to confirm the gut feel. Therefore, product commercialisation is a function of gut feel, experience in research and development and actual implementation of innovative ideas. As literature demonstrates, technology entrepreneurship is an outcome of intuitive decision-making behaviours such as some insight/perceiving, gut feel, "knowing" a decision is right, solving problems and making decisions (Armstrong et al., 2012; Bradley et al., 2011).

I had a gut feeling that we needed to start getting some subscriptions from the clients which I thought we would not get because customers hate subscribing to these technologies. We found that we needed to add value, my gut feeling said I cannot just say to clients that "you need to subscribe." I needed to add more value and I added more value in saying "if you don't subscribe you get the basic product but if you do subscribe you get the basic plus value added features." Which means the customer always has an option and they actually all went for the subscription which shows my gut feeling was wrong. I thought more customers would say no but they said yes but education has taught us that "you can't just add money or ask for more money, you need to add more value." So, you can see how gut feeling, education and experience are intertwined with another. In terms of how gut feel affects the realisation of sustainable technological innovation, I would say you can have a gut feel about of introducing technological products, but you must confirm it with reality through research otherwise you are just dreaming (Participant 22).

Collectively, the narratives above demonstrate the persistent interaction between gut feel, research and prior experience, where gut feel serves as an intelligent guess that must be validated by market research and practical experience with customers. This fusion of intuitive thinking and deliberative cogitative processes based on empirical evidence cohere with the narrative that technology entrepreneurship processes such as opportunity recognition, commercialisation of innovations and creative processes are a consequence of the fusion of conscious and unconscious (e.g., gut feel) processes, including pattern recognition and memory retrieval (Akinci, 2014; Gillin, 2020).

c. Product and service specifications

Given the direct contribution of incubatees' intuitive thinking to the incubation processes (as discussed in the individual factors-TBI relationship), the researcher pondered whether and how intuition could affect the realisation of incubation outcomes such as TE. The incubatees were requested to characterise the role played by their instincts in the realisation of TE and participant 1 highlighted that:

> *Intuition guides and gives our firm direction during product development especially when we develop some specifications for our business' interaction in the insurance industry. Intuitions also previously informed our development of water meters for schools. So, regarding large revenue, I think I want to explain the whole insurance model. Our business employs a good business model whereby both the policyholder and our company can be rewarded financially through using Internet of Things solutions. This system involves a large volume gadget connected to 10 to 20 thousand devices in the field for you to reach the breakeven point in terms of operation cost*. *So, for the model to work, it requires insurance companies to have let us say tens of thousands, 100 of thousands of home insurance policies, at such a scale*. *But unfortunately, it takes much time before you get to this scale* (Participant 1).

The fact that intuition shaped the process of product development and specification of interactions with clients and business model development coheres with the role of arrangement scripts in shaping venture creation stages. This points to the reality that intuitive judgements can facilitate rational entrepreneurial behaviours (Glöckner & Herbold 2011; Usher et al. 2011) such as product specification and development which require analytical and deliberate processes such as product conception and designs. Therefore, intuition enhanced product development, specification of interactions with clients and business model refinement, which contributed to the commercialisation of product development – an aspect of TE.

d. Business process methodologies

It was vital to compare the aforesaid perspective with that of other incubatees to establish the extent to which the incubatees in incubator A applied intuition in similar or different ways. For this reason, we queried another incubatee from incubator A on how his instincts affected his achievement of business incubation outcomes, especially TE.

> *I think at the beginning we had a gut feeling that there is no business opportunity here even though the gut feeling was only felt in terms of making decisions to empirically research that problem. So, once we thought "we think there are options here," we conducted much quantitative research to feel the blank spaces. We went out and surveyed numerous consumers to understand the problem we wanted to solve. So, it started with a gut feeling but I think we followed it up to know the problem that we are going to solve* (Participant 19).

This points to the reality that even though intuitive judgements are deemed to be quick, unconscious, effortless, and more error prone (Kahneman & Frederick, 2002) in reality, these judgements work in conjunction with deliberate rational thought judging from the commitment to back gut feeling with evidence on the ground using empirical research. Therefore, while some dual information processing involves intuitive processing of different information to propose an immediate solution, simultaneously, a rational deliberative process is activated to assess the quality of the proposed solution, which it may approve, alter or override (Ayal, Zakay & Hochman, 2020). Therefore, intuitive decision-making was followed subsequently by rational deliberate thought involving rigorous market research to establish the extent of the problem that required entrepreneurial action to solve.

8.5.1.4. Innovation champions' perspectives on the role of intuitive thinking in supporting technology entrepreneurship.

When asked what role gutfeel played in supporting or hampering TE, an innovation champion noted that:

> *Gutfeel helps me cuts through the clutter. If I have no experience in the cosmetological industry, I would not know which lipstick would work best and you say I am really depending on you for the best results. I would have to do much research on the topic, and I might make a mistake. Yet those with experience in the industry can tell you what lipstick would be the best and for which client. They can tell you the right answer within an instance because of years of content knowledge and experience. I mean we are four years old and we are gaining more experience and that contributes to quicker and better technology investment and innovation decisions* (Participant 23).

In short, the possession of gut feel would assist an entrepreneur in "knowing" that a decision is right under which circumstances (Gillin, 2020) based on prior experience. However, with experience, gut feel expedites entrepreneurial decision making under conditions of uncertainty.

8.5.2. Scripts

Apart from intuitive thinking, scripts were the other dimension of entrepreneurial cognition discussed in relation to TE. Scripts comprise schemas that render a knowledge base that guides the interpretation of information, actions, and expectations (Graesser, Woll, Kowalski, & Smith, 1980). Schemas are "a cohesive, repeatable sequence possessing component actions that are tightly interconnected and governed by a core meaning (Piaget, 1952: 7). The next section discusses TBI sponsors' views on the contribution of scripts to enhancing technology entrepreneurship.

8.5.2.1. TBI sponsors' views on the contribution of scripts to enhancing technology entrepreneurship

Since incubation sponsors normally sponsor activities of TBIs whose impact they would not directly assess, it was fundamental to investigate the possible contribution of scripts to the enhancement of TE. "Different scripts for different entrepreneurial stages," and "steer business growth" were the main codes that emerged from TBI sponsors' views on the role of scripts in facilitating or disrupting TE. These codes are discussed in the sections below.

a. Different scripts for different entrepreneurial stages

To establish the possible association between scripts and incubation outcomes, the study explored whether including how the incubatees and entrepreneurs that the sponsors funded or supported employed scripts to advance TE. One sponsor noted that:

> *Generally, most incubatees and entrepreneurs will identify where they are in the technology development or technology entrepreneurship stage such as business expansion or human resource skilling stage or alleviation of poverty. We have a dedicated customised programme that we designed for them to cater for that specific stage. So, we have a different project plan for each stage, and they can employ their scripts at any stage in that process. We identify where they are in the stage of business development and what should be done for that stage* (Participant 14).

Therefore, by aligning the use of scripts to specific stages in the technology entrepreneurial process, incubation sponsors made incubatees aware of the relevance of their scripts to the process of venture creation and development. The sponsors' support for incubatees' use of scripts at various stages of technology-based incubation gels well with the view that when confronted with large information volumes and uncertain situations, entrepreneurs and business executives may deploy specific arrangement scripts that support specific venture creation decisions such as idea protection, accessing resources and venture specific skills (Urban, 2015). These venture creation decisions are instrumental in fostering TE.

b. Steer business growth

An enquiry into whether and how entrepreneurs harnessed scripts to facilitate the realisation of TE generated an evasive response:

> *I am not sure what this question is speaking to because it has several dimensions but if you ask these entrepreneurs that join our incubation programmes why they do so, they give an almost standard answer that they want to grow their business. It is only when you try to peel off the layers to understand what that "growth" means that you get different dimensions as to what they mean by growth. So, the general intention is the desire to see their businesses grow in whatever way growth manifests itself* (Participant 15).

No specific association was reported between the use of scripts and the realisation of TE, even though sustained business growth was cited as one of the dimensions of TE. Regarding private sponsors covered in this study, this lack of association contradicts the claim that the use of scripts is fundamental to entrepreneurial decision making such as venture creation decisions (Mitchell et al., 2000). Therefore, private sponsors could not have emphasised the use of scripts in entrepreneurship decision-making.

8.5.2.2. Incubator management's views on the contribution of scripts to enhancing technology entrepreneurship

As scripts were postulated to influence the TBI process at the beginning of this chapter, the study investigated whether and how scripts contributed to the enhancement of TE. "Lean canvas business model", "prudent decision making," "incubator knowledge levels" and "partnerships and clientele for technology licensing" were the codes that emerged from the hard data relating to scripts category as discussed from the perspective of incubator management. These codes are individually discussed next.

a. Lean canvas business model

When participant 24, a middle level manager of incubator A, was requested to explain the contribution of scripts to enhancing TE, her response was affirmative:

> *Incubatees' use of scripts greatly impacts their technology entrepreneurship. When we get new incubatees, we take them through a business process involving scientists which sensitises them to business concepts. When they have a full day session on the lean canvas business model workshop, we take them through innovation-based business aspects. Upon completion, their business canvas model becomes a reduced business plan. The lean canvas business model is a one-page summary of a business plan. We get an education expert who knows the theory of scripts and a serial entrepreneur in whichever industry incubatees want to enter, who share their opinions on these matters. Then we get the entire entrepreneurship team together and the TTO staff also present. Through the lean canvas business model, entrepreneurs get experience regarding how to optimise revenue, profits and how to develop sustainable technology innovations. Months later, when we engage these scientists on the technology entrepreneurial process, they can speak the same language. They understand the technological opportunities they can exploit, how to access technology markets and how to create unique technological innovations. Although some scientists may not necessarily have or sold the physical product during incubation yet. We help them to understand how to run a technology business, and it clicks in their minds. They would understand the processes, so they rely on scripting when they engage in technology entrepreneurship* (Participant 24).

When participant 25, a senior executive manager of incubator A was also requested to explain the ways in which the use of scripts by incubatees affected their realisation of TE, the response was lukewarm:

> *Not to a great extent because they lack those scripts when it comes to technology. They need some business and technological skills to use scripts to realise technological entrepreneurship outcomes such as increasing the revenue for their businesses. So, during the process of business incubation, these scripts would not have been well developed and therefore are insufficient for the realisation of technology entrepreneurship* (Participant 25).

Participant 24's view that incubatees employ scripts to grasp innovation-based business concepts, locate technological opportunities for exploitation, access technology markets and to generate unique technological innovations resonates with the view that entrepreneurs deploy arrangement scripts to identify entrepreneurial opportunities, locate resources for exploitation in different markets, identify and exploit networks (Urban, 2008; Seawright, Mitchell, & Smith, 2008; Abdelnaeim & El-Bassiouny, 2019). On the contrary, participant 25's claim about incubatees' lack of business and technological skills that undermine the application and deployment of scripts in the realisation of TE contradict literature which emphasise entrepreneurs' employment of scripts as cognitive processes and structured way of imagining business plans, activities and requirements when creating their ventures (Smith et al., 2009; Abdelnaeim & El-Bassiouny, 2019). **Proposition: Scripting enables a structured process of cogitation and learning about the technology venture creation process (e.g., identification of technology opportunities, access to technology markets) that makes technology entrepreneurship (e.g., revenue and profit generation and developing technology innovations) possible. The lean canvas business model is an epitomised scripting processes that provides theoretical concepts for the conception and development of technology ventures in support of technology entrepreneurship.**

b. Prudent decision making

The study inquired about incubator management's perceptions of their incubatees' use of scripts and its possible impact on the realisation of TE. The senior executive manager of incubator A highlighted that:

> *The more entrepreneurs use scripts, the more scripts can be administered thoughtfully, and the higher the probability that the incubatees have for success in terms of revenue generation, creating new sustainable innovations and commercialisation of their outcomes. That speaks to the idea that there is a technical process to technology company building and startup activity. I believe that the incubatees must make good decisions within a startup environment and it is not just all gutfeel, there is also a script to that process. So, I think if the incubatees and entrepreneurs administer scripts well, then they should give them a higher probability of success in terms of generating revenue and profit for their business* (Participant 11).

The above narrative demonstrates that scripts do not work in isolation. Proper administration of scripts must be coupled with good decision making (e.g., about investment options, resources acquisition and allocation, strategy implementation) to contribute to TE in terms of increasing the revenue generation capacity, profitability, new sustainable innovations and commercialisation of their outcomes. This view partially validates the notion that cognitive script facilitates technical processes critical to the organisation of startups and the generation of commitment to the successful execution of entrepreneurship projects (Shepherd & Patzelt, 2018). One infers that when scripts are harnessed to inform good decision-making and guide procedural steps employed in startup development, then startups and incubators will have a greater proclivity towards success. **Proposition: Scripts can be gainfully applied to facilitate technology entrepreneurship in contexts where startups engage in good entrepreneurial decision making.**

c. Incubator knowledge levels

The views of the senior executive manager of incubator A were corroborated with those of the management of incubator B. The study investigated the views of the senior executive manager of incubator B regarding the contribution of scripts to the realisation of TE and the response was ambivalent:

> *I think the use of scripts by the incubatees in advancing technology business development varies depending on their background. You will find that some incubatees know business principles and others do not and those with such principles tend to know how to apply scripts to increase the success of their firms. So that is why it is important to understand where our incubatees are in terms of business knowledge so that we tailor the incubation programme according to their needs. So, you cannot have a programme that is generic that every entrepreneur must go through as some entrepreneurs would know how use scripts to do venture creation and venture financing while some would not. The seasoned entrepreneurs need to be put on an accelerator programme rather than an incubator. So, the effects of scripts on TE will vary based on incubatee experience* (Participant 8).

One infers that the ability of incubatees to harness and exploit scripts in pursuit of TE is dependent on their level of entrepreneurial knowledge, with more knowledgeable incubatees being positioned better than their counterparts to channel scripts towards attaining TE. This view buttresses the notion that even though scripts facilitate technology entrepreneurial decision making by creating structured plans, sequential processes and requirements for founding ventures (Abdelnaeim & El-Bassiouny, 2019), entrepreneurial knowledge and experience to locate and harness technological opportunities to create new products and commercialise them (Jehazi, Farsi & Nobakht, 2014) would be required.

d. Partnerships and clientele for technology licensing

To corroborate the evidence availed by the senior executive manager of incubator B, the views of his subordinate (i.e., middle-level manager who operated the incubator) regarding the contribution of scripts to the attainment of TE were solicited. His response emphasised the role of incubators in honing the scripts of the incubatees:

> *I think the realisation of technology entrepreneurship has been the best thing that happened to the incubatees after joining the incubator because the incubator will look for clients who would do business with incubatees, which would lead to outcomes such as technology entrepreneurship. Incubatees have used scripts very well to identify who could be their partners and their clients, which could end up in the licensing of their technologies. Not all of them come in with the technological know-how but after joining the incubation programme they will be able to build a team, form partnerships, and identify the business processes and outcomes in a manner that technological entrepreneurship becomes possible as their businesses acquire more partners and clients. So, they can use those scripts as far as technological entrepreneurship is concerned* (Participant 12).

The use of scripts for team building, the formation of partnerships, identification of clients in the market, and conduct of business processes are all symptomatic of the application of arrangement scripts.

Arrangement scripts are those scripts deployed to secure contacts, networks, resources, and assets deemed critical to the generation of a new startup and the fulfilment of venture creation decisions (Urban, 2015). Therefore, one of the dimensions of TE such as technology licensing was a consequence of incubators' development of arrangement scripts facilitated by providing the incubation infrastructure.

8.5.2.3. Incubatees' views on the contribution of scripts to enhancing technology entrepreneurship

Since management of incubators A and B affirmed the deployment of scripts as tools for advancing business development, it was critical to corroborate their views with those of incubatees to establish whether what incubators advocated was implemented by their incubatees at operational level. The codes that emerged from the incubatees' narratives ranged from "risk taking during innovative product development and business logistics," "sequencing of business processes," "efficient product development and revenue generation," and "unstable revenue streams" and these are discussed consecutively in the following sections.

a(i). Risk taking during innovative product development

The researcher inquired about the role that scripts played in enhancing TE, and risk taking was emphasised:

> *Scripts have helped us to take risks during the development of innovative products. When we want to develop a new product for the market, we often have some ideas of what we are going to implement in terms of the changes. However, how we will implement them to develop a new product for our business is often a grey area. We then draw on scripts to assist us take the risk of implementing them as we are advised by the senior personnel in business at the University to help us figure out what could the possible outcomes and possible risks be. So, from my experience, the use of scripts to take risks and having people help us implement these innovative changes to the product really helped us develop the product* (Participant 26).

The use of scripts assisted the incubatees in taking risks in innovative product development as well as developing coherent pathways for such development. With the support of technology transfer staff, script development ensured the refinement of innovative products being developed. This finding resonates with the notion that entrepreneurial cognitive scripts render coherent and structured way of thinking that enable entrepreneurs to take on high risk opportunities in adverse market conditions which make commercialisation of innovative product development possible (Smith et al., 2009).

a(ii). Business logistics

When asked to explain the role of scripts in realising TE, one incubatee emphasised business logistics:

> *We often have ideas of what we want to do and then we need to have the mental idea of how we will run that. Where we need ideas, the incubation staff assist us form the mental path in our heads from where our idea is to how to get your innovative product out to the*

market. So, scripts assist us with how to estimate the market size, determine market taste of products, how to figure out the volume of sales and expected revenue streams. As scientists, we know how to create the product, we know how to package it, we know how to make something good. However, we did not understand the logistics of the market, sales volumes and revenue to get these things done (Participant 27).

Scripting creates in the entrepreneur some mental pathways that innovative product development and innovative technologies must undergo from idea conception to conclusion of sales. As such, from a business process perspective, scripting facilitates business logistics of market size estimation, ascertaining consumer tastes, sales volumes which collectively enable sustained revenue streams for the business, which are a dimension of technology entrepreneurship. **Proposition 1: Scripts facilitate the reduction of risks during process of innovative product development. Proposition 2: Scripts support the development of business logistics especially understanding market dynamics, which enable sustainable revenue streams for technology-based startups.**

b. Sequencing of business processes, efficient product development and revenue generation

When one incubatee from incubator A was interviewed on whether including how his use of scripts affected his business' realisation of TE, his response was affirmative:

I think a high growth orientation in terms of revenue generation of the business can be sustained if entrepreneurs use scripts because they force them to follow a sequence of business processes. Otherwise, entrepreneurs can invest much money in products and services that are not viable. Scripts keep the entrepreneur on track as they ensure that s/he is taking risks sequentially and partially all time, not going into big risks that s/he has small chances of managing. Taking calculated risks prevents huge financial losses arising from investment in products for which there is a limited market. Taking calculated risks also increases the chances of steady revenue generation for the firm (Participant 19).

When requested to explain the role of scripts in TE, one incubatees noted:

Scripts allow the entrepreneur to build sequential knowledge on how to connect to resource persons. They increase one's access to financial mentors and advisors that provide financial advice, which enables business outcomes such as technology entrepreneurship to be realised. Through scripting, we access financial and technology mentors who can advise on the cost of developing the product at a lower price to maximise revenue and profits. Technology mentors can also advise on the technology or engineering side of product development. So, through the scripting process, we know the other resources that are needed in product development. So, scripting positively impacts technology entrepreneurship through greater knowledge of efficient product development, cost reduction which increases revenue generation of startups (Participant 22).

The claim that scripts compel entrepreneurs to follow systematic and sequential processes to entrepreneurial pursuits and take calculated risks seems to cohere with the application of venture diagnostic scripts, which emphasise the need for entrepreneurs to identify the material conditions and potential of startups including the system components that must merge in their creation (Krueger, Reilly

& Carsrud, 2000; Urban, 2015). **Proposition 1: Scripting promotes high revenue generation by facilitating calculated risk taking and investment in viable products. Proposition 2: Scripts facilitate the identification of resource persons who advise on efficient production processes that maximise revenue generation for technology-based firms.**

c. Unstable revenue streams

When the same question on the contribution of scripts to incubation outcomes was posed to one of the incubatees, the response was positive:

> *Since revenue sources are unstable, we have used arrangement scripts to apply for grants or seek external funding for the business. For instance, we use scripts to ascertain what terms to use to get a grantor's attention. We tap into scripts when talking about balancing risks and rewards, exploiting opportunities, identifying competitors and ascertaining how to deliver a unique innovative product. Originally, when our incubator staff asked us who our competitors were, we would say "…nobody, this is brand-new." Yeah, now we are scripting our knowledge we gained from our exposure to the incubator. We now have more coherent knowledge on how to structure funding proposals to access funding opportunities that expand our business* (Participant 21).

One infers that scripting facilitates the mobilisation of the critical resources such as external funding and revenue, which makes the commercialisation of innovative product development possible. This finding supports the view that scripts enable entrepreneurs to engage in challenging tasks (e.g., resource mobilisation) that are fundamental to execution of technology entrepreneurship projects and sustained commitment to them (Shepherd & Patzelt, 2018). **Proposition: Scripting enhances the development of structured knowledge of resource mobilisation such as grant funding application.**

8.5.3. Heuristics

This section is devoted to a discussion of how different participants conceived the role of heuristics in the realisation of TE. Heuristics denote simplifying strategies which entrepreneurs use in making judgement-based decisions (Randolph-Seng et al., 2015). The subsequent section discusses TBI sponsors' perceptions of the role of heuristics in the realisation of TE.

8.5.3.1. TBI sponsor's perceptions on the role of heuristics in the realisation of TE

The study also investigated funders of incubators and entrepreneurs' perceptions of whether and the extent to which heuristics affect the achievement of TE. It is important to acknowledge that not all incubation sponsors addressed this question due to lack of knowledge on the subject. "Delays in product launches and cost overruns" and "neutral view" were the main codes that emerged from sponsors' narratives, and these are elaborated on in sections below.

a. Delays in product launches and cost overruns

When requested to explain whether and how heuristics (i.e., “shortcuts”) affect the realisation of business incubation outcomes such as TE (i.e., commercialisation of innovations, sustained revenue streams, and promoting high growth orientation), the senior executive manager of a public funding agency explained that:

> *Shortcuts may delay the process of commercialisation of products because they could affect how soon and whether the product gets to the market or could result in financial losses. This is because, if using heuristics results in the by-passing or skipping of important technical processes or stages required by the South African Bureau of Standards or certain ISO certification standards, the startup founder may be required to go back and develop a product development process over again after it collapse and then incur additional expenses. She must go back and do it the way it was supposed to be done. Taking shortcuts may result in financial loss and loss of first-mover market opportunities* (Participant 14).

She elaborated:

> *You may discover that sometimes product development takes longer so you adopt some shortcuts that may make the product development process shorter and more efficient in terms of resource consumption. However, these may cause further delays as the entrepreneur is forced to rerun the prototype or product development process over again to get the product or industrial design of the acceptable quality from the South African Bureau of Standards perspective. So, there could be delays caused by shortcuts, leading to a loss of financial opportunities in the market. So, shortcuts may have dire consequences for speed to market and can result in loss of that opportunity if you are taking shortcuts* (Participant 14).

Therefore, the heuristics constitute abstract knowledge structures, against which new information is tested for relevance and this simplification of information processing may lead to bias and the discarding of appropriate or innovative information due to weak signals (Urban, 2015). The overall effect of heuristics could be the by-passing, negation or skipping of critical stages and processes during innovative product development. This may result in sub-standard products, necessitating re-engagement with the entire process of product development. This finding consummates the view that the use of heuristics may conceal or negate certain subtleties (e.g., conformity to established standards, cost overruns, loss of opportunities) that confuse novices entrepreneurs and could be invisible to experienced entrepreneurs (Makings & Barnard, 2019).

b. Neutral view

When the same question on how the use of heuristics affects TE was posed to the middle-level manager of a private financial institution that sponsored incubation processes in incubators A and B, the response was ambivalent: “*As I said, our incubatees come from different sectors but your question is specific to technology-based businesses so I will not be able to express an opinion on that*” (Participant 15). The next section discusses the view of incubator management regarding heuristics.

8.5.3.2. Incubator management's perceptions of heuristics' role in the realisation of technology entrepreneurship

The study investigated whether incubation management felt that incubatees' use of heuristics affected their realisation of TE. The codes that emerged from incubator management's narratives were "revenue losses", "scientific business processes," and "ambivalent effect" and these are elaborated in the next sections.

a. Revenue losses

The study sought to establish whether incubatees employed heuristics and how these heuristics affected their realisation of TE from the viewpoint of incubator management. The senior executive manager of the incubator A observed that:

> *The use of heuristics often happens when incubatees just pursue an idea because it comes from a person whom they like or they just like an idea but not because the idea is valid. Sometimes the distinction between passion and heuristics is blurred. Because entrepreneurs are so involved with the idea they are pursuing, they become so excited and just want to push through and get their product to the market despite their lack of knowledge and commitment to doing extensive market research. Despite their push to get the product to the market, there are many entrepreneurial concepts, steps and processes that they do not understand leading to financial losses when a product does not sell* (Participant 24).

One infers that, while the use of heuristics may be fundamental to increasing speed to market, they may undermine due consideration for entrepreneurial processes (e.g., risk calculation; market research to establishing feasibility of product) leading to losses in financial revenue. The finding resonates with the view that entrepreneurs draw on a repertoire of well-developed heuristics to address market dynamics (e.g., access to market for products) with financial implications for the business (Makings & Barnard, 2018). **Proposition: Entrepreneurs' use of heuristic biases (e.g., optimism bias and illusion of control) may convince incubatees to push ideas and products to the market despite their limited lack of knowledge of the market, leading to loss of revenue.**

b. Scientific business processes

When the question of whether heuristics were instrumental to the forging of TE was posed, the senior executive manager of incubator B highlighted:

> *Those that we have incubated were simply tenants so we cannot ascertain the effect of heuristics on TE. However, going forward, from a programme design perspective, we would want our incubatees to be less concerned about heuristics, take their time and ensure that*

> *whatever they do is based on proper processes around having done feasibility studies so that they get a good view of the opportunities at hand. That is very important* (Participant 8).

The uncertainty on whether heuristics were applied and whether their use affected TE seems not to cohere with the popular narrative that the use of heuristics is instrumental in mobilising TE elements such as the appropriation of strategic resources the business can leverage on such as access to revenue and financial resources (Makings & Barnard, 2018). The emphasis on scientific processes such as feasibility studies and the subtle discouragement of the use of heuristics somewhat contradicts the view that using heuristics facilitates the making of quick decisions (Wright, Hoskisson, Busenitz & Dial, 2000), and give entrepreneurs greater focus when making decisions based on their previous experience (Bingham et al, 2007).

c. Ambivalent effect

When the senior executive manager of incubator A was requested to establish if there was any possible connection between heuristics and TE, the response was evasive:

> *It is a hard question to answer because I am not sure. Heuristics are indigenous to every person. They are very specific to you and how you operate and are based on your background. So, I am not sure whether they are using them to make better and more educated decisions that impact TE and how.* (Participant 11).

The response suggests that although incubatees possessed heuristics, it is unclear whether they applied them for prudent decision making. The lack of clarity on whether such heuristics were applied for realising TE deviates from the narrative that when making entrepreneurial decisions, entrepreneurs employ extensive, well-developed heuristics as their foundation (Makings & Barnard, 2018). The ambivalence surrounding role of heuristics in facilitating TE does not cohere with the view that most entrepreneurs exploit heuristics during their entrepreneurial decision making to facilitate development and exploitation of innovative technology-based opportunities (Alvarez & Busenitz, 2001).

8.5.3.3. Incubatees' perceptions on the role of heuristics in the realisation of technology entrepreneurship

The researcher also sought the views of incubatees regarding whether they employed heuristics and if so, how their deployment facilitated the realisation of TE. "Outsourcing non-essential services," "improvision during product development", "expediting decision making," "consolidation of business operations" "overcoming currency fluctuations and technology reviews" were the main codes that emerged from incubatees' narratives on this subject. These are elaborated consecutively in subsequent sections.

a. Outsourcing non-essential services

When requested to explain the role of heuristics in facilitating TE, one incubatee remarked that:

> *Well, the heuristics we employ in our company are playing a role in saving time. Because our business model is outsourcing our activities we take shortcuts - smarter or more efficient ways of running the business. Instead of us purchasing financial software and doing our own financial statements with that software, we outsource from another firm all our financials and the capturing of financial data and then they give us the financials at the end of the month. Instead of us going through the finances and spending time on that we only approve the final reports. I still do the budget based on the data that generated from outsource services. The time saved from using outsourced financials is committed to critical aspects of the business such as looking for new customers, increasing sales and devising revenue generation strategies* (Participant 22).

The exploitation of heuristics to avail time for finding new customers, increasing sales, revenue generation identifies with the view that entrepreneurs may exploit heuristics (e.g., representativeness heuristic such as drawing on small samples) during the evaluation of entrepreneurial opportunity to make useful inferences about revenue and other financial data (Busenitz, 1999; Cassar & Gibson, 2007; Cristofaro & Giannetti, 2021).

b. Improvision during product development

The views of incubatees in incubator A were solicited regarding whether they employed heuristics and how such heuristics contributed to enhancing TE. The response of one incubatee was affirmative:

> *I can relate to the use of heuristics in terms of technology product development. When developing new technology products, we employ existing prototypes we developed before or use the same product for a different application or different value proposition. So, we are using certain things we have done already that are not necessarily clear at the onset. The net effect of this is to reduce the costs of production, make product development more efficient, increase number of products per unit of resources, increase our profit margins* and maximise the growth prospects of the firm (Participant 1).

One infers that heuristics allow the incubatees to shorten the product development cycle by employing strategies such as the deployment of existing prototypes and products for different applications or using the same product for different value propositions. This view resonates with Bingham et al. (2007) who conceive heuristics as supporting high-performing processes, by allowing entrepreneurs to focus and improvise on tasks, thereby accentuating the growth potential of firm. For instance, Gaglio and Katz (2001) and Cristofaro and Giannetti (2021) considered alertness heuristic (i.e., "distinctive set of perceptual and cognitive processing skills that direct the opportunity identification process" (p. 96) as a key force in the recognition of entrepreneurial opportunities that maximise the profit and growth potential of the business.

c. Expediting decision making

When the same question on the contribution of heuristics to TE was posed to another incubatee from incubator A, accelerating the speed and reducing the complexity of decision making were advanced as the main benefits:

> *Heuristics help me to just make quick decisions and make sense of a complex business world. They help me to move forward quicker to gain foothold of new markets and increase chances of making profits from new products. Yeah, they help with increasing the speed of decision-making in the business. I guess after conducting research every time you tend to take decisions* (Participant 19).
>
> *Heuristics help me five out of ten times. I am always trying to use shortcuts. For example, I sell genuine leather – like Edge designs. I design them and I send them to Cape Town. I remember when I went to SEDA to ask them if they can assist me with the development of a website, the gentlemen there was asking me questions like how am I getting them from Cape Town to Bloemfontein. So, I explained to him that I use a shortcut, they must travel from Cape Town by taxi to Testpret in the Eastern Cape and from Testpret to Bloemfontein and I spent only R200 on that. He ignored my response and said no I should use proper courier companies that ensure that everything is ensured, and if anything happens, I know that the bags are safe for insurance purposes and for tax purposes. So, the shortcut allowed me to save much money, and again to get my bags faster to Bloemfontein and increase speed to the market* (Participant 27).

This need to make quick entrepreneurial decisions resonates with the view that, given the uncertainty that often characterises entrepreneurship and the need to make timely decisions (e.g., to increase speed-to-market for products) without the hindsight from past experiences (Makings & Barnard, 2018), heuristics are fundamental to integrating imperfect and limited information to expedite quick decision making in uncertain and complex entrepreneurial situations (Wright et al., 2000). The view that heuristics facilitates quick entrepreneurial decision-making regarding accessing new markets and increasing prospects of generating profits for firms, consummates the view that heuristics assist entrepreneurs with rapid exploitation of perceived opportunities and creating profitable ventures (Wright et al., 2000). Consistent with the resource-based View, which conceives possession of entrepreneurial capabilities as integral to the attainment of competitive advantage (Barney, 1991), one could argue that by helping incubatees with accelerating speed to market for products, heuristics facilitate the fostering of first-mover advantages such as price determination, monopoly of the market and determination of social exchange rules based on control of the product, which contribute to increased competitiveness. One infers form participant 27 that management heuristics, in particular logistics management (planning, coordination, and integration heuristics) (Alspaugh et al., 1999), work to reduce incubatees' costs of transportation, save money and increase speed to market.

d. Consolidation of business operations

The views of the incubatees from incubator B were also sought regarding whether they employed heuristics and how they facilitated or obstructed the realisation of TE. The response of one incubatee was affirmative:

> *My use of heuristics has affected my business positively in terms of growing revenue. I would say it has created a pick there because having the fundamentals of financial management has made me more conscious of cost and revenue management compared to the past. Moreover, before I was in the incubation programme, I had different companies with different trades. So, I have learned to pull together operations and to delegate roles by inviting marketing experts to do the marketing for me. However, I have also used heuristics to work on materials through knowing how to market myself, which I got in the incubation. So, heuristics had a positive effect judging from the issues I have mentioned* (Participant 18).

The narrative above is a clear demonstration of arrangement scripts judging from reference to financial management, the delegation of responsibilities, and effective task execution including the capacity to impact technology business incubation processes. This narrative resonates with the view that heuristics are critical in providing tools relevant to developing scenario management strategies that will assist entrepreneurs in detecting similar future scenarios, eliminate redundancy, and guaranteeing the achievement of consistency in entrepreneurial actions (Makings & Barnard, 2018). It can be inferred that revenue generation, heightened sensitivity to cost containment, consolidation of business operations, and delegation of authority especially regarding marketing the business were the benefits of using heuristics, which could invariably affect TE.

e. Overcoming currency fluctuations and technology reviews

When the owner of a spinout company from incubator B was interviewed on whether she employed heuristics and how such use impacted the realisation of TE for the business, her response was positive:

> *I think in terms of technology, with some shortcuts we ended up achieving what we wanted in terms of better products and services. We have found some shortcuts to shorten the product development process. For instance, instead of subjecting each improvement in technology to usability testing, we often skip some of the testing and concentrate on testing the prototype in the market. The shortcuts help with the shaping of technology. You know while our IT is very dynamic and it will be nice to do shortcuts, you know ideally, we can wait for six months to review improvements through testing. Sometimes shortcut works better. Regarding growing the business, it has also helped us because you cannot wait for six months to make savings with the currency fluctuations so we must rely on some shortcuts. So, shortcuts have been useful in many ways for us* (Participant 20).

The claim that heuristics which involve skipping usability testing for most IT improvements facilitate the faster delivery of IT products and services to market and enhance the growth of the business through promoting savings mirror the view that heuristics inform individuals' financial decisions about savings, developing savings plans and how to make profitable investments (Benartzi & Thaler, 2007).

8.5.4. Perceived entrepreneurial capabilities

The categories explored in the study under the perceived entrepreneurial capabilities (PEC) theme were entrepreneurship knowledge, and business management experience and skills. However, since participants often combined knowledge, experience, and skills in their response to questions on PEC, the subsequent discussion emphasised the combination of the individual dimensions of PEC (i.e., knowledge, experience, and skills) across the different category of participants (i.e., sponsors, incubator management, incubatees, entrepreneurship champions, and innovation champions) rather than these individual dimensions. The other complexity was that the categories of respondents often referred to other respondents further complicating the grouping our responses according to incubation stakeholders. The following sections discuss these participants' responses to questions on PEC, starting with TBI sponsors.

8.5.4.1. TBI sponsors' views on the role of knowledge and experience in supporting technology entrepreneurship

The codes that emerged from sponsors' narratives on knowledge and experience's relationships with TE were "business capitalisation and scaling," the "internationalisation of business" and "business management." These codes are elaborated in the sections below.

a. Business capitalisation and scaling

Acknowledging the role that PEC such as entrepreneurial knowledge, skills, and experience play in determining business incubation outcomes, it was critical to establish whether and how PEC affected the realisation of TE. The response was affirmative:

> *Entrepreneurship capabilities affect technology entrepreneurship especially the capitalisation strategies of the startup. Entrepreneurial knowledge affects how the entrepreneur prepares the company for capital funding, help her understand the venture development issues attractive to the investors and funders. So, the knowledge, skills, and experience are necessary for them to start spreading, start business scaling and attracting growth through internal sales or other funding options* (Participant 14).

One infers that PEC is instrumental in the capitalisation of the business, scaling up production, and facilitating the growth of the business. Furthermore, knowledge, skills and experience were conceived from the perspective of the entrepreneurial process and not necessarily TE per se. That said, the role of entrepreneurial knowledge in accessing funding, scaling up businesses, and promoting sustained growth of the firm points to the significance of in-depth fundamental knowledge about the capabilities that lead to technology entrepreneurial activity (Schmitt, Husson & Nobile, 2016).

b. The internationalisation of business

Regarding the same question on the application of PEC to business incubation outcomes especially TE, the director of the public funding agency elaborated that:

> *For example, we have a company we funded in the Western Cape. When we started, we funded the company for R12 million. We set up a commercial plan, and now the company has set up commercialisation plans in nine countries. So, it just shows how the company has grown through the knowledge, skills, and experience that we provided through the funding and during the training period. So, the company has now expanded to other countries and we see strong growth potential and knowledge, skills and experience have enabled the business to develop technology innovation products that grew the business exponentially. We see that innovators do use their skills to develop their products. Sometimes they come into your facility with one product or a single unit and over time you see that they have now grown. They are now supplying the same technology to 10 to 15 communities* (Participant 14).

The fact that knowledge, skills, and experience can contribute to the internationalisation of business operations and production of technology innovation products demonstrates the role that PEC can play in facilitating the expansion of the business (i.e., growth orientation). By extension, the fact that such growth was enabled through knowledge and skills availed through public training and capacity building demonstrates that new startup owners often lack a range of knowledge and capabilities critical to the effective operation, growth and expansion of technology businesses (Van Scheers, 2019).

c. Business management

The study also sought the middle-level manager's view regarding the contribution of PEC to the crystallisation of TE:

> *I think it is more of giving much of these capabilities in running a business. There is a need for all three (i.e., knowledge, expertise, and experience) otherwise the business will struggle without the capabilities from the startup founder. Knowledge of the product development process and prototype development is key to business growth as each business needs a product with a unique selling point. Expertise in marketing is required to know whether there is a market for a product, establish the size of the market and distribution channel to realise financial sustainability. Experience in price determination is critical to know the optimal price at which a product can be bought to deliver value to the customer and generate profit and growth for the business. Therefore, all are the key to realising technology entrepreneurship* (Participant 15).

Participant 15 viewed effective management of the business in terms of knowledge of product development, marketing expertise and experience in pricing as fundamental to the realisation of TE. As such, this finding confirms that the absorption and assimilation of technological knowledge, skills and experience that entrepreneurs bring into business contexts contribute to the thriving of their startups including their realisation of TE (Shefer & Frenkel, 2003; Frenkel, Shefer & Miller, 2005).

8.5.4.2. Incubator management's conceptions of the role of knowledge and experience in supporting technology entrepreneurship

When the researcher inquired about the role of PEC in supporting TE, the codes that emerged were "increasing competitive advantage," "increasing access to markets," "access to entrepreneurial finance," "entrepreneurial understanding," and "underdeveloped technical knowhow." These codes are elaborated in the sections below.

a. Increasing competitive advantage

The response to the question on the role of PEC in realising TE was affirmative:

> *I think incubatees have some knowledge and skills of developing the product, but business operations that facilitate growth require the entrepreneur to have the technology, good finance, and human resources to maximise competitive advantage. The cofounders are good at technology, so to realise sustained financial growth, they need to figure out how to fill in all the missing pieces in terms of accessing finance and developing competent human resources, activities that the incubator does. For example, the incubator assists with how to build a team as no entrepreneur has all the skills combined* (Participant 11).

Even though entrepreneurs have some basic knowledge and skills to drive business operations to promote sustained growth of the firm, these are not diverse enough to cover the wider range of business management operations (e.g., human resources, finances) and incubators serve as brokers and mediators that breach these knowledge and skills gaps in limited supply among startups. The limited range of knowledge and skills coheres with the narrative on new business startups' lack of management knowledge, which undermines their capacity to operate effectively to promote sustained financial growth (Frenkel, Shefer & Miller, 2005) and hence their commitment to stick to incubators.

When requested to explain the contribution of PEC to advancing TE, the response was affirmative:

> *I have always had knowledge of markets and products, especially how to deliver service or a product to the market. This was the way I was a raised. I had entrepreneurial knowledge of providing services from a younger age based on just making random things and selling them. My knowledge related to business startups especially the benefits of having a startup incubated at the university rather than independently getting startup capital from a venture capitalist or angel or seed funder. I had worked with several incubation projects at the University. My study leaders had technology transfer office related businesses that they were running and I was generally employed by them to help run these things. So, my entrepreneurial experience came from helping other people get their business started. This knowledge helped me to gain practical experience on delivering services to clients in ways that generate revenue for the business. The knowledge I have gained on the psychology and*

emotions of the customer has helped incubatees on how to expand their business and increase their competitiveness through targeting customers' emotions and psyche (Participant 24).

The narrative of participant 24 buttresses the view that prior knowledge contributes to experience in delivering services that contribute to knowing the mechanics of business operations. This knowledge generates revenue and income for the business. This view resonates with the observation that a good combination of knowledge, skills and experience is fundamental to the founding and sustained growth of business ventures in terms of revenue (Mmako, 2019).

b. Increasing access to markets

Given the contribution of incubators to the capacity building of incubatees, it was critical to explore the senior executive manager of incubator A's perspective on the role of incubatees' knowledge and experience in the generation of TE. In his response, he reiterated that:

> *Regarding experience, the more experience incubatees have, and the more skills they have, and the better they will be in terms of the expansion and growth of the technology business in terms of size, revenue, profits and access and share of the market. So, we are trying to build a platform that can provide entrepreneurs with much experience very quickly, and that is the biggest thing - by taking our experiences and trying to populate them to what incubatees need and hopefully they will get to the market much faster* (Participant 11).

From this narrative, it is evident that although there is a serial interconnection between experience and acquisition of skills, these variables coalesce to shape TE through their facilitation of financial growth and expansion of the business. As Bernasconi (2006) observes, the generation of financial resources (in terms of amount required, financial structure and time invested in their mobilisation) is a function of the firm owner's experience and skills in operating business and obtaining funding. The ability of entrepreneurs to deploy their experience and skills as resources through intermediation of technology to meet firm objectives is fundamental to developing TE, especially the growth of firms (David-West, Muritala & Umukoro, 2019).

c. Access to entrepreneurial finance

A comparative analysis of the senior executive manager of incubator A's narrative on the PEC-TE nexus with that of incubator B's management was useful in ascertaining whether the two university TBIs experienced these issues in qualitatively similar or different ways. In his explication of the PEC-TE relationship, one participant highlighted that this relationship was contingent on access to finance:

> *Regarding the role of PEC in advancing TE, I would say it has been 50-50 because if the startup founder funds their technology, it becomes difficult because they will have a negative perception of TE as the growth and success of their business will require much money to*

develop a final product. However, if one secures the assistance of resources such as from an investor then the process of going from level one of technology readiness to level nine becomes easy. In this case, the founder's perception of technology entrepreneurship is much positive because the steps she must follow to reach technology readiness becomes easier if there is funding towards that technology (Participant 12).

One infers that the link between PEC and TE depends on whether the entrepreneur is self-funded or externally funded, with TE being negatively related to PEC when founder conceives TE (i.e., the dimension of growth of the business) to require excessive funding from them. This is because the identification of knowledge with high potential to conceive a product must be followed by an entrepreneur's sourcing capital to define the product, conducting product tests in the market, making adjustments, building the prototype and producing a product that meets the demands of the market (Carrete & de Faria, 2019). Therefore, the relationship would be positive in the short term for the founder if s/he is externally funded as s/he does not carry the burden of securing finance instantly. This view seems to buttress the view that the PEC-TE relationship is moderated by access to finance, as the conversion of knowledge (a component of PEC) into the commercialisation of technology or to support the sustained growth of technology firms depends on the availability of finance (Audretsch, Lehmann, Paleari & Vismara, 2016). **Proposition 1: The perception of the startup founder regarding gainfully deploying their knowledge to promote the sustained growth of the firm depends on the source of the entrepreneurial finance. Proposition 2: Startup founder may exhibit a negative disposition on their capacity to deploy their knowledge to promote sustained growth of the business if they are self-funded than if they sourced funding externally.**

d. Entrepreneurial understanding

When interviewed on how incubatees' use of PEC contributed to the realisation of TE, disciplinary background featured most in shaping the understanding of entrepreneurship:

> *To a large degree, the relationship between perceived entrepreneurial capabilities and technology entrepreneurship depends on the disciplinary backgrounds where academic entrepreneurs come from. We have seen at this university that entrepreneurs from the Engineering and IT, and Management Faculties tend to have that entrepreneurial understanding and drive which contribute to their greater commitment to starting technology startups with levels of capitalisation, profit margins and sustainable technology innovations. However, staff from Humanities and Arts do not see their role within the entrepreneurial space. This is wrong because there is a role for creative arts in the entrepreneurial and innovation space. So, an entrepreneur's background matters because it has to do with the fact some have not understood that their craft or their area of expertise can contribute to technology* entrepreneurship (Participant 8).

This senior executive painted a picture of how the PEC-technology entrepreneurship relationship is moderated by disciplinary differences. It is these differences that determine academic staff's levels of understanding of entrepreneurship, which invariably influence the incubatees' levels of engagement with technology entrepreneurship. The capacity of disciplinary differences in shaping conceptual understanding of entrepreneurship mirrors the view that education system factors (e.g., disciplinary focus) may diminish prospective entrepreneurs' (e.g., student entrepreneurs in IT and management fields) perspectives on barriers to entrepreneurship (Mehtap, Pellegrini, Caputo & Welsh, 2017) which may facilitate engagement in TE. **Proposition: Disciplines with a stronger technical and conceptual focus tend to position incubatees better for the exploitation of their entrepreneurial knowledge to realise TE than those with the weaker technical and conceptual foci.**

e. Underdeveloped technical knowhow

The study also solicited the views of the middle-level managers regarding whether and if so, how their incubates' perceptions of their knowledge affected their engagement in TE. The response was somewhat negative:

> *Sometimes, incubatees' perceptions of their knowledge have affected them negatively because their perceptions regarding their possession of technical ideas in general and their perceptions of building technology businesses, which contribute to technological entrepreneurship, are two different things. They often have technical or technological ideas but when they want to implement those technological ideas to generate startups in the real world, there are business processes they must follow. So, it affects them negatively because what they have is the technical know-how and product ideas not necessarily how to construct technological business successfully. So, when you want to conduct technological businesses, there are rules and regulations that you must follow from ideation to prototype, to the final product ready for the market. So, those are the steps that you must follow. Whereas in their mind when they have a technological idea, they think it is ready for the market. We use the Technological Readiness Levels (TRL) model so, with this TRL model, you find out that someone is on TRL one when they have an idea. Before that idea becomes a product, it must move to higher levels. TRL has nine levels and the most important is level six* (Participant 12).

Technology readiness level, which assesses the maturity of technology for its applicability in environmental contexts, requires the technology to transition from a technical idea to a concept, to proof of concept, the demonstration of its feasibility through tests in the laboratory and the physical environment (NASA, 2012). Therefore, the finding that incubatees assume that possession of technical know-how and technical ideas is sufficient for running technological businesses is inconsistent with the complexity of the transition from level 1 to level 9. Therefore, while the possession of technical knowledge is a critical step towards generation of technical ideas, it would be insufficient for realising technology entrepreneurship as such knowledge needs to be complemented by entrepreneurial and business knowledge and skills. Only then can there be room to facilitate the conversion of ideas into commercialised products, goods, and services. Indeed, knowledge diversity and variety of professional experience are fundamental to efficient resource allocation in technology startups, which facilitate technological innovation and growth of startups (Marques, Sbragia, Oliveira & Borini, 2019).

8.5.4.3. Incubatees' conceptions of the role of knowledge and experience in supporting technology entrepreneurship

The views of incubatees were also solicited regarding the contribution of their knowledge and experience of entrepreneurship to supporting TE. "Appropriate decision making and swift learning," "unsophisticated deal negotiation skills", "knowledge transfer," and "delegation of operational responsibilities" were the codes generated from incubatees' data. These issues are elaborated on in the sections below.

a. Appropriate decision making and swift learning

When asked whether the incubatees' entrepreneurial knowledge and experience played any role in their realisation of TE, the response of an incubatee from incubator A was:

> *Experience has taught me how to avoid going in the wrong direction and not knowing what is important at that stage. This lack of experience often leads to loss of competitive markets and huge financial losses. For instance, when our previous CEO left the company, I went from having a R500 credit card to managing a multi-million-rand project within two months. There was quite a steep learning curve. There was much more responsibility when I stepped into this startup. I learned very quickly but was unsure how proficient I was when stepping in. I did not even know enough how to make the right decisions. So, it was a risk. I am not sure if you have seen that curve, the confidence versus capability. But as time went on, I gained more experience, and with every good decision, we managed to sell to more customers which increased the sales and profit margins of the business* (Participant 1).

Entrepreneurial experience was deemed instrumental in guiding appropriate entrepreneurial decision-making and engagement in swift learning even though the incubatee lacked confidence in the appropriateness of the decisions he took. One infers that lack of experience contributes to wrong decisions leading to failure to capture competitive markets and financial losses while greater levels of entrepreneurial experience may contribute to more informed decisions, increased sales and profit for the business. As Cahen (2019) observes, accumulated technical, management and professional experience are integral to product-based and digital startups' investment in and access to markets, which increase their growth and profitability prospects. The accumulation of experience and expertise also increase nascent entrepreneurs' financial management abilities, which may contribute to the generation of sustainable revenue streams, which are a dimension of TE.

b. Unsophisticated deal negotiation skills

The contribution of the incubatees' entrepreneurial experience and skills to TE was evident in incubatees' negotiation skills:

> *Skills relate more to how to form partnerships or when you are discussing sales deals, to know what the options are, and to negotiate the offering and what the offering brings. As someone that was stepping into a new position in the business world, I did not have the negotiation skills, which I think relates to entrepreneurial skills and experience. However, the further you do down financially, the further you know how to negotiate better deals in startups, but you are competing with big companies and experts whose careers on making negotiations and deals spanning 30-40 years. So, there is quite a disparity between the experience and capabilities of the two people seating at the table discussing business deals. This means the level of technology entrepreneurship in terms of successful financial deals brokered and revenue generation realised is dependent on the level of experience of the negotiator and size of the businesses run by the negotiators* (Participant 1).

Therefore, a lack of experience and skills in negotiating financial and sales deals could have undermined deals (which contribute to revenue streams, which are aspects of TE) especially in situations where startup founders negotiated deals with highly experienced and skilled business deal negotiators. This finding consummates the view that possession of knowledge and experience by professionals is fundamental to the acquisition of service purchases and financial provision (Zou, Brax, Vuori & Rajala, 2019). Consistent with entrepreneurial cognition theory, the development of knowledge, expertise and skills relating to the negotiation of sales deals is a cognitive strategy that facilitates the entrepreneurs' choices and application of information relevant to their technology entrepreneurship behaviours (Busenitz & Barney, 1997; Zichella, 2017).

c. Knowledge transfer

The experiences of the incubatees from incubator A regarding the role of knowledge, skills, and experience in shaping TE were compared to those of incubatees from incubator B for corroboration purposes. When the question of how incubatees' perception of their entrepreneurial knowledge, skills, and experience affected their attainment of TE was posed, the response was somewhat vague:

> *I realised that to be an entrepreneur you do need to pick up much knowledge and skills while you are working in a corporate environment. However, there is little that I can transfer into an entrepreneurial role. There are only a few skills and experiences I can transfer. However, my perception changed when I realised that there are many skills that I need that I already have* (Participant 19).

> *When I got into leather bag manufacturing, I was applying the knowledge and experience that I had acquired from the hospitality industry. I had a restaurant before that I run for one year, in a small town in the Eastern Cape. The restaurant later closed down because we experienced a strike. We had to shut down for two months and the business could not survive that. I used the marketing knowledge and experience gained from restaurant management and I applied it to run my online business. So, before I went into incubation, I had marketing knowledge and experience which I used to run my online stores. I had knowledge of how to*

create adds, post and have a caption, and knew my client demographic because I knew what I was looking for. I know that my leather cannot be for students as they cost around R7000 each. So, I knew exactly who my target market is. So, all this knowledge positively affected my access to clients, increased my chances of successful sales, generating revenue and making profit from the leather bags (Participant 26).

For participant 19, one infers from this entrepreneur that although knowledge and skills transfer from the corporate world into the startups was desirable, not every skill and knowledge used in the corporate sector is readily transferable to small business entrepreneurship. For participant 26, however, marketing knowledge and experience (creating adverts, segmenting the market and knowing client demographics) gained from the retail industry were easily transferable to leather bag production in ways that eased access to clients, which enabled the generation of revenue and possibilities for impacting profit margins. The flexibility of small digital companies lies in their capacity to transfer and externalise knowledge through their weak hierarchies which enable their speed access to markets and facilitate technological innovation (Dibiaggio, 2006).

d. Growth trajectory

The study inquired whether and how incubatees' entrepreneurial knowledge, skills, and experience affected their engagement in TE. The response of one incubatee was affirmative:

Possession of knowledge, expertise, and skills affected my business positively. Growth-wise, I do not count the same turnover as I used to before I joined the incubation. It has improved and grown. Revenue-wise, I do not have the same turnover that I used to have. I have employed more workers than I used to before I joined the incubation. Development-wise, I manage to secure more contracts than I could before the incubation (Participant 18).

Knowledge, expertise, and experience shape the TE of startups and this confirms the view that knowledge has become one of the strategic resources that entrepreneurial firms employ to boost their entrepreneurial outcomes and is differentiating factor among competing firms (Barreira, 2015). Therefore, the application of knowledge, skills, and experience enabled this incubatee to grow her startup in terms of revenue streams, human resources, and access to bigger contracts.

e. Delegation of operational responsibilities

Participant 18 also perceived delegation of responsibility for business operations as an effective way of managing a complex business:

Through experience and knowledge, I learned the difference between "working on the business" and "working in the business." I used to spend much time being on-site, I would *report the same time with the workers and knock off at the same time with them (i.e., working in the business). But I was neglecting what I was supposed to do in terms of managing the business such as costing, contract management, developing financial reports, and checking my competitors. Allowing someone to handle the marketing side of the business to increase brand presence while I manage the core of my business has allowed me to be more efficient and effective in terms of time and resource management, allowed me to concentrate on providing core, unique and superior services while marketers assisted me with expanding the footprint of my band, creating a larger client base that increased revenue generating prospects for the business. I cannot afford to work in my business, I must just work on it, getting the right stuff that will grow my business* (Participant 18).

It is clear that "working in the business" related to the founder's execution of diverse duties in a manner that required her to serve as an employee of the business. On the other hand, "working on the business" involved the delegation of routine operational activities while concentrating on the management side of the business simultaneously. The fact that the founder's knowledge and expertise allowed her to delegate ancillary aspects of the business in ways that increased efficiency and effectiveness in business operations leading to expansion of the footprint of her brand, facilitation of growth through increased client base and created more avenues for revenue generation resonate with the knowledge reservoir argument in the resource-based view. The knowledge reservoir concept has its foundation in how managers construct, assimilate and acquire knowledge (McGrath & Argote, 2000) for efficient and effective business operations and is founded on the resource-based view. The resource-based theory serves as a foundational theory for comprehending how entrepreneurial firms locate and deploy resources within the entrepreneurial environment to achieve competitive advantage (Stevenson & Gumpert, 1985; Widding, 2007).

8.6. INSTITUTIONAL FACTORS AFFECTING TECHNOLOGY ENTREPRENEURSHIP

The institutional factors supporting technology entrepreneurship were summarised as the incubation incentives and support regime, which comprises physical capital, social capital, and intellectual capital. These capital forms as they related to TE were discussed from the perspectives of different stakeholders as articulated in sections below.

8.6.1. Physical capital

The role of physical capital in advancing technology entrepreneurship was discussed from the perspectives of different stakeholders as demonstrated in subsequent sections.

8.6.1.1. TBI sponsors’ perspectives on the role of physical capital in supporting technology entrepreneurship

The only code that emerged from TBI sponsors’ narratives regarding the physical capital-TE relationship was “information portals” and it is elaborated in sections below.

a. Information portals

When requested to describe the extent to which physical capital impacted the realisation of TBI outcomes such as TE, the response of one TBI sponsor was tied to locating funding opportunities using information portals:

> *We have information portals where entrepreneurs and incubatees register their businesses. On these portals, incubatees can find possible funders who provide financial resources they can tap into to increase their production capacities, expand their product range in ways that improve the revenue base of their startups. These portals host solution seekers (e.g., entrepreneurs) and solution providers (e.g., funders, distributors) that provide some contemporary creative and innovative ideas for incubatees to tap into to develop and expand their technology innovation capabilities and grow their businesses. So, if someone is looking for a solution, the first port of call will be the portal. So, one of the things we do is to make these things available so that entrepreneurs and incubatees can tap into these opportunities* (Participant 14).

From the perspective of the funding agency, the provision of a portal for locating funders and other business solutions served as a physical capital provision that could facilitate the incubatees' and entrepreneurs’ pursuit of TE. From such a platform, they could access diverse product offerings, augmenting the revenue base and expanding their technology innovation capabilities. This view resonates with Yang, Yang, and Wu (2005) who explored the effects of developing enterprise information portals (EIPs) on the performance of e-businesses and established some significant differences between those firms with EIPs and those that do not regarding EIP implementation (e.g., level of application, type of implementation, integration ability), and the performance of e-businesses. Consistent with the resource-based view, interorganisational collaboration in innovation ecosystems consisting of multiple parties (e.g., government agencies, suppliers, clients and peer firms) can provide essential resources and complementary assets (Brouthers et al., 2015) for the realisation TE. Literature also demonstrates that small technology firms’ ability to identify, acquire and effectively deploy data and more knowledge-based resources facilitate the technology commercialisation process (Pellikka & Ali-Vehmas, 2019). In short, those incubatees who exploited the information portals for securing funding opportunities and other business solutions stood a greater chance of accessing innovative ideas, enhancing their production capacities, and expanding their product range in ways that potentially increased their revenue base. Such actions sustain their growth and unlock their technology innovation capabilities more than their counterparts.

8.6.1.2. Incubator management's perspectives on the role of physical capital in supporting technology entrepreneurship

When the views of incubator management were solicited regarding the role of physical capital in supporting TE, the codes that emerged were "virtual incubation", and "emporium of incubation services and support" and these are elaborated on in subsequent sections.

a. Virtual incubation

Since incubators are created to bridge resource gaps, hedge incubatees from unfair competition from established corporations, and increase efficient resource allocation among fledgling startups, it is logical to investigate the role of physical capital availed to incubatees in the realisation of TE. When asked whether incubators' provision of physical capital played a role in realising TE, the senior executive manager of incubator A's response was evasive:

> *While it helps to have a physical presence for the incubatees but as we have seen during the* Covid 19 *pandemic it is not always necessary. So, all our programmes are built in a way that they can be administered online. I mean, that was even pre-pandemic, we wanted entrepreneurs to come in, learn and go as they were very busy. They cannot come into the physical space all the time. So, how do they learn something on their own time and then sit with their mentor or an expert when they have time to do so. So, I think for us, physical space is important, but you can run an incubator virtually without a physical space* (Participant 11).

The need for space (e.g., physical office, shared workspaces) depends on the design of the programmes and whether on-site production of a physical product, artefact, or industrial design is required. The provision of virtual incubation services remained ideal under the Covid 19 pandemic where social distancing is deemed to be the norm rather than an exception. This contingency of the capacity of physical capital shaping entrepreneurial learning (a component of technology entrepreneurship) weakens the logic of the public narrative about the importance of physical capital resources in developing new technology ventures (Block, Fisch & Hirschmann, 2020).

b. An emporium of incubation services and support

Although horizontal comparisons across institutions (i.e., senior executive management perspectives across universities) offered top executives' perspectives on the role of physical capital in fostering incubation outcomes, hierarchical comparisons within the same organisation were also ideal for ascertaining whether the vision and perspectives of senior management executives regarding physical capital were shared by the middle-level managers at the lower echelons of incubation structures. When the middle-level managers were asked whether the incubator's provision of physical capital resources affected the incubatees' realisation of TE, the response was affirmative:

> *The provision of physical capital affected our incubatees positively because we have a fabrication facility that works directly and in proximity to the incubator in providing technological assistance, a form of business assistance that they would not normally get at home. They have access to physical resources such as office space, telephone, internet, and working spaces to enhance their business operations and hence these resources have affected them positively. We expose our entrepreneurs to facilities such as a product development facility and a 3D printing facility which are the technological spaces of the university that assist them. Some incubatees have also secured venture funding from different stakeholders allowing such technological businesses to operate effectively and to profit via these entities of the university. With physical offices, they can schedule their programmes and meetings more professionally which would be different if they were running their businesses from home. So, it has affected them positively* (Participant 12).

Therefore, the provision of physical resources (e.g., physical space) has contributed to increased incubatee access to product development, financing and impacted the profitability of these technology businesses. This finding resonates with the view that the provision of physical capital (e.g., accommodation such as laboratories, rooms and specialised equipment) contributes to increased high technology firms' capacity to expand in response to changes in the market as well as being accommodated in the same commercial and scientific space for post incubation expansion (Albert & Gaynor, 2006). The provision of industrial infrastructure such as physical capital is credited with supporting mechanisms of growth and development of entrepreneurial firms and boosting regional economies (Sardeshmukh, O'Connor & Smith, 2020) The provision of physical space for new startups also facilitates access to entrepreneurial funding which contributes to the reduction of the funding gap in the inception phases of business startups (Meinshausen et al., 2012; Moritz & Block, 2016). **Proposition: The provision of physical resources increases incubatees' access to physical infrastructure that broadens access to technical and product development as well as access to finance that facilitates the realisation of TE**.

8.6.1.3. Incubatees' perspectives on the role of physical capital in supporting technology entrepreneurship

The discussion of physical capital from the perspective of incubatees yielded the following codes: "financial expenditure reduction", the "digitisation of the business," "augmenting the clientele" and "access to finance" and these are elaborated in subsequent sections.

a. Financial expenditure reduction

Given the mandate of an incubator is to provide a wide range of resources and services to cushion the fledgling startups from the adverse effects of a competitive external environment, it was critical to inquire about incubatees' perspectives on the role of physical capital in facilitating TE. Specifically, this study explored how the incubator's provision of physical resources affected incubatees' realisation of TE. In response, one incubatee noted that:

> *I think the provision of physical capital has been one of the primary enablers of what we were able to do in the past two years. Without the physical resources such as an office, conference rooms, storage rooms, some desks, and cupboards we would have incurred many capital and overhead expenses in getting things we needed to do product development. So physical resources such as operational space helps in enabling business growth* (Participant 1).

Another incubatee emphasised access to customers and cost savings during meetings:

> *The incubator provides physical space, they have someone at reception that can receive packages. If they are customers walking in, they can guide them to us so this enhances access to customers who can buy the product, thereby increasing sales revenue. They have boardroom facilities, which means it is unnecessary to spend our hard-earned cash or capital going to a restaurant or coffeeshop to see customers and investors. So, the availability of physical space saves us money for booking at restaurants which we can direct to our business operations to enhance growth opportunities* (Participant 21).

The contribution of physical resource provision to capital expenditure reduction, product development and sustained growth of the business supports the view that incubators contribute to the early development stages of technology startups and enhance their success rates (Markley & McNamara, 1994; Yusubova & Clarysse, 2016). Moreover, access to customers and cost savings arising from meeting investors in incubator spaces resonate with the notion that resource sharing and agglomeration of knowledge are areas of specialisation for business incubators, which contribute directly to the entrepreneurship of technology-oriented businesses (Phan, Siegel, & Wright, 2005; Bøllingtoft, 2012). Therefore, the provision of physical capital contributes to the realisation of TE.

b. Digitisation of the business

When requested to describe how the incubator's provision of physical resources affected his business' attainment of TE, participant 18's response was affirmative

> *It is easy for me to send emails, develop and scan documents from the office provided by the incubator. It is more convenient than if I were to spend time going an internet café to do it. Even though marketing changes repeatedly as it becomes more digital, the digital skills that I developed during my stay in the incubator improved my business operations. Now I am working towards marketing my business online- digitisation of my business* (Participant 18).

Another incubatee highlighted that:

> *We have our own facilities within the incubator. We have very stable internet connection and that is important because we use many applications and rely on cloud computing. For instance, our invoicing is done over Xero cloud-based accounting software. We cannot overstate how important it is to have good and stable internet. So, internet availability*

enabled us to do cloud-based accounting and have online presence at a very low cost. So, we are saving on our finances that we could have committed to data plans if data were provided by private vendors. We have committed such savings to other business operations, thereby increasing the growth prospects of the business (Participant 21).

The provision of physical capital resources facilitated convenient access to electronic services, the acquisition of digital skills, digitisation of the business, and prevented time wastage in queues at internet cafés. The improvement of digital skills coheres with the narrative that incubators contribute to imparting knowledge, skills, and mindsets that transition startup founders from being employment seekers to employment generators (Hassan, 2020). One infers that the provision of physical resources (e.g., office space, access to electronic networks) contributed to the success of incubatees and incubators in realising TE (Bruneel et al., 2012; Soetanto & Jack, 2013) through sustained online presence, digitisation of business accounting processes, cost savings and increasing growth prospects of startups.

c. Augmenting the client base

The researcher sought to understand how the provision of physical resources affected business growth and the commercialisation of business outcomes, which are aspects of TE. When the question was posed to one incubatee, the participant placed premium on increasing the clientele base:

The provision of physical resources helped so much because, the more we accessed computers, Internet, WiFi, marketing, and printing services meant for student entrepreneurs for free, the more we attracted clients. I feel like it was good – because the fact that these physical resources were accessed at university meant the entrepreneurs did not need to stress about infrastructure as they worked on their businesses. So, it allowed us to concentrate on expanding our businesses and seeking more clients (Participant 3).

Access to physical resources sharpened the incubatees' focus on their business by availing more time and resources for engagement in business operations, which increased the capacity of incubatees to seek more clients. Although the provision of working space may not address the wider range of costs of business incubation processes and procedures (Lose, 2016), it however, creates sufficient conceptual (i.e., developing conceptual models and tools for business), physical and temporal (i.e., availing time to concentrate on business operations) spaces for the incubatees to thrive in terms of expanding the client base and the business operations, which enhances the chances of realising TE.

d. Access to finance

The positive impact of physical capital on TE found expression in availing capital for product commercialisation:

Through the incubator we got access to funding. They said they believed in the product, they *assisted us in further developing it, marketing it and selling it as they saw that there is an opportunity for the product. They became our primary source of funding as they facilitated our access and securing of an investor that really helped a lot. So, access to affordable renting space and good quality working space at affordable price has enabled us to get access to funding, which has helped a lot in commercialising the product* (Participant 21).

As a form of physical capital, financial support facilitates the development of technology of high technology firms from conception, development, prototyping and testing, commercial launch and market development (Moreau, 2006; Carrete & de Faria, 2019).

8.6.1.4. Entrepreneurial champions' perspectives on the role of physical capital in supporting technology entrepreneurship

The views of technology champions were also sought regarding the role of physical capital in supporting TE. "Importance ranking priorities" and "links to sources of funding" were the codes that emerged from participant narratives, and these are elaborated in subsequent sections.

a. Importance ranking priorities

The study inquired entrepreneurial champions' perspectives on the contribution of physical resources to the realisation of TE. Participant 13, an entrepreneurship champion, provided a ranking order of priorities of resources in his response:

I believe equipment will be number one, cash and loans second, and inventory such as consumables next when it comes to physical resources that contribute to technology entrepreneurship. By differentiating the inventory from physical immovable to movable equipment, then inventory could be third. In that sense, inventory too will come in. But then from a general entrepreneurship perspective, I will rearrange physical capital factors that drive TE especially firms' financial growth and sustained technological innovations as follows; equipment, inventory, cash, equity and loans (Participant 13).

The physical and material resources (e.g., equipment, inventory, cash) that facilitate the immediate execution of entrepreneurial tasks were rank first, a clear indication that forms of TE such as a firm's financial growth and sustained technological innovations require a strong task orientation. Just like the pecking order theory stipulates that small firms' founders must exhaust their internal sources of funding (e.g., personal saving, equity) to support initial phases technology development (e.g., identification of viable product, testing and prototyping) before they resort to external sources (e.g., external debt) (Frank, Goyal & Shen, 2020), the same argument is advanced for founders of technology-based startups. For instance, to internalise risk and reduce the cost of conducting business, insider financing and bootstrapping were recommended in initial stages of technology development (e.g., product conception, identification of viable technology product and testing and prototyping), while external sources of financing (e.g. angel investor financing, venture capital and private equity) were recommended for expansion stages of technology firms (Carrete & de Faria, 2019). In short, different funding mechanisms during the life cycle of technology firms contribute to the realisation of TE.

b. Links to sources of funding

The question on the role of physical capital in advancing TE generated the following response from another entrepreneurship champion:

> *In our support of student entrepreneurs, we did not provide physical resources to them, so I would not comment on that. Rather I would say, we only linked them to potential funders which would occasionally provide them with financial support for the development and expansion of their entrepreneurship projects which potentially broadened their revenue base* (Participant 5).

> *We have supported one incubatee with funding for a year. The incubatee was the winner of the open innovation challenge. We provided funding resources so that they can pay rent to the incubator. So, the provision of such funding has helped them concentrate their focus on growing their product, look for ways to increase their sales, perfect their marketing strategy to clients something quite important for them to do. Although, during this Covid 19 period, entrepreneurs can work from anywhere, but they will still need internet connections and laptops when they come to the office. So, although an office has been useful pre-Covid 19, good internet, good connectivity and laptop have made business processes easier during Covid 19* (Participant 23).

The finding on the capacity of entrepreneurship champions in incubation contexts to provide incubatees with networking opportunities and connections to funders somewhat contradicts the view that although technology-based incubators must develop highly skilled teams of consultants that facilitate social networking and open communication to facilitate the uptake of innovations, their networking intentions are often undermined by limited engagement with exchange ideas, information and experiences among incubatees themselves (Miranda & Borges, 2019). The provision of funding resources that enabled incubatees to concentrate on perfecting the innovation during product development, increase their sales as well as perfect their marketing strategy to clients coheres with the view that funding is integral to the entire process of innovative development of technology products in startup life cycle (Carrete & de Faria, 2019).

8.6.2. Social capital

Apart from physical capital, the other category derived from the incubation incentive and support regime was social capital. As already alluded to under the discussion of the role of social capital in TBI, the study applies Bourdieu’s (1986) conception of social capital. Attention was devoted to the role of the exchange of resources, the existence of reciprocal relations, the fulfilment of mutual obligations, and social recognition in the creation and sustenance of relations. Social capital was examined from the perspectives of various stakeholders as discussed in subsequent sections.

8.6.2.1. TBI sponsors' views on the contribution of social capital to enhancing technology entrepreneurship

When incubation sponsors were asked about the roles of social capital in shaping TE, the "use of innovation portals" was the main code developed and this is elaborated on in subsequent sections.

a. Use of innovation portals

To the extent that the provision of diverse resources makes business incubation possible, it was logical to explore the intersection between the provision of social capital and engendering incubation outcomes such as TE. The researcher requested participants to explain how the provision of social capital by incubators contributed to the realisation of TE of startups. In response, the senior executive manager of a public funding agency highlighted that:

> *Regarding social capital, whenever there is a business opportunity, we post it on our website and our social media pages. So, incubatees and entrepreneurs that enters the system will be able to access these social and business network opportunities. In addition, at the system level, we created a platform that is called the innovation reach portal and any incubatee can access that to develop their innovation products, services and solutions. So, you find that these incubatees take these innovation opportunities to commercialise the development of their products. In most cases, we do not track them, but they would like to have a tracking system* (Participant 14).

Therefore, the fact that websites and social media pages are vehicles through which the incubatees accessed social and business networking opportunities somewhat deviates from the view that incubators and their sponsors emphasise the dynamics of socialisation that facilitate knowledge sharing and innovation processes in offline engagements between team members, their closeness, and intermediation levels in technology-based incubator companies linked to universities (Miranda & Borges, 2019). The use of websites and social media pages to develop and refine the innovation of products, services and solutions and facilitate technology product commercialisation support the narrative that sponsors of incubation provide comprehensive support networks for the entrepreneurial learning and sustainable technology innovations of startups (Van Weele & Van Rijnsoever, 2017).

8.6.2.2. Incubator management's views on the contribution of social capital to enhancing technology entrepreneurship

The views of incubator management were sought regarding the contribution of social capital to enhancing TE and "effective social networks" and "strong relationships and entrepreneurial learning" were the codes that emerged from the incubator management's narratives. These codes are presented and discussed in subsequent sections.

a. Effective social networks

Given that social networking resources were availed to incubatees by incubators, it was logical to explore the possible intersection between the provision of social capital and the realisation of TE. The researcher interviewed the senior executive manager of incubator A on how the incubator's provision of social capital especially network resources affected the TE of incubatees they hosted:

> *The provision of networking resources helps in the entrepreneurial process. Even though the incubatees do not need to have social networks to make the whole process of entrepreneurship work, but their availability expedites the process. So, I think, the better the social and business networks, the better the technology and entrepreneurial success that incubatees will have* (Participant 11).

Another middle level manager highlighted:

> *As an incubator, we provide networks that are important to a specific product or project in place. So, we seldom have networking opportunities where everyone gets into action with everyone. We select, we go through a process of identifying proper mentors, financiers, suppliers, distributors and then we would engage within a closed environment with our project and those people, but it is not open networking. We identify industry experts or leaders in their fields or someone who can contribute to the project. So, these leaders are so fixated on a specific target market or a specific product until one of those mentors or networks asks a question and it blows a completely new market open; one that is more profitable, easier to enter for incubatees. So social networking enables technology entrepreneurship by expanding the knowledge and access of incubatees to new markets, new products, increasing chances of making profit* (Participant 24).

The argument, therefore, is that even though social and business networks are not the panacea for the realisation of entrepreneurial processes of technology-oriented business, their provision contributes significantly to the enhancement of TE. Hisrich, Peters, and Shepherd (2017) argue that since entrepreneurship is a socially mediated activity that unfolds in social contexts, entrepreneurs benefit from forging connections and networks in the inception phases of the venture formation process, and these drive the realisation of entrepreneurial outcomes such as TE. The claim that the better the networks the better the success of incubatees resonates with the view that the frequency, level, and reciprocity of resources shared determines the strengths of networks and the economic benefits derived from them

(Aldrich & Zimmer, 1986). Participant 24's view that social capital networks expanded knowledge and access to new markets, new products, increasing chances of making profit aligns with the view that new firms overcome barriers of newness, smallness and foreignness by expanding their collaboration with service providers, professional partners and competitors (Manolova, Manev & Gyoshev, 2010) facilitating the expansion of the range of business products into new local and foreign markets (Misbauddin & Nabi, 2019).

b. Strong relationships and entrepreneurial learning

The middle-level manager of incubator B was also interviewed on the role of the incubators' provision of social network resources in enhancing the TE of incubatees. The response was affirmative:

> *The provision of social capital has affected our incubatees positively because, through the networks they built, they have gained experience on what to do next through learning from those who have been in business for a long time. For example, we have exposed one incubate in agriculture business to businesses that operate under [names of two large farming networks highlighted], which are companies owned by large-scale farmers with experience, and they take them under their wings. Network resources have yielded benefits such as building strong relationships, strong networks by aligning incubatees with these big guys with experience in different markets* and facilitating firm growth opportunities (Participant 12).

The capacity of social network resources to engender entrepreneurial learning, lubricate mentorship relationships, and facilitate the construction of strong affinities with established corporations served to catalyse the realisation of entrepreneurship of new technology-based firms. Social capital is a key resource for the development of new technology-based startups as it presents them with the capacity to increase sales and expand to new markets through augmenting founders' and customers' decision-making on personal and business contacts, product selections, and information sharing instantaneously (Berman, 2012). Social capital facilitates the relationships between different mentors and managers that enhance the flow of advice, insights, contacts, tacit knowledge that engender the development of new technologies among new technology-based startups (Schillaci & Romano, 2016).

8.6.2.3. Incubatees' views on the contribution of social capital to enhancing technology entrepreneurship

"Generating innovative ideas and exploring untapped markets" "conundrum of sales and investor networking", "accentuating sales", "enterprise social networking", and "product distribution via offline and online social networks" were the codes that emerged from the views of incubatees regarding the contribution of social capital to enhancing TE. These are views are discussed in sections below, starting with views from incubatees from incubator A.

a. Generating innovative ideas and exploring untapped markets

When asked to explain the contribution of social networks provided by the incubator to the realisation of TE, the response was positive:

> *Access to social networks has assisted us 100% with the generation of innovative ideas for our business. For instance, my business partner, whom I accessed through the networking opportunities availed by the incubator, is one of the very innovative people I know and this has enabled us to introduce effective and sustainable innovations in the business such as digital marketing and crowdfunding. Through social networking provided, I secured my business partner, who contributed 50% of what we have built thus far. So, through coming together at the incubator, sharing ideas with other people, we have discovered markets with high growth opportunities. When we meet with our networks at the incubator, we also discover many untouched markets that we can exploit through developing innovative solutions* (Participant 21).

The outcomes of the exploitation of social capital comprised sharing of knowledge and ideas on the exploitation of high growth markets and facilitation of sustainable technology innovation. There is compelling evidence to suggest that social capital serves as a fertile ground for the development of technology-based startups as they nurture close relationships for learning and applying knowledge about creating innovations and expanding markets through attracting customers (Batjargal, 2000; Romano, Nicotra & Schillaci, 2017). **Proposition: Social capital creates ambient opportunities for co-creation of knowledge and exchange of ideas regarding high growth markets and sustainable technology innovation that support the growth and maturity of new technology ventures.**

b. The conundrum of sales and investor networking

Since incubators often report social networking resources as components of the gamut of the resources they offer to incubatees, the current study investigated whether the provision of social networking resources by the incubator contributed to incubatees' attainment of TE. The response of one of the incubatees whose business was in the foundational stages of development demonstrated the flip side of investment networking for incubatees with low sales volumes:

> *This again speaks to the investing part. I think we wrongly pursued investment when we could have pursued sales so that our business would not have been negatively impacted. So, we were introduced to many investors, and though the opportunity was there, we could not show the investors what they wanted to see, that is, sales and revenue projections. So, we should have driven sales from the beginning. So, we went down the wrong path because we concentrated on building network resources for almost a year. Therefore, having a template of what startups should do made us go down the wrong route* (Participant 1).

> *The whole incubator is set up in such a way that social networking is easy. The range of offerings include deliberate events that are held by the incubator, so we do not have to go somewhere else and look for networking events. We are based at the incubator that provides these events. So, guests, partners and investors come to the incubator so that helped a lot in*

accessing professional advice and increasing funding opportunities that increased the growth opportunities of startups (Participant 22).

Since the incubator emphasised developing networks in the innovation ecosystem, participant 1 identified the dark side of social networking as incubators' misdirection of incubatees. This flip side emphasises securing investors at the expense of driving sales and revenue that investors evaluated in any startup as a condition for investing their funds. This finding somewhat contradicts the view that social networks facilitate engagement in conversations, sharing of relevant content, and knowledge management, which promote value creation and positive business outcomes (e.g., increasing sales, access to funding, acquiring new customers, image building, brand recognition) for small nascent firms with limited budgets (Looy, 2016). To the contrary, participant 22's claim on the capacity of social capital to create avenues for accessing professional advice on funding opportunities resonate with the view that open networks (generated from weak relationships) are critical sources of heterogenous knowledge and technology innovations (Rodan & Galunic, 2004) which facilitate the growth of startups.

c. Accentuating sales

While participant 1 emphasised the conundrum of pursuing investment networking and boosting sales volumes, another incubatee appreciated the role of social networks in increasing sales:

> *We were able to sell our products because of social networks we established over the years. So, social networks are helpful in increasing the business' sales. So, networking resources helped us in selling the technology products as opposed to just building mor*e (Participant 19).

Another incubatee highlighted:

> *Through social networking, we complement the skills of some incubator staff, which means that we can help them in situations where they need assistance while they give us new customers which increase the sales and revenue base for the business. Access to social networks has also increased our access to financial resources through increased access to investors, which increases the income base for the startup. Through these networks, we managed to appoint the right people or just had the right people at the right time working for us. Through the networks that are available, we have also accessed new market opportunities for developing Agrotech solutions. This has helped us with getting new business which increased our revenue base and growth opportunities* (Participant 21).

The capacity of incubator-sanctioned social networks in supporting business development through augmenting sales resonates with Nair and Blomquist's (2019) view that business incubators' strategies and activities (e.g., deployment of social networks) are instrumental in preventing and mitigating the failure of startups (e.g., by increasing sales – itself a component of TE) at personal, organisational, and social levels and supporting the value creation of these firms. The outcomes of social capital development such as availing new customers that contribute to increased sales and increased access to investors who avail financial resources that increase the income base for the startups (aspects of TE) cohere with the view that social capital provide entrepreneurs with commercial opportunities for developing and expanding their technology ventures (Coleman, 1988, Barreira, 2016).

d. Enterprise social networking

When another incubatee from incubator A was interviewed on the contribution of the incubator's provision of networking resources to the realisation of innovative enterprises, revenue growth, and sustained growth of technological startups (i.e., technology entrepreneurship dimensions), the response was lukewarm:

> *I think social networking is a real factor on the large enterprise side more than on the small business because they lack will power to mass credible and resilient networks. So, I would not say social and business networking makes a big impact from the technology entrepreneurship* perspective of startups due to their few networks, lack of resources and limited potential for large scale production of technology products (Participant 19).
>
> *The provision of social networking has not increased the commercialisation of innovation outcomes because we are in a startup phase. However, social networking has increased the awareness of our brands among clients, which has allowed us to meet with other potential customers, partners and investors via these networks. So, while social networking has not increased enterprise growth from a commercialisation perspective, it has increased the growth of our presence and image* (Participant 22).

The claim that social networks generated greater value in the form of technology entrepreneurship for large corporations than startups which are resource constrained contradicts the view that social networking communities are integral to the survival of startups through their first year as they facilitate the provision of customer feedback at the conception stage (R&D stage), enabling codesign or cocreation of products to suit individual customer needs (Looy, 2016). However, the claim that social networks contributed to increased customer base and increased brand presence and image corroborates the view that social networking (e.g., through social media platforms) facilitates brand presence and recognition by availing content relevant to customers and firms' needs (Coelho, Nobre & Becker, 2014) with possibilities for increasing the client base and sales.

e. Product distribution via offline and online social networks

An enquiry was conducted into the possible association between the incubator's availing of networking resources and incubation outcomes such as commercialisation of products/applications, financial sustainability, and the growth of startups. The response confirmed the value of social capital:

> *The promotion of social networking was very good because when you are a student entrepreneur, data is very expensive. So, within the university incubator, there is free data,*

> *you get to sell and market your stuff via online platforms which increases the sales volumes and profit margins. Also, I was able to use social networks to distribute my products within the university's premises. So, it was good because you could do everything in one place without saying when I get home, I still need to do this and that. So, it makes business operations more synchronised and efficient in terms of time management. This increases time invested in research and developing technology innovations* (Participant 3).

The combination of offline and online social networks when merchandising products and services in fulfilment of technology entrepreneurship objectives (e.g., increasing sales volumes, business profitability, developing technology innovations) transcends reliance on either online social networks (Berman, 2012; Goh et al. 2013; Keegan & Rowley, 2017) or offline social networks advanced in the literature (Baird & Parasnis, 2011). Precisely, however, one discerns that online platforms rendered marketing avenues for products while the offline social networks facilitated direct sales, which collectively signified the benefits of social capital in advancing TE.

8.6.2.4. Entrepreneurial champions' views on the contribution of social capital to enhancing technology entrepreneurship

"Entrepreneurial advice and linkages" and "illuminating the entrepreneurial process and business viability" were codes that emerged from the entrepreneurial champions' views on the contribution of social capital to enhancing TE. These codes are discussed in subsequent sections.

a. Entrepreneurial advice and linkages

When asked about the role of social capital in enhancing TE, the response amalgamated social and intellectual capital:

> *If you start a business without intellectual resources the business comes to nullity. The same applies to social networks yeah. It may not collapse the business, but other aspects of the business would suffer. So, our provision of entrepreneurship advice and linkages from business partners to our student entrepreneurs made sure that students bring all these resources together in their social entrepreneurship businesses. Although, we did not know that these are the terms (i.e., social capital and intellectual capital) to use we did know that we are giving them intellectual resources* that would *impact the growth of their business in terms of revenue, workforce size and asset base* (Participant 5).

Linking student entrepreneurs to business networks and availing intellectual resources enabled these entrepreneurs to integrate resources and convert them into positive business opportunities and outcomes. This finding resonates with the view that professional linkages and networks facilitate knowledge exchange among entrepreneurial startup firms (Sá & Lee 2012; Kitagawa & Robertson 2012), which are fundamental to the development of high-quality, growth-oriented and viable commercial technology ventures (Ruffing, 2006).

b. Illuminating the entrepreneurial process and business viability

Another entrepreneurial champion was also interviewed on his perceptions of the contribution of social capital to the realisation of TE. His response was encouraging:

> *I remember there is a guy I was talking with about technology enterprise. Then my university opened an incubator in Welkom of which he was a part. Sometimes, this guy would informally consult with me during discussions, and I gave him some ideas. I think this networking support has positively assisted him to understand the entrepreneurial process, how to evaluate business viability and apply it to forecast the prospects of making revenue and profits, including whether he had the minimal technical skills to be involved in it. This is because people often jump into technology enterprise once it invokes something without having any competency in it which may be very disastrous. So, from my advice and interactions, he was into something that he has capability in as he is an IT person and so he looks at technology business from that perspective. The only thing he was lacking then was business acumen, which I complemented with* (Participant 13).

The fact that social networking facilitates knowledge of the entrepreneurial process, business viability and projection of revenue streams and profit margins demonstrates that social capital deepens human capital development, which can be employed in the realisation of TE. This finding complements the view that the construction of new links with external partners and leading experts in an incubation environment facilitates incubation tenants' technology entrepreneurship development (Hansen et al., 2000; Williams & Tsiteladze, 2016). Precisely, this technical incubatee lacked the entrepreneurship expertise, the correct business concepts, and principles to run the business successfully and the provision of entrepreneurial support breached that knowledge gap.

8.6.3. Intellectual capital

The last dimension of the incubation incentive and support regime examined is intellectual capital, which comprises all knowledge-intensive assets whose book value is often not included in financial statements (Hejazi, Ghanbari & Alipour, 2016). Intellectual capital comprises human capital, relational capital, and structural capital (Bontis, 1998; Leitner, 2005; Vergauwen, 2007). Bontis' (1998) characterisation of intellectual capital has a wider application in literature even though this study did not present findings on each of these dimensions. This is because some of the dimensions such as human capital and structural capital span the physical capital, social capital, and intellectual capital domains. To avoid confusion, therefore, intellectual capital covers any form of intellectual resources that the incubator provided to incubatees such as access to knowledgeable persons (e.g. experts, mentors, investors and skilled workforce i.e. *human capital*), organisational databases and processes (i.e. *structural capital*) and opportunities for knowledge sharing, collaboration and dissemination and other specialised business training that expanded the knowledge base of incubatees (i.e. *relational capital*). The views of different stakeholders on intellectual capital category are discussed in subsequent sections.

8.6.3.1. TBI sponsors' perceptions of the role of intellectual capital in supporting technology entrepreneurship

"Intellectual opportunities" and "personal development and financial performance" were the codes that emerged from the review of transcripts covering TBI sponsors' conceptions of the role of intellectual capital (as a category) in supporting TE. These codes are discussed in the sections below.

a. Intellectual opportunities

Given the increasing diversity of resources (e.g., physical, social, and intellectual capital) availed in incubation programmes, it was critical to explore the possible intersections between intellectual capital and the fostering of incubation outcomes such as TE. The researcher investigated whether intellectual capital played a role in supporting the realisation of TE of incubatees and entrepreneurs, especially those the sponsors funded. The response was affirmative:

> *Remember I said our entrepreneurs consult us and our networks when they are looking for intellectual opportunities such how to access venture finance, financial accounting advice and knowledge and specialised training such as developing grant applications. The firms take up these opportunities to facilitate the development of new scientific and technological innovations, promote the expansion and financial growth of their startups by expanding the income or revenue base. We have a long relationship with our entrepreneurs. Although our institution is 10 years old, we have entities that have been in existence longer than it and I was in one of those entities. Some of our relationships started 15 years ago and we are still having those relationships with our entrepreneurs and they give us updates in terms of where they are and their technical needs* (Participant 14).

One infers that intellectual capital in the form of knowledge embedded in people (human capital) and knowledge embedded in different stakeholders (relational capital) (Guthrie et al., 2012) contributes directly to the generation of added value for firms (e.g., in terms of financial growth, sustained technological innovations) (Conicella, 2013). The development of intellectual capital facilitates systems integration (i.e., the integration of hardware and software with functional activities of firms such finance, manufacturing, finance and retail) to enhance, redesign and reconfigure the firm's proprietary technologies and the development of technologically advanced products and processes (Link & Siegel, 2007).

b. Personal development and financial performance

For the corroboration of the sponsor's evidence on the possible association between provision of intellectual capital and the attainment of incubation outcomes, the other funder was also requested to characterise the contribution of intellectual resources to TE and the response targeted personal development which contributed to financial sustainability:

> *I think by intellectual support you imply programmes we provide aimed at supporting strategic thinking. For example, our business training and development programmes assist entrepreneurs to plan at a strategic level for their businesses. We measure their progress during the programme in terms of personal development and how such personal development invariably contributes to the financial performance and sustainability of their firms. We believe that once we execute these programmes well, we must be able to measure the personal development of the entrepreneur and financial growth of the business* (Participant 15).

The tracking, monitoring, and evaluation of entrepreneurs' personal development was an integral part of providing intellectual resources, especially human capital to incubatees that contributed to the realisation of financial performance, sustainability and growth of firms, which are the dimensions of TE. This finding mirrors the view that human capital (e.g., expertise, education, work-related knowledge and competencies) acquired through different mechanisms (e.g., training and business development programmes) contributes to the financial sustainability of technology businesses (Çalhan, Akdağ, & Öter, 2020). Similarly, the intellectual capital of scientists enhances the growth of biotechnology industries in the United States (Zucker et al., 1999; Calza et al., 2014).

8.6.3.2. Incubator management's perceptions of the role of intellectual capital in supporting technology entrepreneurship

The growing appreciation of intellectual resources availed by incubators in facilitating incubation processes necessitated the researcher to establish the possible contribution of these resources to the advancement of TE. "intellectual resources" and "seamless business operations" were the codes that emerged from incubator management's narratives regarding the relationship between intellectual capital and TE. These are elaborated in the sections below.

a. Intellectual resources

The study explored whether and how the incubators' provision of intellectual capital affected the realisation of TE, to which participant 24's response was affirmative:

> *We avail intellectual resources to our incubatees such as the three technical training and advisory sessions where we engage with them. Firstly, we start our training on a limited basis to get incubatees to think entrepreneurially. Next, we move into asking them questions whose implications in terms of revenue streams, cost structure, market size, minimum viable product and supporting sustainable innovations, they must address. Next, they go through the lean canvas business process where we provide them with business mentors who dissect their*

> *business ideas and putting them back together. This supports technology entrepreneurship by providing them with knowledge and expertise on processes of developing a technical product, determining sales projections, segmenting the market and which improves their chances of locating paying customers, increasing their sales and product competitiveness and generating profit* (Participant 24).

In short, the provision of specialised technical and advisory services (entrepreneurial, market, cost management and product development training) is fundamental to developing entrepreneurs' capability, talents, and abilities to harness entrepreneurial knowledge in ways that contribute to new technological innovations (Acs & Audretsch, 1988). This finding supports the resource-based view that organisations comprise a constellation of resources and the capacity of management to tap into them in exploiting market opportunities contributes to increased organisational performance (Penrose, 1959; Taher, 2012), which manifests in technology entrepreneurship (e.g., technical product development, revenue and profit generation and increasing product competitiveness) of technology startups. This finding, however, contradicts the view that strong intellectual property rights protection coupled with high levels of foreign direct investment per capita at national level undermine entrepreneurs' proclivity to engage in TE (Pathak, Laplume & Xavier-Oliveira 2014). **Proposition: A technical training approach in which technical knowledge is gradually availed to incubatees based on their venture creation needs is more effective for enhancing TE than a blanket approach where all technical knowledge is provided at once.**

b. Seamless business operations

Since the senior executive manager of incubator B did not express an opinion on this matter, the researcher sought the perspective of his middle-level manager on the extent to which intellectual resources impacted the fostering of TE. The response was positive:

> *The provision of intellectual resources has positively affected the incubatees because bringing intellectual know-how has made their business operations seamless. For instance, through the training services that we provide, incubatees now know how to put together a funding proposal to partners especially the biggest funders that we have around. We trained our incubatees on how to apply and secure for funding from South African Breweries (SAB). So, for them to put a proposal became seamless as we exposed them to this intellectual know-how by helping them to apply for funding from business partners and how to file for corporate tax. SARS officers sit with them and advise them on the process of filing for corporate tax (i.e. e-filing). So provision of intellectual knowledge on seamless business operations increases their chances of securing funding for product development, which increases the volumes of products produced per unit cost of resources used, increase the size of revenue generated from products sold and increase opportunities for business growth. Tax compliance also enables them to access government contracts, which increases their access to finance for expanding their technological services* (Participant 12).
>
> *The experts from government, industry, banking, technology or agriculture that we engage*

to support incubatees training assist them with promoting technology entrepreneurship through increasing their knowledge of technology products, knowledge of suppliers, product manufacturing and product quality processes. This has enhanced their knowledge of production machines and technologies which help them streamline their business venture processes. These expert and business mentor training have increased incubatees' knowledge of market for technology products, the size of demand for products and increased innovation opportunities by informing them about the changing market tastes and preferences (Participant 25).

Training in its different formats (e.g., training on product development, distribution channels, funding proposal development, filing for corporate tax) has contributed to supporting seamless business operations, which positively impacts innovative product development and increases growth opportunities through scaling the volume of products manufactured. This finding is congruent to the view that intellectual capital is a significant predictor of technology innovation (Vyas & Vyas, 2019).

8.6.3.3. Incubatees' perceptions of the role of intellectual capital in supporting technology entrepreneurship

Given the reality that the incubators are major benefactors of intellectual capital (Guerrero & Urbano, 2014; Link et al., 2015; Yusubova & Clarysse, 2016), the researcher sought to establish how their provision of intellectual resources affected the incubatees' realisation of TE. "Use financial planning to project the commercialisation process", "strategies for winning customers," and "access to specialised services" were the main codes generated from their perspectives on this matter. These codes are discussed in the next sections.

a. Use financial planning to project the commercialisation process

When one incubatee was interviewed on the role of intellectual capital in supporting TE, the response was affirmative:

The incubator's provision of intellectual capital in terms of training and coaching opportunities has helped us realise all the factors we need to keep in mind such as market opportunities, cash flow versus budgeting, what KPIs we must keep an eye on. For instance, training on financial management has helped us understand something called runway, which means how much money you have in the bank and how soon you can deplete it on business operations. This process helps us gauge when we are going to reach day zero, meaning when we are going to run out of money. So, knowledge of financial management has enhanced our knowledge of financial planning for business activities to ensure the growth of the business, facilitated the planning and projection of schedules of product commercialisation based on the cash available and efficient distribution of products across different markets which increases the profitability of financial outcomes. It also helped us to spot the gap to say, we might need some additional funding, and which came with good timing because it simply does not happen overnight. Financial management has also increased realisation of innovation outcomes by considering where financial gaps for product development are and where products improvements would be needed to increase product sales (Participant 21).

The provision technical training and coaching opportunities (i.e., human capital) on financial management knowledge improved financial planning. Such planning facilitated the projection of schedules of product commercialisation, efficient distribution of products, which engenders business growth and profitability. As Mian (2016) suggests, the provision of targeted intellectual resources accelerates successful development of startups by facilitating financing and capitalisation, allowing for the distribution of new technologies to the market thereby expanding incubatee revenue.

b. Strategies for winning customers

In response to the question on the role of intellectual capital in shaping TE, one incubatee emphasised generating a strategy for accessing and winning customers.

> *The provision of training and consulting services on market gap and trend analysis has assisted us in terms of developing our strategy for our technology business. It allowed us to prioritise, rank and highlight what products are important and trending in the technology market and devise strategies on how to win customers and increase our sales and revenue base. Training on market dynamics has highlighted for us how to articulate our company's purpose and strategy in a better way to exploit the technological opportunities in the market to increase our sales volumes. For example, how do we want to win a new market based on our startup's purpose? What is the strategy for increasing market competitiveness? Where do we want to place our products, how do we price them competitively to increase sales and profit margins? So, training has allowed us to articulate our business purpose to specific segments of the market, refine our strategy for growing the business and to optimise profit margins* (Participant 22).

Specialised training on market dynamics was fundamental to forecasting trends of technology market and devising strategies for augmenting market size by increasing customer base, augmenting sales volumes and the revenue base (aspects of technology entrepreneurship). One infers that relational capital as manifested in relations between incubatees, incubators and their reference groups (e.g., customers, market players) (Hormiga et al., 2011) is fundamental to technological development, maturity and the financial performance of high technology firms (Coelho, Mazzola, Fernandes & Oliveira, 2019).

c. Access to specialised services

The researcher inquired about the role of intellectual resources in facilitating or disrupting TE in the context of incubator B to establish if there were areas of convergence and divergence of opinion among incubatees. Participant 18 observed that:

> *I interacted with many businesses some of whom became my business partners. For instance, I met my accountant through those networking and advisory sessions. I met her through those business sessions, and we got a chance to communicate with each other and she gave me technical advice. So, from those sessions, my financial management and technical business operations have improved because I have an accountant. Finance management has helped in cost containment, identification and exploitation of areas that would most impact business profitability and growth* such as quality enhancement and customer relations management (Participant 18).

An inference from this narrative is that relational capital availed by the incubator in the form of accessing experts with technical services and capabilities facilitated improvements in technical operations of technology-based startups. The relational capital facilitated the quality of relationships, including resource aggregation and agglomeration effects among incubatees, their partners and the incubator. These constructs were critical to improving the technical and technological operations which contribute to firm survival and growth (Von Zedtwitz & Grimaldi, 2006).

8.6.3.4. Innovation champions' perceptions of the role of intellectual capital in supporting technology entrepreneurship

Innovation champions were also requested to articulate their views on the role of intellectual capital in supporting technology entrepreneurship. "Technological improvements" and "demonstration sites for showcasing technology" were the main codes generated from their perspectives on this matter. These codes are elaborated in sections below.

a. Technological Improvements

In addressing the role of intellectual capital in supporting TE, one innovation champion detailed the following:

> *The incubator's provision of training and advisory services has contributed to farm production improvements facilitated by technology. You know that 'seeing is believing' and our clients want to see how technology works in a real world setting to their benefit. So, training in the utilisation of technologies has contributed to the introduction of innovative technologies in the wine yard space and to the showcasing how new technology makes a wine yard more effective and efficient. So, through training in technology capabilities, technology has improved processes such as pest and disease control, moisture, soil fertility and management and efficient harvesting, which has contributed to high quality crops harvested, more yields, competitive prices and increased sales for wine products* (Participant 24).

As a form of human capital provision, training and advisory services on the application of agricultural technologies have contributed to the exploitation of new technologies, efficient and effective production processes and growth in terms of productivity. Since smallness of new ventures contributes to deficiencies in the entrepreneurial ecosystems, the harnessing of human capital integrated with coherent incubation policies and goals often contributes to more productive technology entrepreneurial ecosystems (Velt, Torkkeli & Saarenketo, 2020). The finding of this study also resonates with Audretsch and Lehmann's (2005) finding that human capital fosters access to knowledge and knowledge spillovers in high technology sectors, which enables the growth and development of high technology firms. This view also coheres with the argument that human capital is positively associated with individuals' propensity to become technology-based entrepreneurs (Mosey & Wright, 2007) because nascent confidence in pursuing entrepreneurial opportunities is derived from the individual's human capital which often facilitates early planning to exploit technology opportunities (Dimov, 2010).

b. Demonstration sites for showcasing technology

The same technology champion elaborated that:

> *Training in technology has also reduced the time it takes to harvest grapes using technology. The sharing of technical knowledge through networks has contributed to greater technology use in running successful ventures. The increase in the number of incubatees who ask questions about technologies has provided a sustainable knowledge base that serves as a reference point on how technology can change the technology business environment. There are demonstration sites for showcasing technology and sharing experiences, which have led to the development of new technology applications, saving of operational costs using technology, increased productivity and revenue for the business* (Participant 24).

One senses that the combination of human capital (i.e., provision of general and specialised training) and relational capital (i.e., transmission of technical knowledge through networks) blended in shaping greater application of technology for developing technology ventures. As Guerrero, Urban and Herrera (2017) aptly assert, the possession of individual human capital is integral to entrepreneurs' ability to tap into environmental conditions based on opportunities created for the fostering of new technology innovations.

8.7. ENVIRONMENTAL FACTORS AFFECTING TECHNOLOGY ENTREPRENEURSHIP

This last segment of the chapter explored environmental factors that affect incubation outcomes especially TE. The factors are covered under the broad theme of incubation ecosystem dynamism, which comprised national entrepreneurship policy, regional SMME funding, regional innovation culture, and legitimacy of incubation. These are discussed in conjunction with empirical data, starting with national entrepreneurship policy in the next section.

8.7.1. National entrepreneurship policy

Under the national entrepreneurship policy category, the codes that emerged related to "awareness of national policy" and "lack of awareness of national policy" and are elaborated from the perspectives of the different stakeholders. The next section discusses the perspectives of incubator sponsors.

8.7.1.1. TBI sponsors' perspectives on the role of national entrepreneurship policy in facilitating technology entrepreneurship

Concerning the "awareness of national policy" code, "national recognition" was the only sub-code that emerged from data while "private financier policies" was the sub-code under the "lack of awareness of national policy" code as elaborated in subsequent sections.

a. National recognition

Given the literature on the capacity of entrepreneurship policy to shape incubation (National Development Plan, 2010; White Paper on Science, Technology, and Innovation, 2019; Syed & Magd, 2020), it was essential to explore the potential of national entrepreneurship policy in shaping incubation outcomes, especially TE from the perspective of the incubation funders. The senior executive manager of a public funding agency that supported university incubators A and B highlighted the commitment of the South African national government to harnessing national entrepreneurship policy to advance the startups agenda:

> The *national policy recognises the importance of technology entrepreneurship. There is a strong push for supporting the creation and expansion of SMMEs and technology startups through direct funding, export promotion incentives, technical training and other support mechanisms* (Participant 14).

The narrative on the coupling of national entrepreneurship policy to render diverse incentive support and funding mechanisms mirror the public discourses on the South African government's provision of institutional, technical and financial support to SMMEs based on its preferential procurement policies, policies on broad-based black economic empowerment, and other funding strategies, structures, and instruments to SMMEs (e.g., SEDA, National Youth Development Agency) (Preferential Procurement Policy Framework, 2000, Broad-Based Black Economic Empowerment Amendment Act, 2013). Oliveira, Cahen and Borini (2019) emphasise the significance of public policy in creating an ecosystem that supports the financing of the development and performance of new startups as well as promoting the close affinity of incubators, incubatees and other internal and external stakeholders.

8.7.1.2. TBI management's perspectives on the role of national entrepreneurship policy in facilitating technology entrepreneurship

The views of incubator management on the contribution of national entrepreneurship policy to TE were solicited. "New startups and spinoffs", "commercialisation of products and services", "organisational reconfiguration" and "lack of self-awareness" were the sub-codes that emerged from the two codes - awareness of national policy and lack of awareness of national policy respectively. These two codes are elaborated on in the sections below.

a. New startups and spinoffs

When requested to explain how national entrepreneurship policy contributes to the realisation of TE, the response of a middle level manager of an incubator A was affirmative:

> *National entrepreneurship policy directs us to identify academics and students with*

innovative ideas. The policy underscores the importance of generating new entrepreneurs with the capacity to create patents, new startups and spinoffs which create new job opportunities, sustain economic growth and create national wealth. However, I must tell you that it is not the policy that has the biggest impact on technology entrepreneurship but our understanding of the importance of generating a pool of entrepreneurs and we go and look for them actively. So, while national policy has an impact on our selection of technology entrepreneurs and where we look for them, but in our own university, we understand the importance of third-stream income, which motivates us to go and identify technology entrepreneurs. So, as a university we are strongly focused on and understand the need for technology entrepreneurship which helps in creating jobs. So, our university is the significant driver behind the process more than national policy (Participant 24).

The central message is that as much as national policy on entrepreneurship acknowledges the importance of developing entrepreneurs who can generate TE outcomes such as patents, new startups and spinoffs, new job opportunities and sustained economic growth, even more important is the university's appreciation of the importance of TE. This success of high-tech entrepreneurship is a function of the capacity of public policy to advance government's economic development goals and its synergy with university TBIs' strategic plans to ensure effective management and performance of high-technology startups and innovation ecosystems (Oliveira, Cahen & Borini, 2019).

b. Commercialisation of products and services

In response to the question on what role national policy on entrepreneurship plays in the realisation of TE, one senior executive manager of incubator A noted:

The national policy on entrepreneurship is up to standard and it shapes technology entrepreneurship in positive way. National policy informs and directs our entrepreneurial strategies and incubation activities that contribute to commercialisation of products and services first through IP disclosures, patents and TTO feedback that leads to new businesses, spinoffs and licenses upon commercialisation. We align our commercialisation and incubation strategies with national entrepreneurship policy to ensure that we get government support and this is important. If you set up your incubator in South Africa and you do not align it with national entrepreneurship policies, you are going to have some challenging time in realising success (Participant 25).

One key inference is the centrality of national policy in sustaining technology entrepreneurship especially its framing of the university entrepreneurship and incubation strategies, which facilitate the commercialisation of products and services (e.g., IP disclosures, patents and TTO feedback), creation of new businesses, spinoffs and licenses. When appropriately designed and well executed, national policies on entrepreneurship including supportive institutions can positively contribute to encouraging and nurturing innovative ideas, new technologies and knowledge, including their transformation into sound commercial ventures, technology-led and knowledge-based enterprises (Subrahmanya & Krishna, 2021).

c. Organisational reconfiguration

When the views of the senior executive manager of incubator A regarding the national policy-technology entrepreneurship relationship were corroborated with those of incubator B management, the senior executive manager of the incubator B emphasised the reconfiguration of structures of the university as one consequence:

> *To a greater extent, national policy has shaped incubation outcomes because if you look at how the senior executive management structures of the university were, we had two deputy vice-chancellors - focusing on research and another focusing on teaching and learning. The splitting of the two into teaching and learning, and research, innovation, and engagement gives credence to the fact that the university fully understood the importance of technological innovation and engagement roles of universities- and this is where incubation functions are located. That decision demonstrates the importance of understanding that technology commercialisation requires creating and capturing economic and social value of firms using technological innovations. It is a separate mandate that required a separate portfolio* (Participant 8).

The fact that national policy shaped the innovation and engagement function of the university (as manifested in the reconfiguration of university structures) signifies the potential of policy in supporting the development of an entrepreneurial university. This finding echoes the narrative that infusing entrepreneurial elements in national policy facilitates the diffusion of entrepreneurial value systems into educational systems stakeholders (Ramlogan & Rigby, 2012), a viewpoint that speaks to the reconfiguration of university structures.

d. Lack of awareness

When the senior executive manager of incubator A was interviewed on the contribution of national entrepreneurship policy to the realisation of TE, he professed a lack of knowledge:

> *No. You can pass this question. I do not know the national policy very well. So, I am afraid I cannot say anything* (Participant 11).

As already indicated in previous sections of this study, professing lack of awareness reflected the newness of this senior executive manager to this position as he had been recently appointed. This lack of awareness is incongruent with the view that national entrepreneurship policy can contribute to increased entrepreneurial activities, accelerate the development and growth of startups (Salman, 2016).

8.7.1.3. Incubatees' perspectives on the role of national entrepreneurship policy in facilitating technology entrepreneurship

As incubatees constituted the primary stakeholders directly involved in incubation processes, it was necessary to get their perspectives on the possible contribution of national entrepreneurship policy to their realisation of TE. The awareness of and a lack of awareness of national policy codes generated "business networks and entrepreneurial development programmes," "internationalisation of startup operations," "mixed results" and "neutral effect" as the main codes. These are elaborated in the sections below.

a. Business networks and entrepreneurial development programmes

The study elicited the incubatees' views on whether national entrepreneurship policy affected their realisation of TE such as the development of innovative and enterprising technology solutions, and if so, in what ways this happened. The response to the enquiry was distinct and emphasised the fostering of relationships:

> *National entrepreneurship policy positively contributed to technology entrepreneurship because now I have established relationships that are sound with big organisations in the country. Moreover, national policy has also enabled me and other student entrepreneurs to participate in the programmes such as SAB kickstart and Global CleanTech programmes which helped us to realise the growth of our startups* (Participant 9).

It is clear from this narrative that national policy has entrenched university students' participation in business development programmes and expanded their business partnerships. This has essentially facilitated the growth of their startups. The finding mirrors the capacity of national policy to harness collaborative partnerships with the private sector and thereby promote new capabilities among entrepreneurs. This apparently ensures substantial investment in sectors (e.g., SMME development) well aligned with policy objectives (Department of Trade and Industry, 2018). While this citation focused on industry policy that supports government-private sector collaborative partnerships, the current finding foregrounded business-to-business (corporate-SMME) partnerships that are critical to promoting the growth of startups.

b. Internationalisation of startup operations

One incubatee was requested to reflect on how national entrepreneurship policy affected his involvement in TE. The response emphasised internationalisation of business:

> *National entrepreneurship policy as influenced the growth of our technology startup. For instance, SMME development part of national policy has emphasised the internationalisation of SMME activities through exportation, joint ventures and partnerships to support the growth of SMMEs. The fact that government has assisted us to submit a tender to a British company demonstrates the potential of entrepreneurship policy to grow the footprint of our business and our products internationally. Informed by policies on exportation and internationalisation of SMMEs, we have also been able to develop innovative products that drew on our past experience in bidding to help us get leverage over others on the international scene. However, regarding commercialisation of products, national policy has not played a crucial role. We tried to get to the Technology Innovation Agency to fund our product development as they do have funds available, but our racial demographics were not*

> *fitting for the policy. This kept us from being fast tracked to get funding, but they also said we must not depend too much on that* (Participant 21).

The internationalisation focus of national entrepreneurship policy and its potential in promoting sustained growth of the firm, expand international market for products consolidates the view that national policies and institutions can contribute directly to successful growth of startups and avail opportunities for scaling up operations and innovations (Subrahmanya & Krishna, 2021).

c. Mixed results

There was a mixed reaction from one incubatee when he was interviewed on the role of national entrepreneurship policy in facilitating TE:

> *The national policy on entrepreneurship has created a complex and dynamic environment and businesses have been changing and adapting all the time. For example, although Covid 19 financial relief was given to support small startup growth and prevent closure during Covid 19, when the alcohol ban took place, many of my clients had to shut down. So, we had to very quickly and dynamically adjust to the changing environment all the time, but as far as the national entrepreneurship policy, I have always had the impression that entrepreneurship is well supported nationally judging from the technical and financial support provided to technology startups. The same can be said about the publicity that government gives to technology entrepreneurs which increases their visibility and market for their businesses. My involvement in the business incubation processes was in part of, a result of such publicity of technology-based incubators* (Participant 27).

The contradictory message characterised by praise for the policy's capacity to facilitate technology startup growth (including the provision of financial support to accelerate the development of startups) on the one hand, and policy directives that resulted in the shutdown of most startups during national lockdown suggests the ambivalent effects of national policy on TE. This resonates with the view that although governments enhance technology entrepreneurship by leveraging on local resources (e.g., financial support) in the exploitation of entrepreneurship opportunities, the same public policy could present challenges when it fails to eliminate obstacles to growth and relax constraints in the entrepreneurial pursuits and technology innovation contexts (Kuratko & Menter, 2017).

d. Lack of policy awareness and neutral effect

When the same question on how national entrepreneurship policy affected incubatees' involvement in TE was posed to one of the incubatees from incubator A, he professed lack of awareness: "*To be honest, I am not that familiar with the national policies on entrepreneurship*" (Participant 1). However, another incubatee from the same incubator highlighted that despite his knowledge of national policy, the policy did not affect his startup directly:

> *I would not say there is any national policy that affects us directly. I think am aware of this*

stuff, but they do it at the national level. So, I am aware of national policy but I cannot say that we benefited or used any of that. I am aware of one incubatee that applied for a grant, the SMME fund to accelerate but we did not take any of those funds as we were self-funded (Participant 19).

The incubatee from incubator B's response to the same question was overtly negative "*I do not see any connection as I did not get any funding from any national body as a result of any entrepreneurship policy*" (Participant 18). The failure to make any association between entrepreneurship policy and TE was shocking given the growing literature on the capacity of entrepreneurship policy to avail increased funding for scientific and technological activities among businesses (Department of Science and Technology, 2016), increase employment opportunities, and support infrastructure development (Department of Trade and Industry, 2018), and facilitate the deployment of science, technology and innovation assets and resources as vehicles for enabling equitable human development (Department of Science and Technology, 2019).

8.7.1.4. Innovation champions' perspectives on the role of national entrepreneurship policy in facilitating technology entrepreneurship

When the views of one innovation champion were solicited on the contribution of national entrepreneurship policy to the realisation of TE, the response was affirmative:

It is positive. I mean our national policy focuses more on technology startups and SMMEs as drivers of economic growth. The government through its Department of Small Enterprise Development always emphasise that these startups and SMMEs must be supported financially and technically to support their growth in terms of sales, revenue and profits just like technology SMMEs in China. So, national policy on entrepreneurship is driving the vision of putting South African startups at the same levels of those of China in terms of supporting high growth ventures, creating sustainable innovations, creating economic value of firms. China is becoming one of the leading economies worldwide because of SMMEs and South Africa is following its style. So, there has been a positive impact (Participant 23).

This finding on the contribution of entrepreneurship policy to growth and innovation resonates with the view that public policies on entrepreneurship could contribute significantly to high growth, high potential ventures that are introducing product and process innovations if they focus exclusively on these matters (Lerner, 2010, Kuratko& Menter, 2017).

8.7.2. Regional SMME funding

As already stated in previous sections, regional SMME funding was the second category of the incubation ecosystem dynamism theme. The codes relating to regional SMME funding are summarised as "funding from public and private entities" and "funding constraints". However, to avoid a clustered presentation, the discussion focuses on the individual responses generated by the different stakeholders subsumed under the codes identified.

8.7.2.1. TBI sponsors' perspectives on the contribution of regional SMME funding to technology entrepreneurship

The sub-codes that emerged from transcripts from public funding agencies were "sluggish funding opportunities," and "marshalling private funding" while "historical capital vs. effective resource management" was the only code that emerged from the transcript from private funding agency staff. These codes are elaborated in the subsequent sections.

a. Sluggish funding opportunities

To the extent that SEDA invested large sums of money (e.g., R95.8 million, R96.3 million, R107 million in 2015/2016, 2016/2017, 2017/2018 financial years) at the national level into technology incubator programmes in South Africa, the total client turnover (R605 908 829, R825 688 064 and R766 232 385) of the incubators for these years was phenomenal (SEDA Technology Programme Annual Review, 2017/2018). Given the massive funding that SEDA availed to publicly funded technology incubators and its impact on incubation activities including the capacity of such funding to support knowledge commercialisation (Rubin, 2011), one wonders whether incubator sponsors conceived such funding availed at the national level to have cascaded to regional levels including what role regional funding played in supporting the realisation of TE, especially the commercialisation of ideas and applications. When the senior executive manager of a public funding agency was requested to establish whether and the extent to which regional SMME policy affected (or did not affect) the TE of incubators and business startups her organisation had supported, her response was affirmative:

> *There is a strong push for technology startups, SMME development and financial support in our organisation. We have our policy and support stations through which technology SMMEs are supported in the startup process. There is a strong financial push of SMME as a body of enterprises that create more jobs and scale faster than any other sector. So, this way regional financing is contributing to technology entrepreneurship, and the latter is well recognised. Recently, however, funding has been cut for 2020 because of COVID 19 but there is funding available for new startups and the funding has an impact on how many startups are created. However, I think more than creating new startups, we need to look at the sustainability of those new startups. So, there is no need of creating them in a year and at the end of the year, they are shut down. Startup sustainability is what is more important and therefore there is funding available for that* (Participant 14).

The view that regional funding supports TE through creating new technology startups, new downstream job opportunities, the scaling of such businesses resonates with the view that the provision of public funding instruments facilitates the incubation of new technology-based firms, job creation and wealth generation, and the commercialisation of products (Özdemir & Şehitoğlu, 2013; SEDA Technology Programme Annual Review, 2017/2018). However, the complexities of increasing firm sustainability contradict the view that availing public funding structures and instruments increases the chances of survival, competitiveness, and sustainability of such firms (Mittelstadt &Cerri, 2008, Özdemir & Şehitoğlu, 2013). However, the sustainability challenges of startups in incubation centres cohere with the view that despite incubators being safe havens to incubatees, the failure rate (as high as 90%) of incubatees in Africa remains a major concern (Murithi, Ndegwa & Juma, 2018).

b. Marshalling private funding

When requested to explain the contribution of national policy to the generation of TE, the middle-level manager of a public funding agency that funded innovation ecosystems of incubator A highlighted:

> *The national policies that support entrepreneurship and science, technology, and innovation are guiding us in establishing quadruple helix partnerships that support the development of the knowledge community which includes the university staff (e.g., name of incubator and innovation ecosystem mentioned), industry, government, and the civil society. So, if the university has a computer numerical control (CNC) machine, we (the sponsors) can say to the networks that we can train several startups in CNC. But then, we have two banks that are funding because they have the financial resources. They are pulling in what they specialise in, which is financial resources to fund the training of the CNC. Then we have the incubator, which is a technology transfer office saying, "we are very capable in terms of facilitating commercialisation of technologies" and they would assist and take incubatees and entrepreneurs through the journey of technology commercialisation* (Participant 10b).

From this narrative, one infers that although the national policies set the broader rules of engagement between stakeholders through quadruple helix partnerships, they indirectly influenced the pooling of financial resources by private banks and enabled technology transfer offices to commercialise technology products and services. Moreover, the incubator served as the hub providing training services that make commercialisation of ideas, products, and services possible. This resonates with incubation literature on the role of the national government in creating a conducive environment for private sector investment in TE (Autio & Levie, 2017; SEDA Free State Incubator, 2019) in cases where it cannot invest financial resources directly into the economy. This buttresses the view that although some entrepreneurial and innovation ecosystems may unfold naturally, government policy leverages their development (Ratten & Thompson, 2020) in ways that enable the thriving of TE.

c. Historical capital vs effective resource management

The middle-level manager of a private financial institution was requested to explain whether and how regional SMME funding affected incubatees and entrepreneurs' realisation of TE. His response was ambivalent:

> *I would say yes and no. I said from a startup point of view, the general perception is that black-owned businesses or SMMEs lack funding because of the history of economic discrimination in this country. They do not have a historical capital to deploy into a new business and this affects the commercialisation ambitions of their businesses. However, from an experience point of view, I sense that most SMMEs could manage with internally generated financial resources to commercialise their products and services if they could be assisted to manage resources better through financial record keeping as most do not have records of their operations* (Participant 15).

One senses that although the lack of regional funding opportunities contributes to lack of financial inclusion for designated groups, financial inclusivity is not the major obstacle to product commercialisation. Rather, the challenge resides in a lack of financial management competencies. The finding on the importance of financial record keeping resonates with literature on the importance of the possession of financial management skills in developing coherent funding applications and logical business plans, which is reported as a deficiency of new startups especially those run by youths (Owen et al., 2019). The claim about the lack of historical capital to deploy for the commercialisation of operations gels well with literature that considers poor financial management, a lack of credible borrowing history, a lack of business growth models and lack of collateral as major impediments to accessing funding at regional and local levels by SMMEs and startups (Atiase & Dzansi, 2019; Rambe, Ndofirepi & Mpiti, 2021) for the commercialisation of their technology operations.

8.7.2.2. Incubator management's perspectives on the role of regional SMME funding in the realisation of technology entrepreneurship

The codes relating to regional SMME funding were "funding from public and private entities" and "funding constraints" while the subcodes were "paucity of startup funding," "political criteria", "limited decentralisation of funding instruments" and these are elaborated on in sections below.

a. The paucity of startup funding

There was consensus between senior executive managers of incubators A and B on the contribution of regional SMME funding to TE, particularly that the provision of SMME funding in their respective provinces did not contribute significantly to the realisation of TE. As the senior executive manager of incubator A highlighted:

> *We have not seen enough of the effects of regional funding on the commercialisation of technology applications, services and products. So, there probably needs to be more early-stage SMME funding if advanced levels of technology commercialisation and growth of startups is to be promoted. We are not seeing enough of that funding yet* (Participant 11).

The lack of funding was elaborated by another senior executive manager of incubator A:

> *Regional SMMEs funding has a negative effect on technology entrepreneurship. This is because, although incubatees need funding and other financial resources to test their innovative idea, to run pilot for their prototypes, commercialise their activities and upscale their technology businesses, funding is not available at the regional level. So, even though funding is king in supporting technology entrepreneurship, it is rarely available to incubatees* (Participant 24).

The general lack of funding at the regional level complements entrepreneurial literature that emphasises a lack of financial support as a reason for SMME entrepreneurs' inability to innovate successfully and be profitable in harsh economic environments (Clark, 2019; Baah, 2020). The reasons often advanced to explain the limited funding opportunities at the regional levels to facilitate technology entrepreneurship (e.g. testing their innovative idea, piloting for their prototypes, commercialisation of their activities and upscale their technology businesses) include limited funding mechanisms, limited evidence of economic activity among startups, startups' information asymmetries regarding funding opportunities, high lending rates by lending institutions, startups' lack of collateral and the lack of investor readiness to fund SMMEs due to risk averseness (Mason & Kwok, 2010; Clark, 2019, Owen et al., 2019).

b. Political criteria

When requested to explain what role SMME funding in the region plays in enabling TE of incubatees, one senior incubation manager of incubator A expressed disappointment:

> *Our incubatees are very concerned because there is no funding coming from the regional bodies to support technology entrepreneurship. My cue is that either SMME funding does not exist in our region or is not going to technology startups and projects and that is a problem. We have applied for funding to support our incubatees and incubatees have also applied for funding, with our support. When they apply for funding to support their technology-related businesses, many times there are declined based on not meeting some political criteria relating to racial demographics. Alternatively, they must be in the ruling government or connected to the ruling party to access such funding to support activities related to technology entrepreneurship. Some funding is directed to very informal entrepreneur setting up informal spaza shops and not technology entrepreneurs that really create jobs. So, much government money goes to that sector but not technology startup sector* (Participant 25).

The lack of regional funding is attributed to political criteria emphasising racial demographics that eliminate applications from non-designated groups (previously advantaged groups) and political patronage at the expense of the pursuit of TE. This race-based approach to funding technology entrepreneurship contrasts markedly with the High-Tech Strategy 2020 adopted in Germany where leading-edge cluster-based competition among high-growth technology-based ventures was promoted by eliminating political interference. The ultimate selection of venture clusters to be subsidised was based on an open competitive basis. Instead of handpicking and subsidising regions, emphasis was placed on the self-selection of regions with startups demonstrating sufficient pre-requisites of sustainable technology innovation and growth-based technology entrepreneurship (Kuratko & Menter, 2017). **Proposition 1: The use of political criteria for funding entrepreneurs contributes to preference for necessity-driven entrepreneurs and relegation of high growth opportunity-driven technology entrepreneurs. Proposition 2: Race-based criteria undermine TE as these dispel the chances of funding for high-growth oriented and opportunity driven TE from non-designated groups.**

c. Limited decentralisation of funding instruments

When the same question on what role regional SMME funding plays in TE was posed, the senior executive manager of incubator B lamented that:

> *There is no effect because there has not been regional funding for SMMEs in this region. There are no instruments at the regional level to fund the technology entrepreneurship of SMMEs. I mean if you take the funding instruments that exist to support technology development such as the Technology Innovation Agency (TIA), these funding instruments are at national and not at the regional level. Take, for example, the Square Kilometre Array (SKA) support programmes for innovation, take Technology and Human Resources for Industry Programme (THRIP), all of these are at the Department of Trade and Industry (DTI) at the national level, they are not regional. The Industrial Development Corporation funding is not a regional funding structure. Although there are specifics to the regional imperatives they fund, but these specifics are not innovation and entrepreneurship as such* (Participant 8).

The narrative on limited decentralisation of funding instruments which undermines TE is further demonstrated by South African government departments' (Department of Higher Education and Training, Department of Trade and Industry) recent commitment to fund various programmes related to SMME development and entrepreneurship ecosystem development at the regional levels (e.g., Entrepreneurship Development in Higher Education (EDHE) programme, Forum of Entrepreneurship Development Centres at Higher Education Institutions, National Entrepreneurship Week, University Capacity Development Programme) drawing on national funding instruments (van Staden, 2021). While these decentralisation efforts were concentrated at universities, they have not cascaded to the grassroots. The government's failure to decentralise national funding instruments to the regional level was apparent judging from the absence of entrepreneurship and innovation funding instruments at the regional levels to support the realisation of TE.

8.7.2.3. Incubatees' perspectives on the role of regional SMME funding in the realisation of technology entrepreneurship

"Target of funding", "need for funding connections" and "non-conformity to funding criteria" were the sub-codes developed from the incubatees' perspectives regarding the role of regional SMME funding in facilitating the realisation of TE. These sub-codes are elaborated in the sections below.

a. Target of funding

Given the importance of funding in business operations and ameliorating the financial burden of startups (Harrison & Baldock, 2015), the study investigated whether regional SMME funding contributes to the fostering of TE. In response, one incubatee from incubator A highlighted:

> *Like I said, I had funding from a government agency, the Technology Innovation Agency. This is seed funding from the governmental side to support startups. Funding had been the absolute key to ramping up production levels, which increased my gross annual turnover, supported the growth and expansion of my business. Without funding, my business would not have grown sales wise, in terms of revenue and I would not have grown my workforce from zero to three employees in two years. So, that amount of money given at the right time has contributed to profound success of my business* (Participant 27).

The contribution of funding to production optimisation, increased turnover, growth and expansion of the business resonates with the view that government funds contribute to business capitalisation, promotion and encouragement of entrepreneurs to generate sustained growth through new technology innovations, which are aspects of TE (Ballesteros-Ruiz et al., 2019). Access to substantial amounts of conventional funding resources facilitates TE by enabling R&D and production of prototypes which expedite firm development and venture growth (Hamid, O'kane & Everett, 2017).

b. Need for funding "connections"

Not all responses relating to the role of regional SMME funding in supporting T were encouraging. One incubatee from incubator B who specialised in manufacturing hair and beauty products foregrounded the lack of any association between these variables. She emphasised the potency of having "connections" as a precondition to accessing funding:

> *As a young entrepreneur, I feel if regional funding bodies had funded my business, I would be very far growth wise. I am producing at a slow pace because all our products are made by hand. We make them ourselves. So, if I could get funding which I am not even looking for because it never happens unless I have political connections. As an immigrant entrepreneur, I feel like if I had funding, I would get a big place and I would be producing more because currently, I have been struggling to supply our market as I am self-funded. I have not received any financial support from family members, ethic community, friends or colleagues either. The demand is there but the supply is very low* (Participant 3).

The lack of regional funding that supports TE resonates with the view that without opportunities for the utilisation of eco-ethnic resources and resources from other networks (e.g., public funding), the realisation of TE through exploitation of opportunities would be a mirage for immigrant entrepreneurs (Hamid et al., 2017). The need for business connections to secure funding mirrors the view that, in emerging economies with underdeveloped and nascent institutions, business enterprises have a proclivity to rely on social and political connections with people in power to access resources in these networks in ways that influence the success of their firms (Manimala & Wasdani, 2015). The importance of networks in facilitating and obstructing access to resources coheres with Owen et al.'s (2019) view that young entrepreneurs are often marginalised in business by their limited access to resourceful networks, knowledge, and the lack of experience in running startups successfully and sustainably. However, one incubatee from incubator B did not discern any association between regional SMME funding and the realisation of TE: "*You can skip that question as I did not get any regional funding*" (Participant 18). The same applied to another incubatee from incubator A (Participant 19).

c. Non-conformity to funding criteria

When quizzed about how SMME funding in his region affected his business' realisation of TE, the response demonstrated a lack of association due to his non-conformity to the funding criteria:

> *The SMME funding in the region has not impacted my firm's realisation of technology entrepreneurship. The fact that we do not fit the racial demographics of people the national policy was expected to fund meant that the chances of us getting financial help using the funding criteria and procedures is low. This means that we need to do planning without begging or looking for funding and we have not realised this in the past three years. So, we just stopped applying for any form of external funding. The funders advised us that if we are not fitting these criteria there is no chance of us being funded so we stopped applying because it is very time consuming and very resource intensive to get all those paperwork right. And then just hearing a big no - it is like we could have spent that time seeing more customers. Since then, we have spent more time seeing more customers and exploring ways to increase the realisation of innovation outcomes. The latter we have not realised that much as most innovation comes from the customers' reviews and feedback* (Participant 21).

Therefore, for non-designated groups (i.e., individuals from historically privileged backgrounds), there was no relationship between regional SMME funding (especially public funding) and the realisation of TE as they were not eligible for funding. The relentless use of political criteria for funding of entrepreneurial activity coupled with the downplaying of incubation performance indicators diverts attention from critical considerations for innovation activities, focus on value addition and exploitation of technology advancements (Kastelli & Caloghirou, 2014) issues at the heart of TE.

8.7.3. Regional innovation culture

The study also investigated another category of the incubation ecosystem dynamism namely, regional innovation culture. The perspectives of different stakeholders on the role of a culture of innovation in the region where participants were situated in the realisation of TE, were explored. Schertlin (2018) describes an innovation culture as an environment that supports the generation and implementation of innovations. It supports creative thinking and advances efforts to extract economic and social value from knowledge, and thereby generates new or improved products, services, or processes (Hepburn, 2013). At the core of innovation culture is creativity, openness and receptiveness to new ideas, risk taking, and entrepreneurial mindset (Capon et al., 1992; Hilmarsson, Oskarsson & Gudlaugsson, 2014). The codes developed from the regional innovation culture category were a "poor culture of innovation," "culture of networking," "need for innovation awareness" and "barriers to nurturing a culture of innovation." Since different stakeholders contributed to these codes, it is important to discuss the sub-codes that were derived from each code and discuss them from the perspectives of these contributors. The next section discusses the sub-codes generated from the incubator sponsors' data.

8.7.3.1. Incubators sponsors' perspectives on the role of regional innovation culture in enabling technology entrepreneurship

The perspectives of sponsors on the culture of innovation in enabling technology entrepreneurship were explored. The sub-codes that emerged from the raw data of sponsors' responses were "fostering innovation culture mechanisms" and "practical problem solving" and these are elaborated on in subsequent sections.

a. Fostering innovation culture mechanisms

We sought to explore the possible role of a culture of innovation of a region in enabling technology entrepreneurship. This was informed by the literature on the entrepreneurial ecosystems which foregrounds a culture of innovation as instrumental to the deepening of TE (Cowell, Lyon-Hill & Tate, 2018; Huang-Saad, Duval-Couetil & Park, 2018). The response to the question on the role of innovation culture in advancing TE points to the lack of such a culture in the region where participant 14 was situated:

> *With regards to the regional culture of innovation, there is a need to develop a mechanism that stimulates such a culture of innovation. Innovation in terms of the development new products, services, organisations forms and creating new markets including the commercialisation of innovations, that is how to take innovation from an idea to market is not something that is just well understood by most individuals in this region. It is not a thought that comes naturally to everyone in this region. Training in innovation is very important for startups to realise technology entrepreneurship through technology and innovation commercialisation. Therefore, the innovation skills department of most institutions must teach learners the innovation process along the value chain* (Participant 14).

The absence of a unique culture of innovation (White et al., 2016) together with low density, fluidity, connectivity, and diversity of networks and resources as metrics for measuring the vibrancy of entrepreneurship (Strangler & Bell-Masterson, 2015) in this region collectively undermine the realisation of technology entrepreneurship (Huang-Saad, Duval-Couetil & Park, 2018). This is specifically evident in the commercialisation of technology and innovations. In the current study, a lack of understanding of the innovation process and the paucity of mechanisms for harnessing the innovation culture among SMME entrepreneurs explained the lack of TE in that region. The failure by entrepreneurs with a vague understanding of innovation to realise TE is inevitable as innovative and knowledgeable technology founders and their associated engagements in the entrepreneurial environment are central distinguishing features for gaining insights into the operation of entrepreneurial ecosystems that stimulate startups, business formation (Valdez, 1988) and realisation of TE (Huang-Saad et al., 2018).

b. Practical problem solving

When the same question was posed to the middle-level manager of a private financial institution, the response was revelatory:

> *The concept of innovation has been swapped with many concepts such that I do not know what it means anymore. So, in our business development programmes, we move away from concepts that have become run-on-the-mill but do not have clear translation into entrepreneurs' behaviours and business performance. For instance, instead of talking about big words like innovation, we give focus to our entrepreneurs by asking them "what customers pain does your business solve?" This is a very basic concept which the entrepreneur can relate to in a very practical way. So, if they cannot pinpoint what pain point of customers they are solving, you can see intuitively that their business will be struggling. If they cannot identify a pain point they are addressing, we then provide a solution. I do not know if that speaks to innovation*" (Participant 15).

On senses that although this organisation emphasised practical problem solving, "how" to address such complex problems (i.e., implementation part) is what brings innovation through either new discovery (radical innovation) or incremental innovation. For instance, the implementation of innovations through conversion and commercialisation of intellectual property through spin-offs and licence agreements, availing finance for proof-of-concept development, venture financing and knowledge transfer relationships are proven ways of implementing innovations that facilitate the realisation of TE (Rusk, 2017). That said, one could assume that pointing to the "pain" of customers could contribute to TE if it can be channelled towards developing innovative products that increase the customer base, sales volumes and promote sustainable technology innovations that change the configuration of market.

8.7.3.2. Incubator management's perspectives on the role of regional innovation culture in enabling technology entrepreneurship

The views of incubator management on the role of the regional culture of innovation in enabling TE were solicited. "Lack of trust," "good innovation ecosystem" and "invisible innovation culture" were the sub-codes generated from the responses of incubation management and these are elaborated in sections below.

a. “Lack of trust

When asked to explain how the innovation culture of the region affected the incubatees’ technology entrepreneurship, one middle level manager of incubator A was negative:

> *I think innovation culture has a negative impact on technology entrepreneurship because stakeholders such as innovators and society in general are used to not trusting each other in this region. Stakeholders in the innovation process such as investors, funders and society tend to trust big corporates and they want someone from Pick’n Pay to say that you can eat this mushroom or organic food compared to emerging innovators or entrepreneurs from the University. So that is the perception of the region on technology entrepreneurship. Society typically tends to associate innovation culture of new entrepreneurs with those who could not make it in the corporate world and therefore, try and do something else and now you get these lesser quality products that you buy from them. But, fortunately for us, that does not have a big impact on us, because, then when we do our networks and when we put out our resources around that entrepreneur*; *we formalise that process innovation relationship. But, in general, most regions have a negative perception about technology entrepreneurship of new startups which is quite sad*. *People want to be entrepreneurs but once they find out the other side the market to which they must sell that product, investors, funders and society tend to be skeptical about emerging entrepreneurs’ ideas and products in favour of big corporation’s product or ideas. Entrepreneurs are negatively impacted in terms of selling the product, increasing sales and commercialisation their innovative product* (Participant 24).

The capacity of regional innovation culture, especially the lack of trust for emerging entrepreneurs among investors, funders and society to negatively impact the realisation of technology entrepreneurship resonates with the view that the ability of regional culture (e.g. collaborative learning practices) to contribute directly to idea generation and the realisation of technology innovations in organisations depend on the prevalence of trust within and beyond stakeholder networks (Dovey, 2009). Society and stakeholders’ trust and faith in the innovations of nascent entrepreneurs whose products are yet to be tried and tested in the market is fundamental to increasing their product sales, expansion of their market size and commercialisation of innovations. As literature observes, dealing with ambivalent innovation cultures and addressing the real challenges (e.g., trust issues) that startup entrepreneurs confront during the commercialisation process are some of the surest ways of implementing an integrated, holistic approach to the commercialisation process (Appio et al., 2017; Pellikka & Ali-Vehmas, 2019).

b. Good innovation ecosystem

The study sought to understand the role of the regional culture of innovation in enabling or undermining technology entrepreneurship. The senior executive manager of incubator A’s response to this question was affirmative:

> *Yeah, I think, the culture of innovation is already part of our regional ecosystem. So, the better the innovation culture, the better it will be in facilitating technology entrepreneurship. I think we have a good environment for driving technology entrepreneurship, but we can make it stronger. So, having a culture that supports creativity among entrepreneurs, is open to the*

generation of new ideas and to unleashing entrepreneurial passion has helped in the creation of new technology startups even though there is more room for improvement (Participant 11).

The reported positive association between the regional innovation culture and TE confirms the view that fostering an innovation culture enables the greater entrepreneurial success of startups through the stimulation of product, process, and social innovation especially where there is a prevalence of support from the management of organisations (Abhari et al., 2020). This view also buttresses the notion that the presence of an innovation culture contributes to the transformation of innovations through idea generation, idea documentation, idea screening, and evaluation (Bikfalvi, et al., 2010), which make TE possible (Gillebo & Hugo, 2006). The prevalence of new startups harnessing and commercialising different technologies (e.g., website development, software development, Internet of Things to support agricultural activities, online supported logistics, data science, beauty and game development studios, curated leather goods) has been one of the strengths of the innovation ecosystem where incubator A was located. This ubiquitous distribution contributed directly to the realisation of nascent TE.

c. Invisible innovation culture

When asked to explain how the innovation culture in his region affected TE, the senior executive manager of incubator B's response was somewhat negative:

> *The innovation culture in the province is not there because the policy landscape has been driven from the national perspective, so devolving the policy to address institutional arrangements at the regional level is the way to go. Now the White Paper on Science Technology and Innovation is addressing that, but also the National Development Plan stipulates that regional development is important. So, we cannot address things just globally but also locally and that is why the concept of supporting innovation that unfolds in township economies is gaining traction. From a policy landscape, the government just like universities, is looking at how township economies can be stimulated and enhanced* (Participant 8).

The absence of a culture of innovation contradicts the view on the importance of innovation culture in the generation of digital innovations (Kiefer, van Dinther, & Spitzmüller, 2021).

8.7.3.3. Incubatees' perspectives on the role of the regional innovation culture in enabling technology entrepreneurship

"Excitement about technological innovations," "application development companies," and "thinking outside the box" were the sub-codes developed from incubatees regarding the role of regional innovation culture in advancing TE. These narratives are elaborated in subsequent sections.

a. Excitement about technological innovations

Mindful of the reality that incubators A and B were situated in innovation ecosystems where innovation was expected to thrive, it was critical to specify what role the culture of innovation in the region played in the realisation of TE. In his response, the incubatee from incubator A voiced the following vignette:

> *The culture of innovation prevalent in our region brings the excitement of developing new technologies and working on something new among incubatees and sustains the desire of being an innovative entrepreneur. The innovation culture has increased the impact of financial, agricultural and health technologies in the region judging from the number of clients impacted positively. I think that has been beneficial to this region* (Participant 1).

This narrative demonstrates that the excitement in developing new technological innovations and experimenting with new applications is precipitated by a culture of innovation entrenched in the region. This finding resonates with Fontes and Lessa's (2019) study that examined the effects of a culture of innovation in the cultural sector. When such innovation is entrenched into the popular culture, there was vibrant social transformation in Venezuela. Their finding confirmed that the culture of innovation as entrenched in the cultural policy of President Chávez's era (1999-2013) contributed significantly to the production of new cultural and audio-visual goods. This in turn transformed the social fabric of the Venezuelan society. The production of new audio-visual goods can be seen as a form of technological entrepreneurship, even though it was not characterised as such in Fontes and Lessa's study.

b. Application development companies

In investigating the role of the culture of innovation in the region in the development of TE, another incubatee from incubator A devoted his response to the application development opportunities enabled by a culture of innovation:

> *I think because in this city there is a dominant culture of innovation, things that we need such as application developers have flourished and there is quite a number that we can choose from. So, there are many companies and application developers that can assist startups with building applications that can contribute to improvements in services that startups give their clients and to their financial growth, because technical skills are available* (Participant 19).

One senses that the prevalence of a culture of innovation in this region contributed significantly to the availability of application developers and application development companies, which are instrumental in fostering TE. The centrality of innovators such as application developers in TE coheres with the findings of Gillebo and Hugo's (2006) study that explored the effects of regional innovation cultures on sustainable entrepreneurship in the ecological food sector. Their findings demonstrate that the development of a cohesive community of innovators shapes and facilitates sustainable entrepreneurship through stimulating activities founded on intentional interaction, collaborative dialogue, and creative enquiry based on long-term commitments.

c. Thinking outside the box

Concerning the contribution of a regional innovation culture to the realisation of TE, one incubatee from incubator B alluded to the displacement model of entrepreneurship by emphasising the capacity of rejection of innovations to contribute directly to innovative thinking:

> *Regarding the culture of innovation in the region, you may approach a funding agency and present your innovative idea for funding support. You find that they would love to adopt the idea, but they cannot. You realise that "Okay, perhaps whilst there's an interest in the solution being offered, there is a lack of drive that values innovation in that person." So, I think that has positively contributed to my thinking out of the box, so that I, as the innovator, get tools that channel the innovation to the desired target audience to make it easy to get the innovation out. So, the rejection of innovations has pushed the levels of comfort of multiple stakeholders that deliver this value to end-users by compelling them to think differently about circumstances they find themselves in to enjoy this value (*Participant 9).

> *There are some entrepreneurs in the region that are innovative and think outside the box. They strive to start and growth their new businesses, but the problem is the funding. The process of applying for and securing funding takes forever. No one is out there to fund us, and this undermines the realisation of technology entrepreneurship as funding is critical to commercialisation of operations and the growth of business. I mean it took me four years to get funding from National Youth Development Agency to expand this business even though I have been attending all these seminars they give. So, yeah, is difficult to finance business expansion and growth without financial support* (Participant 26).

It can be inferred from participant 9 that an ambivalent innovation culture (i.e., one marked by co-existence of an appreciation of innovative ideas and a lack of drive to support the innovation financially or materially) can ironically push an innovator outside their comfort zone. This ambivalence compels them to think creatively by sourcing alternative pathways to taking the product to the market. This somewhat does not cohere with the popular notion that a social acceptance of cultures of innovations and knowledge development fuels the realisation of TE (Matejun, 2016; Lamine et al., 2018) as supporting such innovations financially remained a challenge. Concerning participant 26, the lack of funding support at regional level (as an expression of regional culture) for technology-based businesses is seen as an anathema to the development of TE. The creation of technology-based startups is tied not only to non-financial efforts of entrepreneurs but rather the availability of funding to support the R&D stages of the startup. This includes the capacity of the entrepreneur to diversify financial support during commercialisation, thereby effectively transitioning from R&D stage to prototype development and product launch (Demirhan, Temel & Durst, 2019).

8.7.4. Legitimacy of incubation

The last category of incubation ecosystem dynamism was legitimacy of incubation. This category was discussed from the perspective of the different stakeholders. "Acceptance of incubation ideas" and "acceptance of the incubation process" were the main codes developed from the narratives of these stakeholders. Since these were further attenuated by different stakeholders at the sub-code level, each of these sub-codes is then discussed and not the individual codes per se.

8.7.4.1. Incubator sponsors' perspectives on the role of the legitimacy of incubation in supporting technology entrepreneurship

The legitimacy of incubation is the last category this chapter grapples with regarding TE. "Social acceptance of technology" was the only sub-code derived from the code "acceptance of business ideas." This sub-code is elaborated on in subsequent sections.

a. Social acceptance of technology

Drawing on the postulation that incubation practices must be socially legitimate from the perspective of various stakeholders (Rutherford et al., 2009; Batchelor & Burch, 2011; Liu, Schøtt & Zhang, 2019), we sought to explore the possible connection between social acceptance of incubation and the realisation of incubation outcomes especially TE. The response to the question interrogating the possible association between social acceptance of incubation and TE was somewhat positive:

> *There is much less acceptance of technology than the social acceptance of startups. For example, sometimes you can build a certain type of toilet in a rural community, and you find out that they are not familiar with that type of toilet and anything that replaces water may not be socially acceptable. So, for us, we deal with social acceptance of types of technology, and the acceptance of an incubation programme. I do not see social acceptance of technology in general but a wider acceptance of technology firms as vehicles for fostering technology entrepreneurship. Where the issue is relates to acceptance of technology* (Participant 14).

The positive association between legitimacy of incubation and TE resonates with the view that, in the context of incubation, legitimacy facilitates incubatees' capacity to attract resources and the level of resource transactions flowing in the incubation system (Parsons, 1960; Terreberry, 1968), which invariably affects startups' chances of survival and growth (Rao, 1994; Deeds, Mang & Frandsen, 2004), as measures of TE. One senses that although some societies have challenges in accepting technological innovations themselves, the technology-based ventures that foster TE have general receptivity among societal members.

8.7.4.2. Incubator management's perspectives on the contribution of the legitimacy of incubation to realising technology entrepreneurship

The views of incubation management were also solicited regarding the contribution of the legitimacy of incubation to realising technology entrepreneurship. "Legitimising sub-optimal incubation performance" and "nascent social acceptance" were the sub-codes that emerged from incubator management's views on this matter, and these are discussed in sections below.

a. Legitimising sub-optimal incubation performance

The researcher investigated the possible role of the legitimacy of business incubation in enabling TE. The senior executive manager of incubator A's response was negative:

> *I think incubation is too socially acceptable than it deserves. It is too socially acceptable for incubators to not produce good technology-based companies and to not build great innovation-oriented businesses. So, the more we can get real with our incubators, the more we can say how they are producing the expected outcomes in terms of the growth and sustainable technology innovations of firms that we want, the better. So, I think, the social acceptance of mediocre incubators is too high* (Participant 11).

The hype around incubation is perceived as having contributed to the acceptance of poor incubation outcomes of technology businesses. This in turn has negatively impacted the growth and sustainable technology innovations of firms. The hype around incubation has been attributed to the mistaken belief that availing financial and non-financial resources and incentives exclusively contributes to TE leading to disappointing results (Demirhan et al., 2019). Without recourse to developing robust entrepreneurial ecosystems where different actors have multiple interdependencies and complementarities and where incubatees are capacitated to convert resources into proof-of-concepts, spin off companies, collaborative arrangements and licensed companies, the legitimacy of incubation may not culminate into germane incubation outcomes especially TE.

b. Nascent social acceptance

The narrative in the previous section contradicts the senior executive manager of incubator B's sentiments on whether and the extent to which social acceptance of incubation affected (or did not affect) TE:

> *No. There is not so much social acceptance of incubation due to the poor design of such programmes. However, there is now a growing understanding at this university that we need to do incubation properly going forward in line with the new Vision 2030,* which emphasises creating entrepreneurial ecosystems within the university and beyond, if technology entrepreneurship is to be realised (Participant 8).

This senior executive manager presents a dynamic perspective of social acceptance of TBI in which the poor design of the incubation programme generates a lack of social acceptance, leading to the realisation of the need for a proper design of programmes that would contribute to TE. This dynamic view mirrors the argument that the social acceptance of incubation ideas is founded on the quality of incubation policies and standards (Ahmed et al., 2020), which invariably shapes the number of technology spinouts (Mas-Verdu, Ribeiro-Soriano & Roig-Tierno, 2015; Albort-Morant & Oghazi, 2016), which are an expression of TE.

8.7.4.3. Incubatees' perspectives on the contribution of social acceptance of incubation to realising technology entrepreneurship

Given the entrepreneurial literature that highlights the significance of social legitimacy of incubation in supporting TBI processes (de Clercq & Voronov 2009; Yusubova & Clarysse, 2016; Liu, Schøtt & Zhang, 2019), we sought to examine the contribution of social acceptance of incubation to the realisation of incubation outcomes such as TE of incubatees. The sub-codes that emerged were "social appreciation and excitement," "brand association and promotion" and "perceptual change and emboldening innovations." These sub-codes are elaborated in the sections below.

a. Social appreciation and excitement

When one incubatee was requested to ascertain whether incubation was socially accepted in the university community where his business was located including whether it played a role in fostering TE, the response was positive:

> *Yes, there is social acceptance of business incubation. Social acceptance of incubation gives us the incubation support networks and partners who believe in us as a business to pursue entrepreneurial goals. Without that social acceptance from our partners, you would find people becoming reluctant to become technology entrepreneurs. If there was no legitimacy of incubation and especially if people had a limited appreciation of technology startups, there would less excitement about starting up new technology ventures and trying to make it in this technology-based industry* (Participant 1).

From this narrative, the broader social appreciation of incubation is seen as instrumental to the development of incubation support networks and the formation of technology-oriented businesses. Since legitimacy emphasises the desirability and appropriateness of actions of organisations within some socially constructed system of norms, values, and beliefs (Suchman, 1995), this finding gels well with the view that alignment of incubatees' operations with the norms of society allow these firms to communicate their value to resource holders, allowing these stakeholders to have more confidence in the value of their businesses (Martens, Jennings & Jennings, 2007; Cha, 2020). One infers that the social acceptance of incubation contributes to resource pooling among business partners and increased enthusiasm to pursue venture creation in ways that promotes TE.

b. Brand association and promotion

When another incubatee from incubator A was requested to explain the role of social acceptance of business incubation in the realisation of TE of startups, the response was inclined towards brand promotion and visibility:

> *Incubators have a very real good reputation and if I put their logo at the bottom of my startup website, then it creates a positive effect for my company or brand and if there is social acceptance, it can be positive for brand promotion* (Participant 19).

One infers that when employed strategically to piggyback on the goodwill of the incubator, the incubatees' association of their brand with the incubator could promote the reputation of their brands, products, and services. The legitimacy of incubators as appropriate tools for branding resonates with the view that university business incubators serve as ideal platforms for accelerating TE. Brand association and promotion contribute to customers (e.g., of incubatees) recognising and making choices of trusted suppliers in dynamic markets as well as enabling producers to secure trust for new opportunities to fulfil consumer needs thus availing the market for technology innovation (Clayton & Turner, 2012).

c. Perceptual change and emboldening innovations

When the same question on whether and how social acceptance of business incubation affects incubatees' engagement in TE was posed to an incubatee from incubator B, the response emphasised perceptual change:

> *I would say the social acceptance of business incubation has affected my firm's development of agricultural technologies because when perceptions of incubation change, it gets easy for entrepreneurs to start moving, talking, and creating awareness about their technology work. The fact that social acceptance changes perceptions, allows entrepreneurs to collectively feel comfortable with the idea of innovation regardless of where it comes from. So social acceptance of incubation allows technology entrepreneurs to believe in entrepreneurship's ability to change not only our perceptions but our lives in general* (Participant 9).

It can be discerned that the social legitimacy of incubation gives technology entrepreneurs more leverage and credibility to engage with stakeholders regarding their technology businesses, accentuates their confidence in innovation, increases these founders' beliefs in the transformative impact of entrepreneurship. This intangible soft side of the social legitimacy of incubation resonates with the view that social acceptance of incubation facilitates new ventures' contribution to sustainable development debates (Salmivaara, 2017) as well as co-creation of ideas and products. Co-creation describes a process by which products, services and experiences are developed jointly by firms and their stakeholders, opening a whole new world of value (Munro, 2020). However, the fact that social legitimacy fosters opportunities for business networking and engagement with stakeholders of technology businesses responds to previous studies that express concerns over the paucity of literature covering legitimation as an interactive process comprising multiple actors (King et al., 2011; Wry et al., 2011). The same finding also responds to previous studies which argue that the success of ecosystem actors depends on engagements and activities of distinctive groups drawn from multiple segments of society (Weber et al., 2008; Salmivaara, 2017).

8.8. CHAPTER SUMMARY

Chapter 8 presented and discussed the research findings on the diverse factors affecting technology business incubation (TBI) and incubation outcomes, especially TE. Given the diverse concepts and dimensions that characterise each individual, institutional and environmental factor affecting TBI and TE, the study dealt with each identified concept and dimensions derived from these factors and related them to TBI and TE. The discussion provided a detailed account of literature and theories that could illuminate these relationships. Where necessary, some propositions were developed to enrich the understanding of the issues investigated. The next chapter provides a conclusion and recommendations emerging from this study.

CHAPTER 9: CONCLUSION AND RECOMMENDATIONS

9.1. INTRODUCTION

The previous chapter presented and discussed the research findings drawing on empirical evidence and previous studies respectively. This last chapter renders a conclusion and recommendations of the study. It is structured to recap the motivation of the study and proffer a conclusion drawn from extant literature. Second, the research questions are recapped and responses to the questions are rendered. Third, the contributions of the study to theory, methodology, policy and practice are articulated. Fourth, the implications of the study for future research are deliberated on. Fifth, the study limitations are articulated. Lastly, the concluding remarks are rendered.

9.2. RECAPPING THE MOTIVATION OF THE STUDY

The problem tackled in this study is the complexity of developing synergy from individual, institutional and environmental factors affecting technology business incubation (TBI) to generate optimal incubation outcomes, especially technology entrepreneurship (TE) when these factors are considered individually and selectively. The study constitutes a response to Tang, Baskaran and Pancholi's (2010) call for studies that accommodate diverse factors situated at multiple levels by emphasising an integrative and systematic approach to assessing the operational efficiency of TBIs at a general level. They elaborate that and integrative and systematic approach to TBIs is critical to overcoming the limitations of contextual factors, where some factors may be relevant in some contexts and irrelevant in others. The study follows Kim and Lee's (2019) view that technology entrepreneurship is embedded in cognitive, cultural, structural and political contexts such that researchers are exhorted to appreciate the situated contexts in which TE unfolds to fully account for the interplay of individual psychology (*individual level*), group membership, group interactions (*institutional level*) and contestations for power and resources at play (*environmental level*). Since cognitive processes influence human entrepreneurial behaviour (just as much as environmental factors shape human behaviour through cognitive functioning), social contexts inform the social networks that shape different entrepreneurial behaviours while broader political contexts shape resource allocations (Kim & Lee, 2019), these contexts of interaction need to be fully understood relative to TBI processes and TE.

Appreciating the multi-layered nature of factors influencing TBI is critical as university technology business incubators (TBIs) are intermediaries that bridge gaps between tenants and their external environment and these incubators differentiate themselves through combinations of individual and collective strategies. These strategies may interact with individual, organisational, and environmental factors to achieve intended ecosystem benefits (Theodoraki, 2020) such as TE. Despite this recognition of university TBI as an outcome of factors located at multiple levels (Garud & Karnøe 2003), studies that investigate the interface between these levels of analysis (e.g., individual entrepreneur, institutional factors and environmental factors) are sparse (Link et al., 2015). Yet an integrated, systemic view of TE that considers individual, institutional and systemic level factors, micro-macro links and interfaces between the different levels is critical to examining these factors *in context.* This is because TE transcends single individuals as it is inextricably linked and affected by multiple individual, organisational and environmental circumstances (Petti, 2012). Therefore, an analysis of factors located at one level is insufficient in developing a coherent, integrated picture of the factors that coalesce to shape TBI and incubation outcomes. As such, the current study also responds to McAdam et al.'s (2016) exhortation for researchers to develop incubation frameworks that consider factors located at different levels where multiple relationships unfold between internal and external players.

The primary objective of the study was to understand in greater detail the individual, institutional and environmental factors that affect university-based TBI and how they coalesced to support TE. One of the secondary objectives was to establish how a conceptual framework for advancing technology entrepreneurship based on the coalescence of these factors that affect technology-based incubation could be constituted. To address the primary and the secondary objectives, the study fulfilled certain research process. First, the study identified and characterised TBI. TBI is a complex process that reduces transaction costs of startups, supports the creation of new innovative ventures and promotes science-industry-government interactions through intermediaries whose actions emphasise creating job opportunities, economic wealth, and expanding economies (Ramar et al., 2020). TE was deemed as the outcome of technology business incubation and was defined as a project investment that assembles and deploys specialised individuals and heterogeneous assets that are intricately related to scientific advances and technological knowledge to create and capture value for a firm (Bailetti, 2012). This means that value creation and value capture are outcomes of TE, investment in business projects is the main mechanism of creating and capturing such value, facilitated by internal and external individuals that influence and are influenced by science and technology advances. Notwithstanding some outcome variations depending on the sector of business operation and size of the firm, the dimensions of TE examined in this study were business growth in its diverse forms (e.g., increases in sales, profitability growth, returns on assets, staff growth), commercialisation of technology innovations and applications and generation of sustainable revenue streams. Although not emphasised in this study, other TE outcomes include improved capacity utilisation, efficient business operations and entrepreneurial resilience. The factors that shape TBI and TE as articulated in incubation and entrepreneurship literature are recapped and discussed in the next section.

9.3. CONCLUSION BASED ON A REVIEW OF LITERATURE ON MULTI-LEVEL FACTORS THAT AFFECT TECHNOLOGY BUSINESS INCUBATION

The individual, institutional and environmental factors that affect TBI are summarised first before these are related to incubation outcomes in the second segment of this chapter. The next section deals with these factors as they relate to TBI.

9.3.1. Individual factors

While the individual factors that affect TBI are in no way exhaustive, these concepts are of an entrepreneurial cognitive (e.g., "intuitive thinking," "expert scripts," and "heuristics") and individual psychological (perceived entrepreneurship capabilities) nature. The focus on entrepreneurial cognition (i.e., knowledge structures that individuals employ to make assessments and judgements involving opportunity evaluation, venture creation and growth) (Mitchell et al., 2002) is explained by the growing entrepreneurial literature on cognition (i.e. mental models) and cognitive psychology emphasising that entrepreneurs employ perceptions, memory and thinking to make entrepreneurship decisions (e.g. decision to have their firm incubated or to build their ventures independently) and direct their entrepreneurship behaviours (Baron, 2004; McMullen, Wood & Palich, 2014; Shepherd & Patzelt, 2018). Entrepreneurs employ mental models (e.g., intuition, scripts and heuristics) to assist them identify business opportunities, integrate disparate information for identifying new products, assemble resources to start and grow their ventures (Urban, 2015). To the extent that the process of resource mobilisation can be eased by incubators that assist tenants in integrating diverse resources and capabilities to prevent startup failure and promote sustained growth of their ventures, entrepreneurial cognition is critical to making business incubation decisions. Therefore, the creation of a new venture that survives and is sustainable in incubation contexts necessitates a deeper understanding of the entrepreneur's cognitive state in conjunction with their environment (Randolph-Seng, Clarke & Atinc, 2020).

9.3.1.1. Intuitive thinking

Intuition is conceived as a judgement based on 'gut feeling' or an affective confidence in an opinion to which no explicit rational support could be offered (Bastick, 1982; Epstein, 1994). Regarding intuition, Pretz et al. (2014) distinguishes between *affective-intuitive decisions*, *inferential-intuitive decisions and holistic-intuitive decisions,* where affective-intuitive decisions are founded on emotional reactions to decision situations and are associative as they draw on prior conditioning and emotional arousal. *Inferential-intuitive decisions* involve automated decision-making processes that were once analytical but have become intuitive with practice, and which draw on well-developed mental schemas (Pretz et al., 2014). *Holistic-intuitive decisions* are founded on non-analytical process that are bottom-up, data driven, and which integrate diverse cues into immediate situational judgements (Pretz et al., 2014).

Although studies on intuitive thinking as a form of entrepreneurship cognition do not make specific reference to business incubation per se, they emphasise the capacity of intuition to shape the venture creation and entrepreneurial process (Busenitz & Barney, 1997; Mitchell et al., 2002; Gemmell, 2010; Urban, 2015), processes that TBI strive to develop and sustain. There is compelling evidence in literature that intuitive thinking contributes directly to venture creation and the entrepreneurial process. For instance, intuition is deemed critical to the strategic timing of entrepreneurial opportunities, the determination of opportunity costs, reward profile, control of timing and organisational readiness and rate of startup development (Walsh 2017). Intuition also provides some useful insights into diverse information relating to entrepreneurship (Shah, Horne & Capellá, 2012; Marder, 2015), which could be applied in incubator contexts. This current study's exploration of the intersection between intuition and venture creation process (especially that enabled by incubation structures) serves as a response to the view that despite entrepreneurial strategists' emphasis on analytical practices and tools, the intuition practices remain largely unexplored (Melin 2007; Walsh, 2017). Yet whether intuition really shapes venture founding decisions or not is debatable. For instance, in a study that investigated whether entrepreneurs deploy intuition in the venture creation process or just claim they do, Blume and Covin (2011) reported on the entrepreneurial traits (e.g., possession of entrepreneurial self-efficacy, domain relevant knowledge, self-confidence bias, and metacognitive skill) that enable and make effective deployment of entrepreneurial intuition more plausible. They point out that while intuition can influence an entrepreneur's decision to pursue an entrepreneurial opportunity, some factors conceived by him/her as intuition could just be as likely to influence the venture founding decisions as well.

9.3.1.2. Scripts

A script is a "a cognitive mechanism that comprises the key elements in a situation decision and the likely ordering of events" (Krueger, 2003: 128-29). Gioia and Poole (1984) define scripts as schema-based knowledge of behaviour and behaviour sequences appropriate to specific organisational situations and contexts. Scripted behaviour in organisations is often performed unconsciously (automatic script processing), although active cognition (controlled script processing) is involved during the process of script development and when encountering unconventional situations (Gioia & Poole, 1984). Studies have emphasised the role of expert scripts in entrepreneurial process but not TBI per se, even though the entrepreneurial process can unfold in TBI contexts. For instance, Urban (2015) postulates that entrepreneurs draw on existing structured knowledge structures (i.e., scripts) to make decisions regarding venture creation such as opportunity identification and exploitation. The argument is that due to the cognitive limitation of the mind to process diverse, complex information during decision making, entrepreneurs do not process information anew. They only process relevant information by fitting it into existing organised mental structures and discard discrepant or forgotten information (Vaghely & Julien, 2008). The three main types of scripts that entrepreneurs can use in their entrepreneurial decision making are arrangement, willingness and ability scripts (Mitchell et al., 2000) and each of these three scripts was extensively discussed in Chapter 3.

Evidence suggests a close interaction between script and venture creation, a process that TBI can facilitate. Mitchell's (1997) study compared entrepreneurs with non-entrepreneurs to establish who has greater discipline to acquire the venturing expert script. His study established that what delineates entrepreneurs from novices is the capacity to develop the cognitive script. Mitchell et al. (2000) studied the capacity of cognitive scripts to explain the differences in venture creation decisions. The study reported that entrepreneurs employ arrangement scripts to facilitate the evaluation of entry into venture creation decision process, while other "doing-related" scripts (i.e., willingness and ability) are applied later in the process. Corbett et al. (2007) explored the connections between cognitive scripts that corporate entrepreneurs employed for project termination decisions and learning levels. Evidence established that they employed three types of termination scripts: (1) undisciplined termination, (2) strategic termination, and (3) innovation drift. Seawright et al. (2008) compared the similarities and differences in cognition between US and Russian entrepreneurs and non-entrepreneurs. Their study established similarities between the application of ability, arrangement and willingness scripts between novices in the two countries, including similarities between experts in the two countries. Despite these similarities, the study concluded that the limited pursuits of entrepreneurship in Russia was attributed to the limited application of expert scripts. Shepherd and Patzelt (2018) conceived an engineering mindset as constituting a cognitive script for creative problem-solving to the extent that it emphasises the process of complex task completion and commitment to project completion. In short, scripts are instrumental to different aspects of venture creation which TBI incubation supports, even though their extent of use varies across contexts.

9.3.1.3. Heuristics

There is growing entrepreneurial literature that acknowledges that entrepreneurs employ heuristics in their decision making (Baron, 1998, Baron, 2000; Mitchell et al., 2002; Fernández, Liñán, & Santos, 2009; Cacciolatti & Lee 2015). The argument is that, since entrepreneurs are exposed to new, unpredictable, complex situations that exert high time pressures in the face of limited information, they often use heuristics to guide their decision making about entrepreneurship (Baron, 2000; Urban 2015). To the extent that heuristics are efficient rules coded by evolutionary or learned processes, they explicate why and how entrepreneurs make decisions, arrive at their judgements or solve problems, when confronted with complex matters with incomplete information (Fernández, Liñán, & Santos, 2009). Moreover, the intense emotional connection between entrepreneurs and their entrepreneurship decisions further makes them susceptible to using heuristics and making various forms of cognitive errors (e.g., over confidence, escalation of commitment) (Baron, 1998). For instance, Busenitz and Barney (1997) found that entrepreneurs have a greater proclivity to deploy the representativeness heuristic (i.e., enhanced willingness to generalise from small, non-random samples) compared to other persons. Gaglio (2004) researched the opportunity identification process to establish the claims of entrepreneurial alertness theory pertaining to entrepreneurial behaviours. Evidence suggests that two types of cognitive heuristics, namely mental simulations and counterfactual thinking, guide the process of entrepreneurial reasoning and facilitate the process of opportunity identification.

However, the pursuit of heuristics can hinder entrepreneurs from effective decision making and hence the claim about a positive heuristics-entrepreneurship decision making relationship is not without controversy in literature. For instance, while the illusion of control can accentuate the proclivity of entrepreneurs to act on an entrepreneurial opportunity, it may also serve to blind the entrepreneur to genuine risks (Krueger, 2005). Besides, the claims about the deployment of heuristics by entrepreneurs to simplify decision making and generate ideas when there is insufficient time or data to use as is the case when applying managerial analysis techniques (Tversky & Kahneman, 1974; Busenitz & Barney, 1997; Gemmell, 2010) is not universally shared by scholars. For instance, Shaver and Scott (1991) and Reddy, Reddy and Madhu (2015) emphasise that entrepreneurs neither pursue a systematic search for solutions nor do they adopt heuristic methods in their entrepreneurial decision making. Similarly, other literature reports entrepreneurs' possession of a fine balance between nonlinear thinking (e.g., heuristics) with more rational linear thinking (Groves et al., 2011; Reddy et al., 2015). This lack of consensus as to whether entrepreneurs use heuristics when making entrepreneurial decisions necessitated this study which covered incubatees' venture creation in TBI contexts at universities.

Notwithstanding the importance of entrepreneurial cognition (e.g., intuitive thinking, heuristics and scripts) in enabling and inhibiting venture development and the entrepreneurial process, entrepreneurial cognition literature has been critiqued for its individualistic and static conceptions of entrepreneurial cognitions which emphasise 'boxologies' and is rejected as an appropriate representation of cognition

(Mitchell et al., 2011). As such, this approach to cognition exhibits shortfalls in capturing the 'gist' (Shepherd & Sutcliffe 2011) of the phenomena (i.e., venture creation; entrepreneurship) they purport to describe, which is marked by dynamism and interactivity (Dew, Grichnik, Mayer-Haug, Read & Brinckmann, 2014). Therefore, we embraced the modern view of human cognition viewed as multi-layered and interconnected with other factors and in which information is processed in parallel (Foti et al., 2008) rather than as something that resides exclusively in entrepreneurs' minds. Therefore, the consideration of institutional contexts in which cognitive thinking happens constitutes a response to the call for scholars to embrace new conceptualisations of entrepreneurial cognition that accommodate the inherent qualities of the entrepreneurial phenomenon (Venkataraman et al., 2012; Dew et al., 2014).

9.3.1.4. Perceived entrepreneurial capabilities

Perceived entrepreneurial capabilities (PEC) are entrepreneurs' perceptions of their knowledge, skills and experience employed to start a business venture (Luong, 2015). Literature has established a clear connection between PEC and new venture creation from a resource-based perspective (Lin & Nabergoj, 2014). Similarly, Ndofirepi and Rambe (2016) reported a strong, positive statistically significant relationship between PEC and entrepreneurship orientation. These studies point to the strong connection between PEC, venture creation and entrepreneurship. For instance, PEC emphasises the capacity of entrepreneurs' skill and knowledge to supply resources and facilitate the identification of opportunities to formulate startups (Siegel & Wright, 2015). Drawing on the capability-based framework, literature demonstrates the potential of PEC to promote the development of organisational spin-offs such as creating new pathways to entrepreneurial action, aligning the organisation to commercial interests and the integration of new resources to support new ventures (Afzal, Mansur & Sulong 2017). Overall, one infers that the possession of PEC contributes to the identification of entrepreneurial opportunities and the mobilisation of resources that makes possible the venture creation availed through incubation structures.

9.4. INSTITUTIONAL FACTORS

The study also explored the contribution of institutional factors such as physical capital, social capital and intellectual capital to the realisation of TBI. These are explored in the following sections.

9.4.1. Physical capital

The study characterised physical capital as all tangible (sometimes intangible) resources that contribute to company operations and production activities. These include raw materials, physical premises, technology, equipment and the company's factory (Barney, 1991). Although there are several physical capital resources that shape business incubation, the most common ones are access to physical space and shared spaces (Bergek & Norrman, 2008), university equipment and library (Van Weele et al., 2017), availability of finance (FinFind Access to Finance Report, 2018) and access to internet and data services.

Incubators facilitate incubation processes by providing tangible resources such as laboratories, share offices, equipment, meeting rooms (Kiseleva, 2017), while universities render libraries and research labs (Mian, 1997). While limited access to finance is a main impediment (e.g., due to high interest rates, lack of credible credit history, lack of collateral) to most startups' venture creation opportunities, literature acknowledges that the increased availability of finance improves the founding of venture startups (Kor, Mahoney & Michael, 2007; FinFind Access to Finance Report, 2018). For example, the creation of new technology-based firms depends on access to finance from stock markets, venture capitalists and financial institutions that support entrepreneurial pursuits (Daramola, 2012) and make TBI possible. However, the failure to obtain resources can be a liability to venture startups (Paeleman & Vanacker, 2015) and may negatively impact new firms' ability to acquire resources in the future (Wu et al., 2016; An, Xu & Zhang, 2018) as well as jeopardise TBI exploits. The liability of newness and smallness is even greater for new firms due to their limited access to a range of resources (e.g., finance, human resources, raw material supplies, office and libraries), which incubators can supply to overcome chances of startup failure.

9.4.2. Social capital

Literature suggests that the success of incubation depends on the availability of social capital. Van Weele et al. (2017) argue that incubators foster social capital through the creation and facilitation of external networks, the development of learning communities, organising social networking events, creation of partnerships and introductions of new ones. Since new startups can be preoccupied with and overwhelmed by developing their businesses, Hughes et al. (2007) argue that they often lack the time and fail to invest in building stabilised relationships. As such, incubators may avail startups with networks and connections to external stakeholders (Soetanto & Jack, 2016) such as venture capitalists, government agencies, potential clients, distributors or other service providers (Van Weele et al., 2017). Apart from co-locating startup companies in the shared offices of incubators and organising social events or introducing incubatees to various stakeholders (Cooper et al., 2012), incubators can also facilitate meet-up and greet events, collaborative workshops and training sessions that facilitate the exchange of resources. There is compelling evidence to suggest that successful entrepreneurs tend to exhibit higher social competence that is, the ability to interact effectively with peers (e.g., they tend to excel at social perception and adjusting to new social scenarios) (Baron, 2000) and such competencies are developed through social capital, which can be availed in TBI spaces.

9.4.3. Intellectual capital

Although the nature of intellectual capital is widely contested in literature, the commonly accepted constitution of the construct is human capital, structural capital and relational capital (Bontis et al., 2000; Gioacasi, 2015, Beltramino et al, 2020). Human capital denotes knowledge, skills and experience required in the successful growth of a business, and providing such traits is critical to entrepreneurs' identification and exploitation of entrepreneurship opportunities (Alvarez & Busenitz, 2001). Structural capital denotes the knowledge inherent in non-human factors of organisations such as such as databases, organisation charts, process manuals, strategies and customs, which can add value to firms (Ryu, Baek & Yoon, 2021). Relational capital comprises intangible assets which can be acquired through relationships between external companies and customers (Stewart, 1997).

In the context of TBIs, human capital, structural capital and relational capital manifest in the provision of technical support (specialised IT, software support, and laboratory equipment and databases), strategic and technical advice (technology specialisations), training, mentoring and coaching (Albert & Gaynor, 2006) which make practical operations of tenants tenable. Incubators render intellectual capital to their tenants through technical and technological knowledge enabled by their nexus and proximity to university libraries and research groups (Kiseleva, 2017; Van Weele et al., 2017). They also provide different training, coaching and mentorship opportunities in specialised fields such as accounting, finance, technology and legal services. Although incubatees could be groomed to acquire and assimilate technological and business knowledge, there is a general view that TB incubatees often come with considerable technological knowledge but often lack entrepreneurial and business knowledge. Given that incubatees often suffer a legitimacy and credibility deficit due to the "liability of newness" arising from the lack of a proven track record in business operations (Abatecola, Cafferata & Poggesi, 2012), the incubators' provision of training in various specialities can contribute to incubatees' gaining of legitimacy, which improve their chances of TBI success.

9.5. ENVIRONMENTAL FACTORS

To provide an integrated, holistic picture on TBI, environmental factors that affect TBI were considered appropriate because physical, social and intellectual capital investments are organisational endowments of incubation that must be understood within their broader environment. Since these systemic factors contribute to TBI processes, they are synthesised under "incubation ecosystem dynamism." These environmental factors comprise national entrepreneurship policy, regional funding policies for SMMEs, regional innovation culture and the legitimacy of incubation processes from the perspective of various stakeholders. These factors were examined in relation to TBI in the following section.

9.5.1. National entrepreneurship policy

This concept examined the range of entrepreneurship and small business development policies that affected TBI. These policies are: White Paper on the National Strategy for the Development and Promotion of Small Businesses of 1995, National Small Business Act (NSBA) of 1996 (as amended in 2003 and 2004), Preferential Procurement Policy Framework Act 5 of 2000, Broad-based Black Economic Empowerment Act 53 of 2003, National Development Plan, 2010, Industrial Policy Action Plan, 2018/19 - 2020/21) and White Paper on Science, Technology, and Innovation (2019). For brevity, these policies address the following matters, which create a conducive environment for advancing TBI:

- A broad framework for facilitating entrepreneurship development and acknowledges the greater role of SMMEs and venture creation in socio-economic transformation and local economic development (White Paper on the National Strategy for the Development and Promotion of Small Businesses of 1995, National Small Business Act (NSBA) of 1996 (as amended in 2003 and 2004)).
- Provide guidelines and principles of transparent, fair and equitable procurement of goods and public contracting (i.e., tendering) for government departments and agencies by SMMEs (Broad-based Black Economic Empowerment Act 53 of 2003).
- Stipulate the strategies for mainstreaming black-owned businesses in the economy, avail funding strategies for startups and SMMEs, and reiterate government sanctioned support systems available for such businesses (Broad-based Black Economic Empowerment Act 53 of 2003).
- Emphasise public procurement by SMMEs and startups as a way of deepening innovation, rendering greater support and collaboration among startups in the SMME sector and supporting the commercialisation of publicly funded intellectual property (White Paper on Science, Technology, and Innovation, 2019).
- Emphasise the need for greater SMME and startup involvement in projects that benefit from technology transfer and process improvement of technology (Industrial Policy Action Plan 2018/19 - 2020/21).

Although these policies target SMMEs in general, their role in promoting technology startups and business incubatees in TBI contexts is not clearly articulated. Moreover, how such policy infrastructure can deepen, entrench and enable incubation processes and mechanisms such as incubation norms and procedures, incubation selection criteria, and incubation manager competencies, remains undocumented and unclear. It was for this reason that environmental factors affecting TBI were investigated in this study.

There is evidence to suggest that national entrepreneurship policy has a bearing on the aspects of entrepreneurial cognition such as the knowledge of the entrepreneur (i.e., individual factor variable). For instance, the review of literature established that when entrepreneurial policies are conducive for knowledge development, entrepreneurs will acquire external knowledge from holders of ecosystem resources within their proximity (Acs et al., 2018; Stam, 2018). Conversely, entrepreneurs operating small firms also endogenously seek knowledge in a regional, industrial and ecosystem contexts (Audretsch & Lehmann 2005, 2006; Qian & Acs, 2013; Audretsch et al., 2018; Stam 2018), thereby creating and recombining existing knowledge from the economy into knowledge inputs, which generate new products and services (Ghio et al., 2015).

9.5.2. Regional funding for SMMEs

Literature demonstrates that regional public funding of incubators is essential in facilitating business incubation (Hackett & Dilts, 2004) as new technology-based firms depend critically on the resourcefulness of their founders (Mian et al., 2016) and resource abundance of their environment. When confronted with unfamiliar and challenging environments, entrepreneurs persist longer when they access support (e.g., financial support) from communities around their locality or region (Jensen, Nguyen & Hansen, 2020). Notwithstanding the claims that incubators must operate independently, be self-sufficient and profit driven and possess entrepreneurship-enabling characteristics to succeed in commercialising their activities (Jensen et al., 2020), these profitability aspirations have not translated into reality for most publicly funded incubators (Bearse, 1998). This is attributed to the high costs of building dedicated infrastructure, and legal uncertainties regarding the use of public support instruments and limited tax incentives (Plonski, Pavani & Pires, 2021). These challenges point to the need for regional funding for technology startups. The dependence of incubators on government subsidy (whether nationally or regionally disbursed) has meant that incubatees operate in politically charged environments where incubator compliance and incubatee success become the basis for continued subsidisation of incubator operations with public funds (Hackett & Dilts, 2004; Gupta, 2022). Moreover, there is tendency for incubator management and policymakers to render positive evaluation of public incubators to showcase the success of such publicly funded initiatives (Gupta, 2022). These views compelled this researcher to establish the contribution of regional SMME funding to the thriving of TBI.

Although different national policies often shape the crafting of regional funding policies, generally regional funding policies target the provision of funding to incubators, science parks and special economic zones. For instance, the Russsian Federation Technopark programme availed funding for the establishment of the technoparks and appointment of incubator staff (technopark managers, fund managers) and resources (e.g., working space, laboratories and employees in the technopark (Williams & Tsiteladze, 2016) making TBI tenable. Similarly, many firms in biotechnology, micro-electronics and electrical equipment which are typically capital intensive (Wright et al., 2007; Clarysse et al., 2016) often rely on public funds availed at the regional level for their sustainability, whether they are run independently or operating under the support of TBIs in the UK. However, in South Africa, many Small Enterprise Development Agency (SEDA) supported incubatees that operate in various sectors of the economy (ranging from agricultural technology, mining, engineering, construction, data management), depend on funding from the national budget allocations and not necessarily from regional funding structures established within provinces to support TBI.

Some associations have been drawn between reginal funding processes and individual level factors such as individual competences. In the isolated incidents where regional funding has been provided through regional public funding instruments to support incubation tenants in South Africa, evidence suggests that this funding for training of incubatee staff has not translated into improved managerial competencies in terms of development of knowledge, experience and professionalism of tenants (Solomon & Lind, 2016). In the context of Brazil, regional funding of incubators unfolds under the auspices of creating innovation habitats that drive knowledge assimilation, knowledge transfer and support economic and social development in Brazil’s peripheral regions. As such, the programmes support technology firms to acquire academic knowledge (e.g., from universities) and research-related knowledge (e.g., product innovation) from technology development institutions to realise business incubation processes (Plonski, 2016).

9.5.3. Regional innovation culture

The study defined regional innovation culture as the collective cognitive orientation of individuals residing in a specific region towards the pursuit of novel ideas, activities, behaviours and values. Poor regional innovation culture could manifest in a poorly developed system of innovation, low presence of dynamic companies and knowledge-generating organisations coupled with low perceptions of business opportunities by entrepreneurs (García-Rodríguez et al., 2017). Since the cultural environment of a region shapes the cognitive structures, human behaviour and social knowledge shared by individuals (Alvarez & Urbano, 2012), the study argues that the innovation culture of region shapes how individuals approach venture creation through the incubation route. Literature emphasises the influence of cultural traits of a region on individuals’ beliefs and motivations to pursue entrepreneurial action (Lee et al., 2006; Guerrero et al., 2016), including the view that cultural values that accept innovation, personal success and affirm the social legitimacy of innovation and entrepreneurship tend to positively affect entrepreneurial decisions (García-Rodríguez, Gil-Soto, Ruiz-Rosa & Gutiérrez-Taño, 2017). Following this premise, one could argue that the innovation culture of a region positively reinforces entrepreneurs' orientation towards creating new ventures under the auspices of incubators. In short, a supportive culture (e.g., one that affirms innovations) can facilitate social legitimation, making the entrepreneurial career more valued and socially recognised in that culture (Krueger, Liñán & Nabi, 2013).

9.5.4. Legitimacy of incubation processes

The study defined legitimacy as a "social judgement of acceptance, appropriateness, and/or desirability" (Zimmerman & Zeitz, 2002) by those with vested interest in the organisation. Therefore, legitimacy is a normative concept dealing with conformity of behaviours, actions, activities and practices to socially acceptable rules, standards and procedures. The argument is that legitimacy heightens the confidence of stakeholders in their judgements and decisions, despite their complexity and bounded rationality, by invoking some signals of conformity and appropriateness (Zimmerman & Zeitz, 2002). These stakeholders could be employees, management, suppliers, government agencies, investors and other research bodies. While new ventures are often challenged by the liability of newness and smallness (Hannan & Freeman, 1984), which negatively impact their access to resources, gaining legitimacy from diverse stakeholders may ease access to resources (e.g., from lending institutions) for entrepreneurs, allowing them to obtain the resources they need for survival of their firms (Rutherford et al., 2009, Rice & Noyes, 2021). Initially, incubators assist new ventures with low legitimacy by availing them with few network ties and a minimal set of internal resources (Rice & Noyes). Incubation processes can gain legitimacy from both internal and external stakeholders if they contribute to the generation of more spinout companies, increase the survival rate of graduate companies and increase the employment opportunities for the general public.

Legitimacy can emanate from customers who interact directly with the products of ventures. The probability of purchase of a product arising from customers' knowledge of the organisation, its management, and the product itself is a sign of customer legitimacy (Shepherd & Zacharakis, 2003; Batchelor & Burch, 2011). Similarly, the possibility of customers by-passing an incubatees' competitors and their continued commitment to purchase products from the incubatees demonstrates customers legitimacy. With reference to employees of organisations, legitimacy can be acquired through imitation of the effective practices and behaviours of already legitimised organisations (DiMaggio & Powell, 1983). The imitation of human resources practices of established firms by emerging startups is central to acquiring the legitimacy of such firms and improving their competitiveness (Williamson, 2000). Therefore, one could argue that securing incubatees' legitimacy necessitates them to mimic the practices of spin offs and other established companies by developing and applying more sophisticated human resource practices and compensation structures. Lastly, the liability of newness and smallness theories means that less established small firms are often disadvantaged with regard to accessing funding opportunities compared to established corporations (Hannan & Freeman, 1984). This lack of legitimacy compels small firms to rely on private sources of incomes, which may not require much legitimacy (e.g., credit cards, private income, loans from friends) until they have transited newness and smallness to access financial legitimacy before investors and angel investors. Therefore, new startups may need to develop a positive track record and build credit in their own names before they can achieve financial legitimacy (Batchelor & Burch, 2011). With reference to incubatees, building internal funding capabilities (e.g., through private equity, personal revenue, credit cards) may build the financial legitimacy of startups that allows them to access other external sources of income. When incubators conceive their incubatee firms as legitimate structures, they may strive to secure additional resources (e.g., through venture financing or subsidy incentives) to support their venture creation initiatives to guarantee their success.

9.6. MULTI LEVEL FACTORS AND TECHNOLOGY ENTREPRENEURSHIP

The study conceived technology entrepreneurship (TE) as encompassing all activities involving the identification of entrepreneurship opportunities arising from technology developments and the exploration of these opportunities through successful commercialisation of innovation products, goods and services (Petti, 2012). Since TE is a complex phenomenon, it requires not only different levels of analysis drawing on different perspectives (Shane & Venkataraman, 2003; Phan & Foo, 2004) but also a case-by-case approach for understanding it (Petti, 2012). This provided a compelling practical reason for adopting an integrative view of TE that considers individual, organisational and systemic factors that drive its realisation and interfaces between the different levels (Petti, & Zhang, 2011; Petti, 2012). The next section provides some conclusions on literature on individual factors that affect TE.

9.6.1. Individual factors and TE

Although entrepreneurship literature recognises the multiple cognitive factors (e.g., self-efficacy, passion, experience and affection) implicated in venture creation (Mitchell et al, 2002; Urban, 2015), some of the entrepreneurial cognition factors at the heart of TE are intuitive thinking (Organ & O'Flaherty, 2016; Walsh, 2017; Baldacchino, Ucbasaran, Cabantous & Lockett 2022), scripts (Krueger, 2003; Zahra, Korri & Yu, 2005; Grégoire, Corbett & McMullen, 2011, Abdelnaeim & El-Bassiouny, 2019) and heuristics (Bryant, 2007; Ahmad, Shah & Abbass, 2021). Apart from cognitive explanations such as entrepreneurial cognition, one of the personal beliefs widely identified as shaping TE is perceived entrepreneurial capability (Lanza & Passarelli, 2014; Yao et al., 2021). For instance, although an individual's perception of her own capacity to identify technological opportunities in the environment and exploit them in generating successful ventures are critical to sustained technology entrepreneurship, Lanza and Passarelli (2014) warn that the study of the application of entrepreneurship capability among small firms is a neglected area that requires further empirical clarification, hence this study. Such an investigation into the application of capability in entrepreneurial settings contributes to the identification of higher order resources that generate successful technology change in the contexts of SMMEs (Lanza & Passarelli, 2014). The next section summarises research on entrepreneurial cognition types, starting with intuitive thinking.

9.6.1.1. Intuitive thinking

Despite intuition's elusive nature, there is consensus on its contribution to the realisation of entrepreneurship in general and TE in particular (Organ & O'Flaherty, 2016; Walsh, 2017; Baldacchino, Ucbasaran, & Cabantous, 2022). For instance, Organ and O'Flaherty's (2016) study on the role of intuition in promoting diversity in entrepreneurial ICT teams established that intuitive decision style exerts a strong influence on team level diversity and team performance. In the same vein, since intuition is founded on impulsive, affective decision making, Manesh, Flamini, Petrolo and Palumbo (2021) contend that it serves as a vital strategy for addressing uncertainty inherent in the development of technology-based entrepreneurial ventures. Precisely, intuition permits the application of involuntary and non-conscious choices to deal with different contingencies arising from the entrepreneurial environment (Sadler-Smith, 2015) which make rapid exploitation of transitory entrepreneurial opportunities possible. Research evidence suggests that experienced technology entrepreneurs deploy intuition extensively during new technology venture ideation and its application is most effective for this stage (Baldacchino, Ucbasaran & Cabantous, 2022).

Despite these observations, entrepreneurial intuition is yet to be fully comprehended from the expert intuition perspective as many questions remain unanswered regarding its constitutive nature (Sinclair, Sadler-Smith & Hodgkinson, 2009). For instance, the mechanisms through which intuition affects different aspects of TE outcomes such as technology commercialisation and sustained technology innovations remain a grey area in literature. Moreover, how intuition operates in the business venturing context to engender innovation and TE is an area which requires further scrutiny, especially mental simulation (Sinclair et al., 2009).

9.6.1.2. Scripts

The central argument regarding scripting is that entrepreneurs receive, perceive, structure and subsequently interpret information differently compared to non-entrepreneurs. As such, scripts allow entrepreneurs to integrate diverse information into a "highly developed, sequentially ordered knowledge" that forms "an action-based knowledge structure" (Mitchell et al., 2000: 975). Cognitive scripts are fundamental to the generation and execution of strategy for new technology ventures as they shape business model development (Maron et al., 2019; Kaffka et al., 2021). As such, expert or serial entrepreneurs are considered to possess expert scripts or knowledge structures about specific domains of enterprise which position them to outperform non-experts in their environment (Krueger, 2007). These domains of expertise could include revenue generation, resource mobilisation and the exploitation of technology opportunities. Scripts are deemed instrumental in the development of and execution of business models which facilitate opportunity exploitation among technology firms by providing “the cognitive link between entrepreneurial appraisal of the opportunity and its exploitation” (George & Bock, 2011: 88; Kaffka et al., 2021). As such, as knowledge structures embedded in the mind of entrepreneurs, scripts give logical structure to entrepreneurial decision making and accelerate the pace of such strategic decision making (Le Roux, 2005; Mitchell et al., 2000). For technology-based firms, such decision making ranges from resource allocation, exploitation of opportunities and sourcing of strategic partners to tackling entrepreneurial challenges such as competition rivalry.

Although entrepreneurs possess some shared scripts and experience about the conceptualisation, development, and growth of new businesses (Mitchell et al., 2000), the exploitation of such scripts cannot be generalised across different firms and industries. Moreover, since cognitive scripts are founded on entrepreneurial expertise (Mitchell et al., 2002a, 2002b), they could be negatively correlated with an orientation towards technology business sustainability because with increased experience, expert entrepreneurs may become more motivated by profit and negate the triple bottom line (Kuckertz & Wagner, 2010). Moreover, since more experience could result in technology entrepreneurs ignoring environmental cues, they might downplay evidence of perceived risks to their investment leading to excessive loss as entrepreneurs invest in unprofitable opportunities. In short, literature has hypothesised a negative association between entrepreneurial cognitive scripts that represent entrepreneurial experience and the realisation of sustainability orientation (Abdelnaeim & El-Bassiouny, 2020). Since entrepreneurial cognitive scripts constitute processes and structured ways of thinking that enable entrepreneurs to perceive opportunities despite the worst market conditions and risks (Smith et al., 2009), one could argue that they may trigger entrepreneurial failure in situations where entrepreneurs pursue wrong signals, leading to loss of revenue.

9.6.1.3. Heuristics

Apart from scripts, another cognitive antecedent to engagement in entrepreneurial behaviour are heuristics, which are defined as a *cognitive short-cut* (Baron & Ward, 2004; Mitchell et al., 2004). Heuristics comprise strategies that entrepreneurs employ to simplify decision making in a complex environment (Riganti, 2019). The Information processing theory suggests that due to limitations in the cognitive capacity of entrepreneurs to process the deluge of imperfect information they are presented with when making strategic decisions, they may be compelled to rely on heuristic judgements leading sub-optimal choices related to opportunity exploitation. As such, when subjected to pressure to make instant decisions relating opportunity identification and exploitation, entrepreneurs may exploit heuristics by default (Goodie & Crooks, 2004).

In TE decision making, resource constraints, time pressure, and volatile environments (Miller, 2007) may mean that nascent entrepreneurs depend on heuristics to facilitate "fast and frugal" decisions (Forbes, 2005a; Gigerenzer & Brighton, 2009). In this way, heuristics provide useful cognitive antecedents for technology business venture development in contexts where technology gives rise to diverse market opportunities (Denoo, Yli-Renko & Belz, 2021). An exploration of the extent to which entrepreneurs deployed heuristics during the evaluation and exploitation phases of their entrepreneurial process established that entrepreneurs deployed heuristics more to the evaluation of opportunities to make effective judgements about them but switched more to rational style of decision making during the exploitation phase (Bryant, 2007; Sassetti et al., 2017), allowing the creation of sustainable technology ventures.

9.6.1.4. Perceived entrepreneurial capabilities

Although PEC is an elusive construct, entrepreneurial capability has gained currency as a concept for describing mechanisms for realising the entrepreneurial process. For instance, Zahra, Abdelgawad and Tsang (2011) define entrepreneurship capability as firm's capacity to sense, select, and shape opportunities, and synchronise their strategic moves and resources in pursuit of these opportunities (Zahra, Abdelgawad, & Tsang, 2011). This work postulates that perceived entrepreneurial capabilities, therefore, denote an entrepreneur's perception of their ability to identify, validate and exploit entrepreneurial opportunities effectively in pursuit of sustainable entrepreneurship to realise successful creation of ventures.

The limited literature on entrepreneurship capability often discusses it with reference to digital firm environments and presents TE as an outcome variable. For instance, Nambisan (2017) reiterates the essence of entrepreneurial capabilities in identifying business opportunities in a digital technology environment, which increase entrepreneurs' participation in TE unconstrained by location and time. In digital environments enabled by technologies, entrepreneurship capability facilitates the forging of relations across industries and regions, fostering greater access to information about business opportunities and resources necessary for the formation of digital ventures (Yao et al., 2021).

However, PEC is not without its limitations. For instance, since PEC it is founded on one's perception of their own capabilities, entrepreneurs may risk exaggerating their capabilities leading to an over-estimation of expected TE outcomes. Drawing on data on commercialisation efforts of university inventions, Rowe and Ziedonis' (2006) examination of whether one's overoptimism of their capabilities affected entrepreneurial venture performance established that new technology entrepreneurs often pursued unsuccessful ventures for extended periods compared to established firms. They elaborate that this behaviour resonates with entrepreneurial over-optimism in technology venture development with uncertain market prospects. Given that PEC framework eases the creation organisation spin-offs, enables entrepreneurs to balance organisational and commercial interests, and integrates new resources in venture formation (Afzal, Mansur & Sulong 2017), the inability of startup owners to mobilise sufficient resources and balance competing interests may frustrate the realisation of TE.

9.7.1. Institutional factors and TE

Another grey area in incubation literature is whether university-based incubators provide services (i.e., physical capital, social capital and intellectual capital) that their incubatees consider fundamental to their entrepreneurial exploits especially technological entrepreneurship (Mian, 1996; Van Weele, Van Rijnsoever & Nauta, 2017). The following sections discusses these capital forms as they relate to TE.

9.7.1.1. Physical capital and TE

In terms physical capital, there is compelling evidence to suggest that real estate-related resources (e.g., office, shared spaces, furniture, computer networks and rental subsidies) (Chan & Lau, 2005; Subrahmanya & Krishna, 2021); office support (e.g., email, copying and fax services)(Carayannis & von Zedtwitz, 2005) and direct financial support and incentives are fundamental to the realisation of TE outcomes. These include increased firm growth, revenue generation or capital accumulation and innovation expansion of startups. For instance, availing rented office and shared spaces (e.g., laboratories) (Bergek & Norman, 2008) and other physical infrastructure (e.g., desk, telephone and electricity), reduces the fixed costs of establishing startups firms (Coelho et al., 2019), and assists prospective entrepreneurs to transition from idea conception to commercialisation of innovations and the successful launching of high-tech ventures (Subrahmanya & Krishna, 2021). Similarly, high tech startups such as those in the bio-technology sector require laboratories, large spaces and specialised equipment in incubator settings for conducting control tests and commercialising operations during expansion phases (Albert & Gaynor, 2006). Moreover, financial investment into university incubators through venture capitalists and business angels leverages tenants' capacity to stimulate sustainable innovations (Lopez-Martinez et al., 1994; Soentano & Jack, 2016) and other forms of technological entrepreneurship (Patton & Marlow, 2011; Buckley & Davis, 2018).

However, the benefits of providing physical capital are not generalisable across contexts as mix results have been reported in literature. For instance, although on-incubator firms perform better than off-incubator firms in terms of TE parameters such as employment growth, educational levels of the workforce and participation in cooperative relations, no statistical differences were reported between on-incubator and off-incubator firms regarding their innovation outputs (Colombo & Delmastro, 2002, Akcomak & Taymaz, 2007). Similarly, a study conducted on 56 000 patents granted from 1969-2012 to U.S. research-intensive universities established a strong negative relationship between the university-based incubator's financial investment and the innovation quality of patents generated at these universities as measured by their citations in subsequent patent applications (Kolympiris & Klein, 2017). This negative association was attributed to investments in incubation being accompanied by less commitment and limited emphasis on activities related to innovation and technological entrepreneurship (Kolympiris & Klein, 2017). These contradictory studies affirm the reality that institutional factors are critical but insufficient explanations for the development of TE.

9.7.1.2. Social capital and TE

Studies on the significance of institutional resources such as social capital affirm that incubators provide proximity to university research libraries and research groups (Rubin et al., 2015) and access to business networks (Bruneel et al., 2012) that are critical to TE outcomes of business incubatees. TBIs assist startups with building networks with external companies, institutions and other individuals (Hansen et al., 2000) which accelerate the firms' learning processes (Zahra, 2005, Subrahmanya & Krishna, 2021) needed to acquire TE in terms of increased technology innovations and firm financial growth prospects. Network heterogeneity facilitates firm startup growth and success (Baum et al., 2000).

Despite these avowed benefits of social capital, business and social networking is not without its own constraints. For instance, some technology-based firms have been critiqued for construing incubators as "hotels" (i.e., mere providers of physical and networking services), making them incapable of harnessing their capabilities to share knowledge and experiences that impact technology innovation potential (Lewis, 2001; Coelho et al., 2019). Although TBIs render networking opportunities to tenants for their industry and technology-based business plans (Sa & Lee, 2012), self-acquired networks are considered more critical to incubatees' realisation of TE compared to the generic networks availed by the TBIs as the former are unique and tailored to their innovation commercialisation and financial growth needs (Subrahmanya & Krishna, 2021). There is evidence to suggest that incubatees' trust depends more on private external networks acquired through their own initiatives than those availed by incubators for the development of their innovation exploits and output commercialisation (Petterson et al., 2016). This demonstrates that social capital effects on TE are an oxymoron dependent on circumstances of incubatees and incubators and the broader environment.

9.7.1.3. Intellectual capital and TE

As already discussed in the intellectual capital-TBI section, intellectual capital comprises human capital structural capital and relational capital. The relationships between these capital forms and TE are elaborated in the following sections.

9.7.1.3.1. Human capital

Literature posits a strong positive association between the acquisition of human capital and the propensity to become a nascent technology-based entrepreneur (Mosey & Wright, 2007; Guerrero, Urbano & Herrera, 2017). Entrepreneurship literature considers higher education, entrepreneurship education and managerial and entrepreneurial experience as influencing the pursuit of entrepreneurship opportunities (Davidsson & Honig, 2003; Carter et al., 2003; Dimov, 2010). The argument is that the acquisition of such human capital forms provides individuals with confidence to pursue opportunities linked to early planning in exploring new technological opportunities (Dimov, 2010). Therefore, entrepreneurs may deploy their human capital to engage in nascent TE through experimentation with new innovative ideas and pursuing TE opportunities.

However, there is contradictory evidence on the effect of education, especially knowledge acquisition on the pursuit of TE. For instance, in two of the four studies conducted by Schefczyk and Gerpott (2000), a positive association was established between education and entrepreneurial success and in the other two studies, no relationship could be established. Moreover, when conceived from the perspective of the different life cycles of innovation performance (a dimension of TE), evidence suggest that human capital of firms exerted a negative influence on performance of innovations (Cao, Xiong & Hu, 2016). In short, the relationship between education and TE is not clear-cut but is nubilous and contested.

9.7.1.3.2. Structural capital

Structural capital is that knowledge which is integrated into the information systems and products of the conversion of knowledge and intellectual properties of the company (Asiaei et al., 2018). The role of structural capital in shaping innovation commercialisation (a dimension of TE) has been an object of discussion of several studies. For instance, studies have demonstrated that structural capital exerts a significant influence on innovation capacity as well as the performance of firms (De Castro et al., 2009; Diaz-Diaz et al., 2006). Other studies concur that structural capital has a significant effect on the implementation of technology innovations of companies (Tseng & Goo 2005; Reed et al., 2006; Beltramino, Garcia-Perez-de-Lema, Valdez-Juarez, 2020). Similarly, Machado et al. (2016) examines the significance of structural capital in the success of incubated startups and reports that this capital exerts a considerable influence on the successful incubation of startups, especially through the physical and technological support availed by incubators. Despite its prominence in supporting aspects of TE such as commercialisation of innovation, Santos-Rodrigues et al. (2011) has warned that most works on structural capital do not analyse the influence of structural capital in conjunction with innovation, but only take few aspects that compose it, with the most examined being organisational culture.

9.7.1.3.3. Relational capital

There is growing consensus on the positive relationship between relational capital and the founding of new innovative technology ventures (Hormiga, Batista-Canino & Sánchez-Medina, 2011; Ryu et al., 2021). For instance, relational capital was reported as exerting a positive significant effect on the capabilities for generating technological innovation (Ryu et al., 2021). It accentuates access to knowledge by generating trusting relationships among collaborating partners and facilitating knowledge exchange through heightening their expectations including the motivation for the value of knowledge (Nahapiet & Ghoshal, 1998; Setini, et al., 2020), which make technology innovations possible. The argument is that engaging relationships based on mutual respect and trust create opportunities for open collaboration and new insights, making technology innovations possible. Precisely, relational capital facilitates the development of capabilities for technological innovation of firms through its potential to support the acquisition, integration and dissemination of external knowledge (Blyer & Coff, 2003; Ryu et al., 2021).

However, a few exceptional studies have questioned the capacity of relational capital to influence TE. Given that developing innovative pathways requires dynamic processes, discursive mechanisms, supporting strategies, stakeholders' communication and negotiation of priorities, the use of relational networks to effect technology innovations is a complex and uncertain affair (Nieth, 2019). Moreover, drawing on relational capital to develop concerted collective action, locate synergies, create a conducive platform for engagement in supporting technology innovations among heterogeneous stakeholders is a highly taxing and complicated engagement (Benneworth, Pinheiro & Karlsen, 2017). One infers that the prevalence of varying, competing public and private interests among stakeholders mean that relational capital cannot always be harnessed to build technology innovation due to the existence of black holes and parochial private interests.

9.8.1. Environmental factors and TE

Although there are several environmental factors that influence TE, the common ones in the context of technology-based firms are national entrepreneurship policy (Davari & Farokhmanesh, 2017; Oyelakin & Kandi, 2017; Oliveira, Cahen & Borini, 2019), regional SMME funding policy (World Bank, 2014c; Pary & Witmeur, 2019; Mphidi, 2021), regional innovative culture (Cooke, 2016; Fritsch & Wyrwich, 2018; Švarc, lažnjak & Dabić, 2019) and the social legitimacy of incubation (Deeds, Mang & Frandsen, 2004; Kong, 2019). Since these factors were extensively evaluated in the literature review, this section synthesises literature to provide a more nuanced picture of these factors' interactions with TE. In the next section, the relationship between national policy and TE is discussed and summarised.

9.8.1.1. National entrepreneurship policy and TE

There is consensus in entrepreneurship literature that government policies on entrepreneurship play a significant role in facilitating entrepreneurship development in general, and TE in particular. For instance, Oyelakin and Kandi (2017) examined the contribution of government policies to technology and entrepreneurship development in Nigeria and established that government policy on entrepreneurship is the most significant variable in explaining entrepreneurship development, the adoption of technology and expansion of technology innovations among startups. Similarly, one infers an associative relationship between entrepreneurship policy and the pursuit of TE in the articulation that Netherlands' entrepreneurship policy was designed to increase employment, promote technology innovativeness of the economy, individual development and economic integration (Rekenkamer, 2002; Stam, 2008).

Despite these inherent promises of national entrepreneurship policy in facilitating the realisation of TE, the relationship is not a clear-cut and automatic one due to the lack of conclusive evidence. For instance, not all elements of entrepreneurship policy culminate in the realisation of TE as not all new small firms are technologically innovative. Consequently, the advancement of national entrepreneurship policies targeting new small firms or self-employed individuals may not automatically lead to an increase in technology innovation (Stam, 2008). Similarly, although South Africa has deployed national entrepreneurship policies (e.g., SMME policies, digital startup policies, government R&D policies to support SMMEs) as instruments for creating high-impact TE among its young population (OC & C Strategy

Consultants, 2018), such policies have not been complemented by high venture investment by large corporations leading to disappointing technology innovation results. The argument is that while creating a fragmented national entrepreneurship policy may create the semblance of an ecosystem for creating new startups, TE may not be an inevitable outcome in the absence of a strong entrepreneurial ecosystem that creates diverse flexible funding instruments and access to a range of customers. As such, Siyanbola, Aderemi, Egbetokun and Sanni's (2011) framework for developing technology entrepreneurs in Nigeria affirms that the realisation TE is a function of a combination of favourable policies, institutions, financial and institutional support.

9.8.1.2. Regional funding for SMMEs and TE

Research has highlighted regional funding, regional institutions and instruments as conduits through which TE can be activated and be sustained (European Commission Committee of the Regions, 2015; Pary & Witmeur, 2019; Mphidi, 2021). For instance, the Belgian Regional Innovation Plan provides evidence of a continual rise in budgets devoted entrepreneurial financing and support for the commercialisation of technology inventions (Government of the Brussels-Capital Region, 2012; 2016) contributing to the Brussels region becoming an economic hub of innovation activities. In the same vein, the South African Department of Science and Innovation through its Technology Localisation and Implementation Unit has employed its Regional Innovation Support Programme (RISP) as a flagship programme for supporting regional funding of technology innovations, technology startups and employment unfolding at regional and local levels. Financed under the auspices of RISP, the Technology Entrepreneurship Programme of the Innovation and Technology Transfer Office at the Tshwane University of Technology has served as a powerful tool for empowering and supporting SMME owners to access education, training, mentorship and coaching for starting and scaling up their technology-based firms (Mphidi, 2021). In recognition of the centrality of regional and local milieus as loci of innovations, the European Union Committee of the Regions (CoR) introduced European Entrepreneurial Region (EER) scheme, which leverages financial support to EU territories that demonstrated commitment to implementing cutting-edge innovation driven strategies for mainstreaming the Small Business Act for Europe (SBA) principles, through the pursuit of TE (European Union Committee of the Regions, 2015).

Although regional funding institutions and instruments are often agents of TE (Florida & Kenney, 1988; World Bank, 2014c; Yu & Fleming, In press) through their support for technology startups at the bottom of the pyramid, the lack of private and public funding at regional levels is a significant inhibitor to the realisation of TE. For instance, in Mozambique, the lack of angel investors to finance technology startups, prohibitive cost of debt instruments, non-existence of equity investment schemes coupled with a lack of entrepreneurial success stories in the technology space at regional level have inhibited the advancement of TE (World Bank, 2014c). Similarly, in the Brussels region, the regional expansion of new technology-based firms has been hampered by insufficient entrepreneurial capital, unbearable R&D costs including technological complexity and the uncertainty concerning viability of startups, which discourage investors and limit the availability of funds (Colombo & Grilli, 2007; Veugelers, 2011; Pary & Witmeur, 2019).

9.8.1.3. Regional innovation culture and TE

Although the concept of regional culture is often invoked as either an explanatory or a residual variable in the context of commercialising innovations in regions, no clear-cut definition is often provided. At best, regional culture (Ministry of Culture of the Republic of Lithuania, 2021), innovation culture (Trippl & Toedtling, 2008) and regional identity (Paasi, 2012) are defined but not regional innovation culture, thereby raising pertinent questions about its exact meaning. Inferring from these related concepts, the study inferred that regional culture of innovation derives from the locational benefits of sharing explicit knowledge, commitment to common goals, trust of motives and actions and mutual respect arising from engagements by individuals situated in the same region. With reference to regional innovation culture, literature suggests that the rich contexts that knowledge-intensive regions provide to startups regarding facilities, planning and implementing innovations (Sapsed, Gann, Marshall & Salter, 2005) are fundamental to the realisation of TE. Similarly, regional innovation cultures constituted by trust, earning respect, demonstrating credibility, fostering commitment to action, and generating social capital among diverse technology startups, are deemed to facilitate the generation of TE (Cooke, 2005).

In some regional cultures, however, innovation capability development (a dimension of TE) has been hampered by peripherality, low density settlement patterns and economic 'individualism' among regional actors, which undermine knowledge flows for the exchange of ideas and expertise (Cooke, 2005). One complexity arising from the deployment of regional culture to explain commercialisation of innovations is the failure to operationalise regional cultures differently from their consideration as exogenous and fixed entities. For instance, literature has postulated regional culture as a weak point when explaining innovation models (Moulaert & Sekia, 2003). Regional culture has either been residualised, served as a way of explaining phenomenon that cannot be explained, or instrumentalised, that is advanced as a combination of variables that promote or hinder effective regional innovation (Tödtling et al., 2011; Benneworth & Ratinho, 2014). As such, Benneworth & Ratinho (2014) call for a transcension from the concept of regional culture as a fixed entity to conception of regional culture as culture emerging within open, porous systems to understand how it may operate in supporting territorial innovation that advance local materialist practices within wider knowledge communities.

9.8.1.4. Legitimacy of incubation and TE

Literature affirms that establishing and maintaining legitimacy is fundamental to engagements between new ventures and incubators (Cheng & Liu, 2019), which when premised on resource provision and realising incubation performance outcomes may contribute to the realisation of TE. They elaborate that maturation of technology innovations is founded on incubator-tenant interactions framed around ventures' *normative legitimacy* emphasising collaborative commitment to perfecting ventures' capabilities. Such technology innovations are also founded on engagements aimed at ventures' *cognitive legitimacy,* which target mutual efforts devoted to establishing the ventures' corporate image and reputations; engagement targeting ventures' *regulative legitimacy*, which relate to joint effort of two parties to invest resources in ventures (Cheng & Liu, 2019).

Despite legitimacy being a central pillar to incubatees' exploitation of their entrepreneurial opportunities to optimise TE, its absence among incubatees potentially undermines their access to resources from resource holders (Überbacher, 2014) and compromises TE. The lack of legitimacy of new ventures (Kong, 2019) undermine access to resources, which subsequently frustrates the establishment of technological ventures as value chains designed to transform "resource and knowledge inputs to marketable outputs" (Phan et al., 2005:170). The next section provided some conclusions based on empirical findings.

9.9. CONCLUSIONS BASED ON THE FINDINGS OF THE STUDY

To provide an integrated narrative on how the literature synthesis fits into the practice of technology business incubation and TE including factors that shape them, the next section discusses and summarises the responses to the research questions. It recaps each question and provides a consecutive response.

9.9.1. Recapping the research questions (RQs)

Seven questions were posed in this study and these questions, and their respective responses are articulated as follows:

9.9.1.1. Research question 1: **The main research question is: How do individual (i.e., entrepreneurial cognition, perceived entrepreneurial capabilities), institutional (i.e., incubation support and incentive regime of TBIs) and environmental (i.e., incubation ecosystem) factors that affect technology business incubation merge to support technology entrepreneurship?**

To address the "how part" of the merger between concepts located at multiple levels, the study drew on the findings and followed the three phases seminal to a typical convergence process: namely the *convergence-confluence* phase, *convergence- integration* phase and *divergence-innovation* phases (Roco, 2020). The fourth stage, the *divergence–spin-off phase*, was excluded from this study given the exploratory nature of the research and the lack of compelling evidence of spinoff companies and activities among university TBIs in South Africa. While the confluence requires assembling identified *concepts* in unity to reach a common goal, and convergence may require bridging domains of activity (e.g., individuals, firms, industries, sectors), *participants* (e.g., incubation stakeholders) and *scales* (e.g., across individual, institutional and environmental domains) (Roco, 2020). Informed by the findings from convergence-confluence stage, the study identified concepts at the individual, institutional and environmental levels that most facilitate TBI based on study findings and how they merged in incubation contexts. The findings suggest that the most prominent factors that coalesce around university-based TBI in driving TE are gutfeel, scripts (*individual factors*), physical capital, social capital and intellectual capital (*institutional factors*) and national entrepreneurship policy and regional innovation culture (*environmental factors*).

Individual factors such as gutfeel shaped startups operation decisions such as investment, procurement and sales deals, while scripts were more relevant to the entrepreneurial process and product development (e.g., concept proposition, prototype development and client feedback assessments), problem solving and risk assessments. Institutional factors such as physical capital related to infrastructure and intangible facilities (business premises, electricity, water, Wi-Fi and printing facilities) largely harnessed for establishing formal business structures and maintaining routine operations such as accessing customers, meeting investors and accessing social networks. Social capital development opportunities such as social networking events, collaborative funding arrangements and business networking were availed by government agencies and incubators to supply, bridge and collate resources (e.g., venture funding, angel investment) not available in incubator contexts. Although not quite prominent, intellectual capital in the form of non-financial incentives such as training on business management, pitching, business plan development, grant proposal development, mentorship and legal support to incubatees complemented the resources availed physically and via social networks. From a systemic perspective, environmental factors involved government's provision of structures and funding mechanisms for the development of regional innovation ecosystems and the provision of TBI key performance indicators (KPIs) to demonstrate their commitment to incubation as a vehicle for technology startup and SMME development. Regional innovation culture related to the Department of Science and Innovation's funding of regional human capital development and research and development under its regional innovation development programmes, incubators' fostering of regional innovation ecosystems and well as incubatees' involvement in technology commercialisation that enhanced the innovation culture of the regions.

Heuristics, PEC, regional SMME funding and legitimacy of incubation were excluded from critical factors driving TBI for various reasons. Although heuristics were widely employed by incubatees for various purposes, senior management of incubators believed most incubatees did not have them and financiers felt that incubatees did not use them for their intended purposes, and hence they were not supported adequately by these critical stakeholders. Although there was consensus among various stakeholders about some incubatees possessing technical knowledge, technological knowledge and some industry experience, there was consensus among incubatees and incubator management that incubatees joined TBIs with no to little entrepreneurial knowledge and business management experience, which undermined the capacity of PEC to shape incubation processes and outcomes. While incubation funders acknowledged that there was funding to support regional innovation ecosystems in general (and not incubation ecosystems per se), incubator managers felt that the funding available was not for university-based TBIs but targeted SEDA supported public incubators. Although legitimacy of incubation existed in general, some technology innovations, especially those viewed as foreign to local communities, were not accepted leading to reluctance to use them – implying failure to realise TE.

The primary participants that interacted to facilitate TBI for the ultimate realisation of TE are financiers (private funding institutions, venture capitalists), university-based TBIs, incubation tenants, government agencies, entrepreneurial and innovation champions. While TBIs provided the business models, resources and specialised capabilities that incubatees needed to function properly, the incubatees themselves brought in their technical and technological knowledge, expertise and capabilities that made the startup development and launch possible. Financiers provided direct funding and incentives necessary to facilitate incubators and incubatees' identification, evaluation and exploitation of technology opportunities, while university management developed the university incubation ecosystems and policies germane to the creation and development of startups. The university management, including TTOs, managed incubatees' intellectual property resources and enabled incubatees' external interactions, networking and collaboration with various stakeholders within and beyond the university-based innovation and incubation ecosystems.

Convergence-integration phase involves forming new models, frameworks or systems that address questions and resolve problems, and building new structures that isolated capabilities cannot. The process of deep integration contributes to new system behaviours that the individual components cannot create while working independently (Roco, 2020). A new model that synthesised relevant individual, institutional and environmental factors that merged to facilitate TBIs and give effect to TBI was developed (see contribution to model development under section 8.9.2). The model is an outcome of the elimination of those factors not critical to incubation and those for which no consensus could be reached among key stakeholders on their usefulness in shaping TBI processes and TI. The model is also a synthesis of propositions that emerged from the detailed discussion of findings. Drawing on entrepreneurial ecosystem theory, the argument is that the individual capacity of each factor in shaping TBI and TBI outcomes can only be felt when conceived in relation to other co-existing factors. Put differently, a systemic perspective where all critical factors are synergised and contribute to the attainment of superior incubation performance and incubation outcomes especially TE is considered.

In the divergence–innovation phase, the new system of integration contributes to novel pathways and opportunities, allowing the frontiers to diverge (expand, branch-out) for new problem-solving and applications (Roco, 2020). In the context of this study, the multiple factors located at different levels to give effect to TBI and TE can contribute to new opportunities such as diversification of technology market offerings, emergence of new industry clusters and knowledge spillovers that make the generation of new innovation, firms and products possible. As Roco (2020) rightly observes, this divergence may expand knowledge, innovation, competencies, technologies, and applications. The expansion of the empirical knowledge on TBI models, strategies and practices based on this study could lead to new best practices of business incubation, new niche areas for research and development that accentuate new innovations and new technologies in the market. Lastly, as Roco (2020) observes, in the divergence-spin-off phase, the initial outcomes of innovation create opportunities for spin-off development to new areas not planned in the initial phases and generate seeds for new convergence and divergence cycles. This stage was beyond the scope of this investigation due to its exploratory nature and the lack of strong evidence of technology spin offs among university TBIs in the regions where the study was conducted and in South Africa in general.

9.9.1.2. Research question 2: **What key issues on technology entrepreneurship emerge from prior studies on individual (i.e., EC, PEC), institutional (i.e., incubation support structure) and environmental (i.e., ecosystem) factors affecting university-based technology business incubation?**

This question was partly addressed in the literature section (i.e., conclusion based on literature) above that explored the relationship between these factors and university-based TBI even though the issues on TE can be inferred. Since TE deals with transformation of technological research, developments and related investments into economic (economic growth, financial sustainability) and social value (employment opportunities, living standards) for stakeholders (incubators, entrepreneurs, investors, employees and governments) (Petti & Ederer, 2012), the study summarises those TE issues that could be consequences and derivations of individual, institutional and environmental factors' interaction with TBI. The next sections discuss the key issues on technology entrepreneurship that emerged from prior studies on individual (i.e., EC, PEC) factors affecting university-based technology business incubation.

9.9.1.2.1. Intuition

Evidence from literature suggest that intuition assist entrepreneurs in technology venture process by facilitating their identification of business opportunities, integration of diverse information for identifying new products, assembling resources to start and grow technology ventures (Urban, 2015). The centrality of intuition in venture creation process lies in its provision of meaning and critical insights into disparate information relating to technology entrepreneurship (Shah, Horne, & Capellá, 2012; Marder, 2015) such as the strategic timing of entrepreneurial opportunities and operational matters such as determination of opportunity costs and rate of startup development (Walsh, 2017). In short, intuition is most critical to the initial stages of venture development such as opportunity identification and validation, which contribute to prevention of venture failure and sustained growth of the high technology ventures.

9.9.1.2.2. Scripts

As sequentially ordered knowledge that form an action-based structure (Mitchell, Smith, Seawright, & Morse, 2000: 975), entrepreneurs employ scripts to make decisions regarding venture creation such as opportunity identification, validation and exploitation (Urban, 2015), which make high technology venture development possible. With the managerial support of incubators, technology-based incubatees can harness scripts to organise knowledge relating to the identification of entrepreneurial opportunities, the mobilisation of resources and their effective exploitation in the incubation of businesses. Arrangement, willingness and ability scripts serve as cognitive foundations for explaining technology venture decisions (Mitchell et al., 2000) in incubator contexts. For instance, entrepreneurs can harness ability scripts to appropriate intellectual capital such as entrepreneurial knowledge and enhance the management of "intellectual property" such as patent registration, technology licensing, technology transfer and commercialisation (Mian, 1996; Isabelle, 2013) with the support of TTOs. Precisely, scripts are critical at giving structure and form to advanced stages of venture development such as technology commercialisation, product development, product marketing and customer feedback solicitation.

9.9.1.2.3. Heuristics

Rational entrepreneurial decision making is constrained by the fleeting nature of opportunities, limited organisational memory of small firms, availability of sunk costs and lack of perfect information on all alternatives needed to arrive at the best decision. As such, technology incubatees are often compelled to rely on simplifying strategies for making judgement-based decisions (i.e., heuristics)(Randolph-Seng et al., 2015) about opportunity identification, mobilisation and exploitation of resources. Cognitive heuristics assist entrepreneurs (including technology entrepreneurs) to make fast decisions based on available information and diminish their perception of risk, which explains entrepreneurs' pursuit of risk ideas and ventures (Busenitz & Barney, 1997; Simon, Houghton & Aquino, 2000; Barbosa et al., 2007; Ndofirepi, 2020). Heuristics, therefore, permit entrepreneurs to grab opportunities instantly and prevent them from missing these opportunities (Shepherd & Patzelt, 2018). However, using such heuristics can contribute to entrepreneurs making errors relating to representivity, illusion of control (Busenitz & Barney, 1997), confirmation bias (McGrath, 1999) and sunk cost bias (Baron, 2004). In TE, heuristics can make entrepreneurs underestimate costs in product development or overestimate the amount of support they can receive from various stakeholders or overestimate their control of the buy-in of customers during product launches.

9.9.1.2.4. Perceived entrepreneurial capabilities

Entrepreneurial capability comprises the knowledge, skills and experience that capacitate a venture to sense, select and shape opportunities, and synchronise its strategic moves and resources in pursuit of these opportunities (Abdelgawad, Zahra, Svejenova & Sapienza, 2013). While knowledge comprises the cognitive and mental structures that render a framework to interpret and comprehend new entrepreneurial information (Frese & Gielnik, 2014), an entrepreneur's experience and resources significantly affect venture startup and growth (Chandler & Hanks, 1998; Westhead, 1995; Edelman & Yli-Renko, 2010). Since PEC constitutes a perception associated with the mental representation of entrepreneurship i.e., what individuals think about entrepreneurship (Palich & Bagby, 1995; Liñán et al., 2011), it is logical to expect this mental representation to be associated with various aspects of the entrepreneurial process (Bayon et al., 2015), technology venture development (i.e., finance, marketing, human resources, investment, product development) and financial growth of such ventures.

9.9.2. Issues on TE that emerged from previous studies on institutional factors affecting university-based TBI

The next sections discuss key issues on technology entrepreneurship that emerged from prior studies on institutional (i.e., incubation support structure) affecting university-based technology business incubation, starting with physical capital.

9.9.2.1. Physical capital

To the extent that incubators render a constellation of physical resources (machinery, equipment, finance and shared laboratories and internet) and support services to technology startups (Bøllingtoft & Ulhøi 2005; Pauwels et al., 2016), they constitute prominent instruments for facilitating the survival and growth of innovative startups (Bergek & Norrman, 2008; Ahmad & Ingle, 2013) and the rapid commercialisation of innovations and inventions. Two schools of thought have persisted regarding incubation tenants' access to physical resources. One school contends that tangible resources availed to TB incubatees attract them to develop their technology ventures in incubator contexts (McAdam & McAdam, 2008; Soetanto & Jack 2013; Van Weele et al., 2017), a view that downplays the contribution of intangible resources initially (Van Weele et al., 2019). The other approach de-emphasises tangible resources and prioritises intangible resources especially incentives (tax incentives, loan guarantees, equity guarantees, investor regulations) (Daramola, 2012) as critical to creating a germane environment for the success of new technology-based firms. Overall, however, a dichotomy persists between physical capital (e.g., technology, accessing finance) and intangible resources (e.g., need to increase credibility and secure external advice) incubatees need upon their selection by incubators (Ratinho et al., 2013) to commercialise their technology innovations. While the provision of physical resources is critical to launching incubatees on an incubation journey, it is the extent of strictness of the funding instruments availed to incubatees, monitoring and evaluation mechanisms and the combination of support provided to incubatees that drive successful incubation outcomes such as TE.

9.9.2.2. Social capital

Social capital enables the location, pooling, and distribution of scarce resources, which an individual entrepreneur would not have legitimate access and control over (Light & Dana, 2013). Normally, incubators harness teams of experts (internal networks) that make informed decisions on the selection of suitable startups to accept for incubation from many applicants in their formative stages that are lacking in terms of defined technology and market (Nair & Blomquist, 2019). From an incubation perspective, therefore, literature conceives the availability of robust social networks of entrepreneurs as integral to improved (technology) entrepreneurship performance through (i) acquisition of inputs at affordable costs, and (ii) securing of stakeholders buy-in (iii) increased access to established and untapped markets (Stam, Arzlanian & Elfring, 2013). The ability to initiate, maintain, and utilise social networking capabilities is considered fundamental to the development of marketable offerings, development of knowledge-intensive products and improvement of performance of university spinoffs (Mort & Weerawardena, 2006; Walter et al., 2006; Pettersen, Aarstad, Høvig & Tobiassen, 2016) such as high technology ventures.

9.9.2.3. Intellectual capital

The quest for intellectual capital in the form of *human capital* (e.g., employee competence, know-how, work-related knowledge, innovativeness and education), *structural capital* (e.g., cultural knowledge, team spirit, copyrights, trademarks, patents, internal databases, management processes), and *relational capital* (e.g., brand reputation, strategic alliances, customers, licensing agreements, distribution channels) (Seetharaman, Low & Saravanan, 2004; Çalhan, Akdağ, & Öter, 2020) attract incubatees to incubator facilities. For instance, innovation capabilities are credited with enabling firms to bounce back from changing and adverse business environments (Teece, 2012), and contribute to realising technology startups' resilience and sustaining business continuity behaviours (Panda & Sangle, 2019). The quest for intellectual capital draws incubatees to well-resourced incubators, whose interaction with and extraction of intellectual resources, contribute to firm growth and increased financial sustainability for such incubatees.

9.9.3. Issues on TE that emerged from previous studies on environmental factors affecting university-based TBI.

The next section covered the key issues on TE that emerged from prior studies on environmental factors affecting university-based TBI, starting with national entrepreneurial policy.

9.9.3.1. National entrepreneurship policy

The first strand of research on national entrepreneurship policy emphasises its role in driving entrepreneurship pursuits and venture creation (Bergmann, 2009; Industry Canada, 2015; United Nations Industrial Development Organization, 2015; Rungani & Potgieter, 2018). This strand focuses on the role of entrepreneurship policy in creating the germane infrastructure for business development. This is enabled by multiple strategies such as: creating a robust regulatory framework that reduce barriers to entry and growth of technology startups, product regulation, promotion of patent systems, capital taxes, creating conducive market conditions by increasing competition, anti-trust laws, improving access to markets and public investment, and promoting knowledge creation and diffusion through R&D investment, university-industry partnerships, technology diffusion and technology cooperation between firms (Industry Canada, 2015; OECD, 2013; Statistics Canada's Survey of Regulatory Compliance Cost, 2008, 2011).

The other strand of research has examined the contribution of national entrepreneurship and venture capital financing to the growth and development of high growth-oriented technology ventures (Oyewale, 2010; Daramola, 2012; Tang et al., 2013). The emphasis is less on incubation per se but rather on increasing access to finance through access to debt financing, venture capital, equity and business angels. Regardless of the approach taken (research strand one or two), it has not been proved whether programmes designed to advance "entrepreneurial culture" or to improve entrepreneurship-related attitudes lead to the founding of technology ventures (Bergmann, 2009; Heger & Metzger, 2006). Moreover, it is unclear whether new technology ventures will continue existing when public support payments are discontinued and whether entrepreneurial support programmes availed in incubation contexts contribute to increased technology startup activities with positive impacts on the regional economy (Bergmann 2009; Koch, Kautonen & Grünhagen, 2006).

9.9.3.2. Regional funding for SMMEs

Research has considered TE as an outcome of the coalescing of resources availed at the system level. M'Chirgui's (2011) study on 29 technology incubators and 1 200 firms revealed that financial resources, patents, advisors, co-location with university research and science park were the critical resource combinations critical to explaining inter-incubator variation in new technology-based firms' (NTBF) development performance. There is evidence to suggest that South Africa through the Small Enterprise Development Agency (SEDA) and its regional funding structures, has a strong and well-established funding infrastructure and funding instruments for advancing TE. However, while regional funding has been availed to most publicly sanctioned incubators through SEDA to support technology-based incubation programmes, lack of depth of insight, experience and professionalism by incubation staff has frustrated efforts at realising TE (Solomon & Lind, 2016).

9.9.3.3. Regional innovation culture

The creation of a vibrant regional culture of innovation is critical to the knowledge spillovers, agglomeration economies and technology innovation among firms. Plonski (2016) argues that the development of technology parks, technopoles and business incubators in Brazil has created a regional culture that has boosted the development of innovative enterprises and created regional mechanisms for driving knowledge transfer (Plonski, 2016). As such, regional innovation culture has facilitated the development of technology ventures, which served as technology innovation habitats in outlying regions that drive knowledge assimilation, knowledge transfer and support economic and social development in Brazil's peripheral regions. Conversely, a poor regional innovation culture could manifest in a poorly developed system of innovation, low presence of both dynamic companies and knowledge-generating organisations coupled with low perceptions of business opportunities (García-Rodríguez et al., 2017).

9.9.3.4. Legitimacy of incubation

The legitimacy or social acceptance of incubates' actions and behaviours contribute to their access to critical resources that would make the development of patents and intellectual property more feasible. While the legitimacy of a person lies in their networking with stakeholders (Liu, Schøtt & Zhang, 2019) and that of entrepreneurs is contextualised in networking with business contacts (de Clercq & Voronov 2009), the legitimacy of incubatee tenants lies in demonstrating the innovativeness of their products, social relevance of their business strategies by solving global social problems and creating long-term financial sustainability for their firms.

9.9.4. Research question 3: Which dimensions of individual (i.e., EC, PEC) factors are fundamental to the incubation of technology businesses and technology entrepreneurship? The most prominent entrepreneurship cognition dimensions the different incubators considered to be most critical to TBI processes were gutfeel and scripts. From incubator sponsors' perspective, gut feelings were critical in incubation and entrepreneurial decisions such as investing in deals, making procurement decisions, and concluding sales based on market trends without prior market research. Although senior executive management of incubators were sceptical about gut feel, middle managers supported their use. Most incubatees employed gut feel to determine the price of products, investigate reasons for cancelling of product purchases by clients, for managing partnerships, deciding when to pitch to investors and in determining the size of the market for products.

In business incubation processes, the most prominently employed dimension of entrepreneurial cognition were scripts. From the incubator management perspective, the use of scripts was anchored in the business clinic processes that emphasised the identification, evaluation and exploitation of entrepreneurship opportunities. The implementation of incubation programmes enabled the harnessing of scripts for navigating the different entrepreneurial stages especially, ascertaining the business value proposition, prototype development, securing client feedback during product tests, launching new technology innovation products and ascertaining some perceived risks for the product in the market. From the incubation tenants' perspective, the adoption of scripts facilitated the proper scheduling of factors of production, forecasting liquidity problems, using of customer base to fix technical problems and resolving problems remotely, and the use of sales referrals to manage expected future risks. Innovation champions professed that incubation tenants employed scripts for building the credibility of the business to external investors through letters of intent from incubators and combined scripts with market-based facts to make entrepreneurial decisions.

Gut feeling were also instrumental in realising TE, with the most compelling narratives emanating from incubation sponsors, incubator management and tenants. From, the incubation sponsor perspective, gut feelings were instrumental in optimising opportunity exploitation in the innovation ecosystem especially locating new customers, new investment and funding opportunities, whose collective ripple effect was optimising production opportunities, increasing the revenue base, leveraging return on investment and profit margins of technology startups. For incubation management, gut feelings founded on entrepreneurial experience and science-based knowledge catalysed the integration and commercialisation of innovative ideas that enhanced the generation of new technological innovations, and increased revenue streams from sales of products. For incubatees, gut feel helped them to sense and discover innovative ideas amenable to commercialisation and becoming revenue generators based on these entrepreneurs' business experience and knowledge. As such, gutfeel enhanced product innovations by directing incubatees to product specifications that, when modified, may facilitate good innovations of greater economic value to their business. Gutfeel was thought to be essential to technology investors' making justifications for the pricing of technology innovation products based on the incubatees' share of the market. With the support of market validation, gutfeel was reported to increase the size of the market through improvisions relating to customer subscriptions to technological services, creating value for technology products and building sustainable financial models that reward startups and their customers.

Scripts were also deemed fundamental to the realisation of TE. Incubation sponsors and incubator management concurred that the lean canvas business model constituted a script that enabled incubatees to develop an innovative lens to technology business development - from concept development to launching technology products in the market in ways that facilitated technology opportunity exploitation, optimal product pricing, generation of revenue and sustainable technology innovation for startups. Scripts enabled the gleaning and grasping of the process of technology company building and sustainable revenue model development that contributed to the financial success of startups. TBI management also conceived scripts to facilitate the identification of right partners in building teams that facilitated the licensing of technology and optimising business processes that increase the client base for firms. From the incubatees' perspective, scripts assisted them in creating mental models of the venture creation process (from idea conception to innovative product launch), and how to estimate sales volumes during product launches. They were also viewed to facilitate risk estimation during innovative product development stages such as implementation of changes to the products and forecasting the intended outcomes. As such, scripts helped to prevent huge financial losses and increase chances of revenue generation during product launches. They also assisted incubatees in making connections between relevant resource persons who provide advice on product development at lower prices to maximise profits and to develop the right terminologies that strike a chord with investors during investment pitching events.

Overall, no dimensions of PEC were considered most critical to TBI as most stakeholders concurred that incubatees lacked the necessary entrepreneurial and business knowledge deemed to be most critical to the incubation process, when they were admitted into incubators. However, there were some weak interactions among entrepreneurial knowledge acquisition, knowledge of training needs and knowledge of technology innovations and TBI, judging from the propositions that emerged from empirical findings. Nonetheless, PEC dimensions did not affect TE in significant ways.

9.9.5. Research question 4: What is the role of institutional (i.e., incubation incentive and support regime rendered by incubators) factors in the successful incubation of technology businesses and technology entrepreneurship?

The discussion of institutional factors will be differentiated between physical capital, social capital and intellectual capital and their relationships with TBI first and then TE. Regarding physical capital, incubation management contended that even though incubators availed physical infrastructure such as offices, shared spaces (e.g. laboratories, co-working spaces), furniture, water, electricity, telephone and internet connections that provided physical presence to incubatees to facilitate internal and external networking opportunities, during the Covid 19 period, such provision of physical capital was not quite essential as incubatees could be incubated virtually or in hybrid forms by combining remote working with limited presence in incubator spaces. However, incubatees felt that incubators' provision of physical capital facilitated their engagement in entrepreneurial activities such as holding meetings with potential investors and clients, marketing of products and services to on-campus clients, accessing social and business networks, and accessing intellectual property knowledge and workshops availed by TTO staff. Moreover, incubation funders, professed that the provision of infrastructure grants availed funding for the purchase of equipment, technology and machinery to facilitate venture development activities. These grants were also used for availing training in business plans development and product certification. Some entrepreneurial champions, however, bemoaned that the provision of grants could perpetuate the dependency syndrome among incubatees who lacked initiative and relied on incubators funding for their venture development efforts.

Regarding social capital, the compelling views emanated from incubation funders, incubation management and incubatees. The overarching view was that incubation funders formalised their networking relationship with incubators using funding instruments managed at institutional level by TTOs, networking events (e.g., conferences and exhibitions), and collaborative funding agreements. These different networking strategies were instrumental in linking technology startups with incubators, investors and other companies operating in related and other sectors- providing opportunities for business networking and accessing funding opportunities for incubatees. Although some incubators did not provide business networking activities within the incubator premises, they served as the bridge connecting incubatees to government sanctioned networking events (e.g., collaborative networking gala dinners, startup meetings), which linked incubatees to potential investors, supply chains and other business opportunities (e.g., export opportunities). However, some incubators also facilitated networking opportunities among incubatees to ensure that they benefit from their resource complementarities and bridging of knowledge gaps. Incubator management also assisted incubatees in deploying their goodwill and reputation as sources of credibility for incubatees when they applied for grants to increase their chances of grant application success. Incubatees reported that they tapped into the social capital availed by constituting a business networking ecosystem for extracting networking resources inherent in such ecosystems. Networking opportunities such as investor pitching events, meetup events and webinars were tapped into to access investment and funding opportunities within and beyond the confines of incubators.

Incubation sponsors, incubatees and innovation champions voiced their opinions regarding intellectual capital as it related to incubation processes. For sponsors, the human capital dimension manifested in their provision of practical training in business management, investment pitching methods, fundable business plan development, how to take innovative technology products to the market, filing for corporate tax with South African Revenue Services (SARS), and financial planning. These training sessions enhanced incubatees' knowledge of the technology venture development, venture operations and the entrepreneurial process. In incubation contexts, relational capital was forged through experts and mentors who facilitated knowledge transfer between incubatees and customers during product launches, the knowledge of how to effectively communicate project milestones to investors during investment and funding pitches. Incubatees emphasised human capital in their explanation of how TTO personnel availed legal support for managing and transferring intellectual property during product development and relational capital embedded in peer mentorship on diverse venture development issues, which were lacking in incubators. Some innovation champions professed the diverse learning opportunities that incubators provided regarding electronics, 3D printing and smart farming, which increased their entrepreneurial learning opportunities as well as those of incubatees.

The study also explored the role of physical capital, social capital and intellectual capital in the realisation of TE. Regarding physical capital, sponsors emphasised the role of information portals that hosted funders and entrepreneurs in accentuating access to funding opportunities, which leveraged the production capacities of tenants (e.g., product and service volumes produced) and expanded the range of products manufactured by incubatees. The ripple effect of the increased production of innovative technology products was an increase in the outputs produced, sales outputs and revenue for the technology startups. Incubation management expressed their confidence in the techno-infrastructure's (e.g., 3D printing facility) capacity to provide spaces where technical assistance could be channelled for high-tech business development, the same way the incubation facilities availed pathways to venture funding opportunities, leverage the efficient and effective operational capacity of tenants and invariably the profitability of technology firms.

The role of physical capital in unlocking TE was also investigated. For incubation tenants, the incubators' provision of physical capital was instrumental in providing a central nodal point for incubatees to access new customers, augmenting opportunities for concluding more sales of technology products and services and accentuating revenue base for these tenants. The greatest benefit of availing physical capital (e.g., offices, shared spaces and laboratories, email and printing facilities) to incubatees was the elimination or significant reduction of overhead costs of emailing, printing, faxing and scanning, eliminating the costs of using internet cafes and expensive data plans from private internet service providers. The savings generated from these services were devoted to innovative and high-technology development, thereby contributing to improved product quality and enhanced financial growth of the business in the long term. The incubators' availing of and incubatees' use of the Internet and Wi-Fi for cloud-based computing programmes also contributed to the acquisition of digital skills (e.g., online digital marketing), increased firm visibility and potentially increased the customer base of incubatees. Incubators' physical spaces aided innovative product commercialisation, increased incubatees' access to potential investors that availed funding opportunities for increasing the financial revenue base and the growth of startups.

The prominent narratives on social capital emanated from sponsors, incubator management and incubatees. One sponsor highlighted that her organisation created an innovation platform whose social networking affordances enabled incubatees to develop and share innovative ideas, develop technology products and innovative solutions with potential for commercialisation in the market. From the incubation management perspective, social capital generated among incubatees, mentors, investors and supplier interactions and engagements fostered innovative ideas that expanded the knowledge base of incubatees, opening up opportunities for new product development, with possibilities for augmenting sales and generating income for technology startups. Incubators' knowledge brokerage and bridging capabilities connected incubatees to large agricultural corporations that broadened incubatees' knowledge base and facilitated access to distributers and emerging markets for their technology products and services. Incubatees highlighted that the exchange of social capital enabled by networking opportunities within and beyond TBI contexts enhanced access to novel ideas for locating new technology markets, while the adoption of professional knowledge, information and advice shared during networking events created avenues for more efficient production methods that accentuated the growth opportunities for startups. The networking opportunities also allowed incubator staff and incubatees to discern technical and technological skills complementarities that opened avenues to accessing new customers, increasing sales opportunities and revenue generation potential for technology startups.

The more dominant views on intellectual capital's role in realising TE were echoed by incubation sponsors, incubation management, incubatees and innovation champions. Incubation sponsors reiterated the role of human capital training in effective business operations and production methods, addressing legal matters and enhancing grant proposal development skills. Human capital training also played a significant role in enhancing access to venture capital, catalysing incubatees to develop and exploit new scientific and technology innovations, creating room for firm expansion and financial growth. For incubation management, the provision of human capital training, especially technical and advisory services targeting entrepreneurial aspects such as the generation of revenue streams, determining cost structure for the business and determining the minimum viable product, contributed to incubatees' identification of viable product markets and location of business domains where sustainable business innovations could be developed. The incubatees' adoption of the lean canvas business model assisted them in dissecting the entrepreneurial processes such as technical product development, determining sales projections, segmenting the market for technology products, increasing the chances of profitability and competitiveness of technology products.

Intellectual capital also directly impacted TE. The social construction of relational capital manifested in government, industry, banking, technology and agriculture networks that forged networked relations with incubatees and availed training in product development, increasing incubatees' knowledge of technology products, efficient product manufacturing, thereby streamlining the technology venture creation process. Such relational capital built among these stakeholders also precipitated incubates' knowledge of technology markets and increased opportunities for ground-breaking technology innovations. For incubatees, the human capital dimension of intellectual capital was predominant - training and coaching in cashflow management and budgeting enhanced incubatees' prediction of liquidity crunch challenges, projection of schedules for product commercialisation based on cash available, enabled wider rollout of technology products and increased revenue generation for technology startups. Training in financial management also improved technology innovation by assisting incubatees in identifying financial gaps for technology development and areas for effecting technology product improvements. Training in market gap and market trend analysis enhanced the technology development strategy, especially the tactics for winning new customers, expanding sales volumes that increased the revenue base for technology firms. For innovation champions, human capital availed through training and advisory services introduced incubatees to new agricultural technologies with potential to improve productivity of agricultural technology firms, enhanced crop and wine quality, and promoted competitive pricing of such products. Similarly, the sharing of technology knowledge through training contributed to greater appropriation of technologies, the generation of new applications, which would invariably contribute to increased production and revenue growth for high technology firms.

9.9.6. Research question 5: Which aspects of the environment (i.e., entrepreneurship ecosystem) facilitate (or undermine) the successful incubation of technology businesses?

The most prominent environmental factors that affected the successful TBI at university were national entrepreneurship policy and regional innovation culture. From an incubation funders' perspective, national policy was instrumental in directing regional innovation development programmes that strengthened the development of the regional innovation ecosystem, which facilitated the localisation of technology innovations at the grassroots. Apart from developing and funding localised innovation ecosystems by funding incubators, the net effect of national policy was overcoming social exclusion in the economy by fostering the development of new startups (e.g., through incubation processes) and incorporating township economies in the regional innovation ecosystem. Although the national entrepreneurial ecosystem was criticised for entrenching a tender-based approach to incubation, the continual financial support from government for startup and SMME development was praised for increasing the liquidity of incubatees especially those that secured such funding.

While some incubation managers conceived national entrepreneurship policy as invisible and ineffective for delivering the technology incubation mandate judging from the insignificant numbers of externally funded incubation tenants successfully incubated at universities, other managers highlighted that the government's insistence on key performance indicators (KPIs) for TBI demonstrated its commitment to harnessing national policy as a lever for advancing successful incubation outcomes. Similarly, other incubation managers conceded that incubator B's commitment to become an entrepreneurial university, which bolstered the development of its incubation ecosystem, was a direct consequence of the government' shift in focus from a national system of innovation to regional and local innovation and entrepreneurial ecosystems. Incubatees held a qualitatively different position - arguing that although the institution of university-based TBI was a direct consequence of national policy, the innovation practices in the incubators were rather direct outcomes of incubators and innovators' efforts to create effective regional platforms of innovation. Therefore, the effect of national entrepreneurial policy on TBI outcomes such as TE was indirect.

Regarding the role of the regional innovation culture in supporting successful TBI, incubator management affirmed that the innovation culture that supported university-based TBI arose from the knowledge spillovers that unfolded between the several universities and the agricultural intensive orientation of the winelands. The argument was that business startups leveraged the IP created by or through these universities even though no clear innovations unfolded among startups operating beyond university contexts. Incubatees affirmed that it was these universities' strong thrust for agricultural technologies that facilitated successful TBI. Innovation champions concurred that the development of a regional innovation culture enabled startups' development of new business models, new funding connections and piggybacking on new funding instruments. Fourth Industrial Revolution (4IR) technologies (e.g., use of digital platforms, web-based accounting practices, drones and sensors) opened up new opportunities for startups to invest in new innovations.

9.9.7. Research question 6: Which aspects of the environment facilitate (or undermine) the realisation of technology entrepreneurship among university-incubated businesses?

The environmental factors that most impacted TE of university-incubated businesses were national entrepreneurship policy and regional innovation culture. Incubation management professed that national policy on entrepreneurship directed universities to identify academics and students that possessed innovative ideas with potential for commercialisation to form technology startups. They elaborated that the policy foregrounded creating a new generation of entrepreneurs who could create patents, startups and spinouts that create jobs, promote sustained economic growth and generate national wealth. Moreover, national entrepreneurial policy directed university entrepreneurial strategies and incubation activities that facilitate the selection of technology startups for incubation and entrepreneurial activities that contribute to commercialisation of ideas through IP disclosures, patents, spinoffs and licences.

Incubatees conceived national policy as the main driver of youth-based TE at university. They also believed that national policy created opportunities for their increased participation in TE programmes and competitions such as South African Breweries Kickstart and Global CleanTech Programme respectively, where solving complex innovation challenges presented funding opportunities to student technology entrepreneurs. Some incubatees also narrated the contribution of national entrepreneurship policy to SMME technology development through its support for internationalisation strategies such as export product promotion, joint ventures and partnerships to steer technology venture growth. In the same vein, innovation champions emphasised SEDA's provision of financial, technical and technological support to SMMEs as availing opportunities for incubatees to increase their sales revenue and promote sustained growth of the businesses.

Incubation managers held a dominant view on the role of regional culture in facilitating TE. They professed that a culture that is receptive to the creation of innovative ideas and unleashing entrepreneurial passion has facilitated the creation of new technology startups in region where incubator A was located. There was a consensus that a culture of innovation in the region ignited excitement about developing new technologies and innovations among technology startups. However, other incubation managers felt that despite the existence of a culture of innovation in the region, the paucity of funding frustrated the process of harnessing this culture into sustainable technology innovations in the regions where these incubators and incubatees were located.

9.10. Study contributions

The study makes four main contributions namely, contributions to theory, model development, methodology, policy, and practice and each is discussed in sections below.

9.10.1. Contribution to theory

Consistent with the need to develop synergy and locate complementarities between theories situated at the individual, institutional and environmental levels, there were some main theories and supportive minor theories adopted in this study. The major theories namely entrepreneurial cognition theory, institutional theory and entrepreneurial ecosystem theory served as interpretive and analytical lens for grasping the individual, institutional and environmental factors that affected technology business incubation (TBI) and technology entrepreneurship (TE) respectively. The supporting theory, namely resource-based view complemented the institutional theory and entrepreneurial ecosystem theory where they had some limitations.

9.10.1.1. Entrepreneurial cognition theory

Entrepreneurial cognition theory rendered this study with rich insights into the thought processes of entrepreneurs including the rationale for the course of their entrepreneurial actions (Urban, 2015), in particular, their commitment to undergo TBI with a view to commercialise their innovations and applications and grow their technology startups. Moreover, this theoretical perspective rendered a theoretically sound and empirically testable approach that coherently and comprehensively articulates and explains the contribution of the individual entrepreneur in the entrepreneurial process (Gregoire et al; 2006; Urban 2015). The theoretical contribution is that the theory provided conceptual lens and empirical explanations on how entrepreneurs drew on individual traits such as intuition, scripts, heuristics and perceived entrepreneurial capabilities to make sense of the identification, validation, mobilisation and exploitation of entrepreneurship opportunities during startup incubation. These insights based on this theory are consistent with the view that entrepreneurial cognition enables entrepreneurs to notice, mobilise resources, leverage and act on entrepreneurial opportunities (Nichter & Goldmark, 2009; Valerio et al., 2014). For instance, the theory shed light on how incubators advised incubatees on script development to facilitate risk identification, risk strategy development and risk mitigation as well as compelling incubatees to provide logical and compelling justifications for entrepreneurial decisions that they adopted in their business operations.

Another theoretical contribution was that although entrepreneurial cognition theory often conceptualised cognition processes (e.g., intuitive thinking from a dual process perspective) as dichotomous and diametrically split between intuitive (unconscious or sub-conscious thought processes) and rational (conscious thought processes) cognitive styles (Martinez, 2006, Sloman, 2014; Hurst, 2018), evidence from the incubatees demonstrated that they applied both cognitive processing styles strategically and contingently. Depending on the situations in which these are presented, this means applying them serially or concurrently, that is, sometimes foregrounding one thinking style while subsuming the other, and sometimes not using them at all. One emergent observation was the use of intuitive thinking as calculative because of the need to continually revisit and validate facts on the ground regarding conditions such as customer base, pricing strategy and appropriate times to take product to the market. This finding was significant as its deviates from the common narrative in entrepreneurial cognition literature that emphasises the Cartesian dichotomy between automatic, unconscious (including sub-conscious) cognitive decisions and rational thinking (Epstein, 1994; Sloman, 2014). Therefore, although the entrepreneurial cognition theory renders some cognitive pathways for predicting who could become an entrepreneur, it provides limited information about why, when, where, or how that thought process should be expected to influence entrepreneurial action (McMullen, Wood & Palich, 2014). The "how" and "when" aspects of cognitive (e.g., heuristics, scripts, intuitive thinking) functioning across different entrepreneurial situations are addressed in this study, thereby extending the theory. Evidence from the study suggest that sometimes rational and automatic unconscious cognitive processes were used sequentially or concurrently during decision making. This finding constitutes a response to the call by Randolph-Seng, Clarke and Atinc (2020) for researchers to interrogate more dynamic cognition theories (e.g., theories that propound ever-evolving and context sensitive thinking) to examining entrepreneurs' mindset. This is instructive because while there is an established tradition of examining cognitive dimensions as being internal to the entrepreneur, the reality is that building sustainable entrepreneurs demands a deep comprehension of the entrepreneur's cognitive state in conjunction with their environment (Randolph-Seng, Clarke & Atinc, 2020).

Despite entrepreneurial cognition theory's usefulness in rendering insights into the cognitive processing of the mind (i.e., microanalysis), the theory takes for granted the motivational factors that govern the level of engagement in entrepreneurship and fails to explain the mechanisms linking social cultural factors to entrepreneurial actions (Urban, 2015). For instance, while the theory illuminates how cognitive processes inform incubatees' engagement in entrepreneurial processes and behaviours, it is insufficient for explaining the motivations for the divergence of opinions between senior executive and middle level managers on the one hand, incubatees and incubators on the other, regarding their use of heuristics in incubation decision making. Based on this conclusion, it is necessary to interrogate other complementing theories. Moreover, in the emerging economy context where institutional incapacity and state fragility contribute to hurdles in entrepreneurial pursuits (Lim et al., 2016), the interplay of micro level (individual level) theories and institutional level theories would be more explanatory of the complexity of TE in the context of this study. As such, entrepreneurial cognition theory was complemented by the resource-based view and Institutional theories to account for the failure of entrepreneurial cognition theory to explain how new startups accessed resources in emerging contexts. For instance, the study employed contextual embeddedness to demonstrate the fact that the resource needs and forms of support incubatees exploit in realising TBI and TE are bound in context and defined by their resource circumstances at different stages of their entrepreneurial journeys. Newly established technology-based firms need physical (e.g., physical location, finance) and intellectual resources more than established incubatees and spinoffs that may require affinity to entrepreneurial and innovation ecosystems to contribute resources to these networked communities. Therefore, the situated contexts in which entrepreneurs found themselves together with their temporal states in their entrepreneurial journeys informed the type, nature and quantity of resources and support types they needed in their startups and in their entrepreneurial ecosystems. As such, contextual embeddedness served the explanatory variable for how the resource-based view's focus on different resources availed by incubators complemented the entrepreneurial cognition theory's preoccupation with the cognitive resources that entrepreneurs bring to their encounter with TBI realise TE. Precisely, entrepreneurial cognition theory was integrated with resource-based view through contextual embeddedness to account for access to, enactment and appropriation of different resources by startups at different stages of their entrepreneurial journeys located in the same entrepreneurial and innovation ecosystems. Therefore, the complex interplay of individual, resource and institutional context make it "improbable that [technology] entrepreneurship can be explained solely by reference to individual traits independent of the situation in which they find themselves" (Shane & Venkataraman, 2000; Scott, Sinha, Gibb & Akoorie, 2020).

9.10.1.2. Institutional theory and Resource-based view

Regarding institutional factors that shaped TBI and TE, institutional theory was the major guiding theoretical lens while the resource-based View supported the institutional theory where the latter was insufficient. According to Scott (1995), institutions exhibit cognitive, normative, and regulative structures and activities that provide stability and meaning to social behaviour at organisational, organisational field and society field. The argument is that institutions comprising formal and informal rules, norms, values of organisation (e.g., business formalisation rules such as new business registration, filing for corporate tax, conformity to labour and BBBEE laws, incubation norms and business models) define and shape behavioural conduct of entrepreneurs in their TBI and TE pursuits. These normative and cognitive foundations also define individuals' beliefs, decisions and actions through implicit rules concerning what is deemed legitimate in any given society (Suchman, 1995). The study employed institutional theory to explain influences that shape social and organisational structures, rules, norms, routines which define the behaviours of social actors (Butler & Daly, 2009). To the extent that entrepreneurship entails economic behaviours and activities that are located and embedded in institutional environments of communities, societies and countries (Aldrich & Fiol, 1994; Baumol, 1990), institutional theory occupied a unique space in explaining entrepreneurship research (Kazumi & Kawai, 2017) such as incubation selection criteria and incubation models.

Literature suggests that entrepreneurs conform to the rules, norms and legal frameworks in the institutional environment to access economic efficiency and social legitimacy (Kibler et al., 2014) and institutional theory deepens understanding of the role of institutional logics and institutional complexity in shaping entrepreneurial actions and outcomes (Cobb, Wry, & Zhao, 2016; Zhao & Wry, 2016). For instance, our research demonstrated that due to the lack of social legitimacy at inception stages, startups sought their incubators' recommendations and endorsements as ways of gaining legitimacy to access resources such as grant funding, venture financing and resources availed though pitching events. Institutional logic found expression in the reality that, due to the performance metrics TBIs imposed on incubatees to track and monitor progress as conditions for funding disbursements, external funding for incubatees channelled through the TBI structures had greater proclivity towards its intended purposes (i.e., evidence of conformity to institutional rules, norms and procedures) compared to funding availed to entrepreneurs operating independently (i.e., outside incubation structures). Moreover, the legitimacy of incubatees was also derived from their affiliation to incubation structures allowing incubatees to exploit the good will of incubators in their access to funding opportunities.

The fact that institutional polycentrism theory emphasises that institutional environments do not comprise individual, standalone institutions, but rather a convergence of interrelated institutions (Kogut & Ragin, 2006; Ostrom, 2005) implies that the differential resource positioning of these institutions as a source of competitive advantage must be acknowledged. This is indeed a critical omission of institutional theory. For instance, evidence from the research suggests that incubatees often deserted public incubators and joined private incubators where they could access more resources for successful incubation. The resource discrepancies amongst TBIs and among incubatees constitute a critical gap in institutional theory that the resource-based view (RBV) filled. The study, therefore, employed *resource differentiation* of incubators and *strategic alignment* of incubatees and incubator goals as enabling the complementation of Institutional theory and RBV. For instance, while resource differentiation and different business models meant that public and private incubators would not supply comparable resources to incubatees, which explained the movement of incubatees from public and private incubators, the strategic alignment of public and private incubator goals operating within the same incubation and entrepreneurial ecosystems would mutually enrich both incubators especially on issues of strategic importance such as founding of startups, regional development and social transformation. This is because social legitimacy is derived from the economic, social and cultural contributions and impact that incubators and incubatees make to their ecosystems and society.

To the extent that the resource-based view theory emphasises distinct qualities of superiority, rareness, non-substitution and inimitability of resources as important catalysts for the sustained competitiveness of firms (Kazlauskaitė et al., 2015, Rambe, Ndofirepi & Mpiti, 2021), the theory was instrumental in accounting for the range of resources that TBIs avail to startups to overcome entrepreneurial failure and sustain their long-term growth. Since organisations comprise specific resources and the ability of an organisation's management to combine these resources enables it to exploit market opportunities (Penrose, 1959), the commitment of incubatees to stay within one TBI was a function of incubators' capacity to deliver on their mandate of providing specialised resources. However, an exceptional scenario comprised one incubatee who reluctantly stayed within an incubator until she was spun out despite the poor resource infrastructure of the TBI because she had no choice. This was due to information asymmetry on sophisticated incubators supplying superior resources integral to incubation success. Therefore, to explain conditions under which resources may not be the key differentiator in explaining the continued stay of incubatees in TBIs but rather institutional logic of mere proximity to an existing incubator, the strategic alignment of the resource-based view theory with institutional theory, was deemed necessary. Therefore, by embracing strategic alignment, the resource-based view was reconfigured by drawing on Institutional theory to account for such exceptional circumstances.

9.10.1.3. Entrepreneurial ecosystem theory

The entrepreneurial ecosystem theory views of an entrepreneurial ecosystem as comprising interdependent actors regulated in ways that enable the pursuit of entrepreneurial action (Stam, 2014). Although the theory presents entrepreneurs as leaders of the ecosystem, it acknowledges the role of universities, researchers, government, distributors and other service providers in enabling innovation and entrepreneurship based on relations of mutual cooperation and interdependence. At the heart of an entrepreneurial ecosystem is the significance of entrepreneurship champions and innovation role models that drive an innovation culture (Bosma, Hessels, Schutjens, Van Praag, & Verheul, 2014). The combination of leader networks, investors and knowledge systems triggers cumulative actions that support the development of positive role models and maintain the dynamism of the ecosystem necessary for generating entrepreneurship behaviours (Ratten & Thompson, 2020). Since competent and strong institutions, policies and human resources in their right size and forms are at the heart of agile entrepreneurial ecosystem (Erina, Shatrevich, & Gaile-Sarkane, 2017), such institutions and policies are integral to the development of high growth-oriented technology firms that support technology innovations in the ecosystem. In short, the entrepreneurial ecosystem complements the market failure theory by acknowledging the diverse actors that support incubation, entrepreneurship and innovation activities in the ecosystem, something that the market theory only cursorily observes.

The study employed the concept of policy diversity and strategic alignment to explain the limitations of entrepreneurial ecosystems. For instance, in resource-constrained contexts where incubatees lacked the diverse resources to lead and drive the creation of entrepreneurial and innovation ecosystems, it is inconceivable for incubatees to take a lead in establishing, enacting and sustaining entrepreneurial ecosystems as national governments and incubators tended to direct regional policy development using top-down approaches. For instance, one such top-down approach was the duplication of the national system of innovation at regional level through the creation of “isles of innovation” and “township economies” at regional levels by regional innovation bodies (e.g., regional offices of the Department of Science and Innovation). This replication of the national system of innovation at regional levels worked for some regions (e.g., university incubation ecosystem A) with a more developed entrepreneurial ecosystem, more venture capital opportunities and more mature entrepreneurial activities to allow for resource redistribution to marginalised areas than others (e.g., university incubation ecosystem B). Therefore, policy diversity/plurality regarding the essential ingredients for establishing, maintaining and sustaining isles of innovation at regional level would be required as not all regions would need the same policy thrust due to differences in resource endowments, entrepreneurial ecosystem maturity and receptivity of regional cultures to innovation. Moreover, strategic alignment of stakeholder networks would be critical to mobilising institutional resources and connecting actors, resources, processes and systems in the same regional ecosystem. In short, policy diversity and strategic alignment of actors, resources, systems within the same ecosystem would be the glue that binds institutional theory to entrepreneurial ecosystem theory as formal and informal rules, norms and behavioural conduct of actors fail to explain for the different resources needs of different actors at different stages of their incubation entrepreneurial life cycles located in the same ecosystem. In short, policy diversity and strategic alignment of actors, processes and resources to the resource endowments and situated contexts of institutional actors would be needed to establish entrepreneurial and incubation ecosystems germane to the level of entrepreneurial maturity of stakeholders, resource affordances and capabilities of actors in that ecosystem. The next section discusses the contribution of the study to model development.

9.10.2. Contribution to model development

The next section addresses the last question: **How is the conceptual framework for advancing technology entrepreneurship based on the coalescence of factors that affect technology-based incubation constituted?** Figure 9.1 demonstrates the factors that coalesce with TBI to influence TE based on the empirical evidence from findings and the propositions derived from the findings. Since these variables were extensively discussed in relation to TBI and TE under the conclusion based on literature section, the current section will elaborate on these interactions focusing mainly on the propositions. However, a justification for this conceptual framework is needed before explaining its constitution. This framework is a direct response to the growing concern that despite previous attempts to develop various conceptual frameworks for grasping TBI (Mian et al., 2016; Lamine et al., 2018), multi-tier perspectives on business failure prevention and management strategies for business incubators that incorporate personal, institutional and environmental considerations are yet to be developed (Nair & Blomquist, 2019).

Embracing a multilevel slant exhorts us to adopt different perspectives that illuminate the distinguishing characteristics of entrepreneurial decisions (De Winnaar & Scholtz, 2019) as was the case with the multi-tier perspective adopted in this study. This model on TBI and TE research integrates, synergises and brings meaning to the 'potpourri' of fragmented research clustered around disparate person-centric, institution-centric and environment-centric variables predicting incubation and entrepreneurial outcomes based on psychological traits and behaviours (e.g., mental models, PEC), role of institutions and broader environmental (i.e., ecosystems) factors (Ahmad & Ingle, 2011; Estrin, Mickiewicz & Stephan, 2016; Chandra, 2018). This fragmentation of approaches precluded researchers from a holistic glimpse of incubation and incubation outcomes. For instance, at institutional level of incubation, the prevalence of siloed perspectives and a lack of cohesive collaborative approaches to provide a more holistic range of support through vertical integration and structured collaboration by incubators, accelerators, advisors, and investors has been criticised for generating poor incubation outcomes (Pan & Correnti, 2018). This is because successful incubation is a consequence of the quality of multi-level human relationships between client firms and incubators that facilitate co-production of products and services in dyads and triads without which co-production breaks down (Ahmad & Ingle, 2011). This growing body of literature critiquing partial narratives on factors affecting business incubation provides an impetus to develop a more integrated account of interrelations between individual, institutional and environmental determinants of successful business incubation to generate the synergy that guarantees the realisation of TE. Since cognitive structures are associated with cognitive alertness to opportunities and opportunity exploitation (Estrin et al., 2016), they can be merged with institutional resources such as the support regimes of incubators to maximise their outcomes.

The 2018 Global Entrepreneurship Index Report attributed the deep fragmentation and lack of convergence of the current body of entrepreneurial research to parallel studies covering individual, institutional and environmental determinants of entrepreneurship outcomes (Ács, Szerb, Lafuente & Lloyd, 2018). Ács et al. (2018) bemoan that while entrepreneurship literature has isolated and examined individual entrepreneur agency, institutions and environmental factors especially broader systems in disparate silos, the real entrepreneurship communities where entrepreneurs operate in (and where business incubation happens) do not have silos but rather comprise building blocks integrated to each other in single, unified structure. The current study, therefore, contributes to a deeper understanding of the business incubation experience of incubatees and incubation performance outcomes, especially TE by integrating the disparate individual, institutional and environmental levels factors affecting business incubation and incubation outcomes. More so, the study contributed to fulfilling Albort-Morant and Oghazi's (2016) exhortation for future studies to examine non-demographic variables that may affect the behaviour of entrepreneurs who create companies within incubators. The study also responds to Busenitz and Lau's (1996) clarion call for researchers to integrate cognition with the social context and personal variables (e.g., PEC) to provide a more comprehensive account of the complexity of the entrepreneurial environment that entrepreneurs operate in.

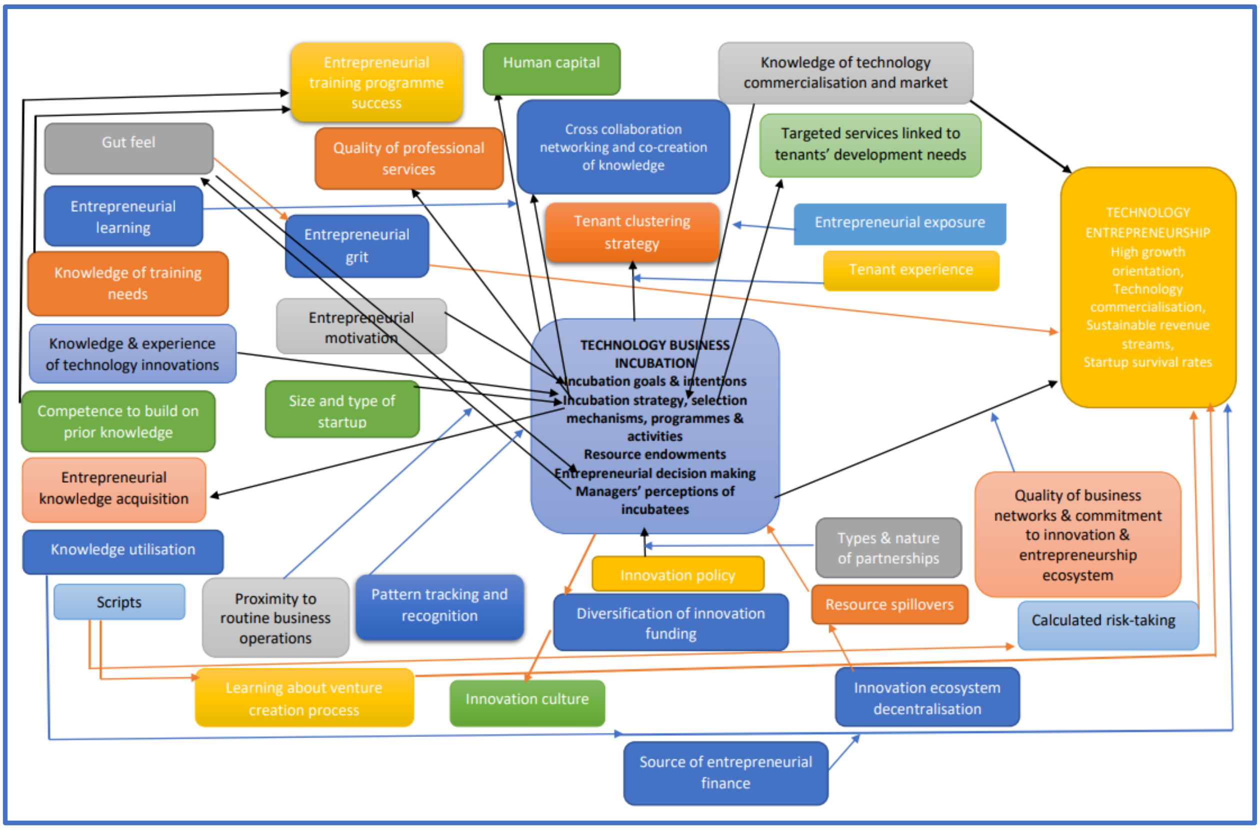

Figure 9.1: A revised model illustrating the factors that interact with TBI to influence TE

Figure 9.1 illustrates the relationships between individual, institutional and environmental factors and their interplay in shaping TBI and TE. These relationships are a summation of the propositions extensively discussed in the findings chapter. The nature of the relationships between these factors exclusively, these factors, TBI and TE can be surmised as **direct relationships**, **indirect relationships** (mechanisms through which two or more variables interact), and the **situational conditions** under which two or more variables interact (conditions that are critical to the interaction between two or more variables). All direct relationships are illustrated in the model using black arrows, indirect relationships using orange arrows and situational conditions under which two variables interact using blue arrows. To reduce complexity and relationship overload as well as to enhance the accessibility of the model, these relationships are explained in greater detail in subsequent sections.

9.10.2.1. Direct relationships among variables

At the individual level, one of the propositions was the direct influence of entrepreneurial motivation on the decision regarding the location of the startup (i.e., an individual factor-incubation goal/strategy relationship). The entrepreneur's decision to locate within an incubator, a shared space (e.g., laboratory or shared office), operate on a digital platform or incubate remotely from home was informed by personal entrepreneurial motivations. These entailed reducing operational overheads, accessing business networks (for those operating in TBI), the need for seamless transition from online to offline workspaces (i.e., for startups operating in a hybrid format), facilitating work-life balance under challenging Covid 19 pandemic times (for startups operating remotely from home), reducing the costs of establishing brick and mortar premises and leveraging the marketing and connectivity benefits of digital technologies (for digital platform-based startups). The reduction of overhead costs has been emphasised in mainstream literature. For instance, as the Kenyan government emphasises economic growth through technology-driven solutions in diverse sectors of the economy (Whitehead, 2012), technology startups in this country leverage on improved broadband infrastructure to benefit remotely from technology incubators and accelerator hubs (David-West et al., 2019).

Moreover, the size and nature of the startup determined the location of the startup (i.e., whether to operate in a TBI, online, hybrid or at home). Location also influenced the relationship between size and incubation strategy. For instance, some digital marketing businesses could be operated fully online or in a hybrid format (i.e., both digitally and offline), while some agricultural technology businesses combined field experiments, field visits and digital operations at home with office operations. Yet other startups such as those in additive manufacturing, surgical, bone implants and repair research required a combination of laboratory space, specialised equipment and office space for conducting their research. Although the nature of such work required them to capture and maximise opportunities created by low-cost and efficient technologies (Elahi et al., 2013), these startups could not operate from home due to the experimental and applied nature of their scientific research and entrepreneurial activities. This implies that a one-size-fits-all incubation model cannot apply to all technology startups given their varying nature and diverse business requirements.

Another direct relationship was between the selection strategy (including criteria) and the extent of knowledge acquisition for incubatees (i.e., TBI-knowledge acquisition relationship). The effective acquisition of entrepreneurial knowledge by incubatees depended on incubators' ability to develop credible and effective screening criteria that accommodate incubatees' current knowledge levels. Whether an incubator focuses on critical success factors that would contribute to incubatees' success post incubation (Ahmad, 2021) or "screening profiles" that emphasise financial, team or market indicators (Aerts et al., 2007) to select incubatees from a pool of clients, incubation tenant selection remains pivotal to the viability and performance of incubatees (Mian et al., 2016) as it informs the knowledge acquisition process of incubatees. However, incubation selection tends to judge entrepreneurial knowledge based on the soundness of the business idea and the appropriateness of the entrepreneur (Ahmad, 2021) but often ignores the variations in entrepreneurial knowledge of incubatees at their inception into TBI contexts.

At the individual-institutional interaction level, another direct relationship identified was between the incubator staff's knowledge of incubatees' training needs and these incubatees' ability to build on prior knowledge. This relationship determined the effectiveness of entrepreneurial training and development programmes of the incubator. As such, the incubator staff's assessment of incubatees' subjective and personal attributes critical to entrepreneurial success such as depth and breadth of entrepreneurial knowledge together with other qualities (e.g., conscientiousness, agreeableness and openness to experiences) (Ciavarealla et al, 2004) is critical to the effectiveness of incubation training programmes. In the same vein, incubatees' ability to leverage their past knowledge is important to their meaningful participation and effectiveness of such programmes. Exploitation of past knowledge is also critical to the sustenance of future relationship dynamics between incubatees and the TBI (Rice, 2002; Ahmad, 2014). Therefore, the success of incubation programmes is not just a function of what the incubator supplies to incubatees and the knowledge and experiences they bring to the incubation process but also the vitality of the relationships and interactions between these parties as well.

Based on the propositions and empirical findings, another direct relationship was that the incubatees' knowledge and experience of technology innovations impacted incubation strategies, practices, programmes and activities. For instance, the decision of an incubator to become a specialist TBI focusing on specific technology sectors including whether clients can survive in such specialised areas or become a generalist focusing on financial, personal and team aspects of its tenants (Vanderstraeten & Matthyssens, 2012; Ahmad, 2021) depends on the nature of the incubatees pipeline in terms of their knowledge and experience of technology innovations. One would expect greater orientation toward specialisation among incubators that receive a high number of incubatees with sophisticated knowledge of technology commercialisation and innovation than those that lack such type of entrepreneurs.

Within the incubator itself, the other direct relationship was that having a pre-incubation phase affects the incubation preparedness (e.g., entrepreneurial readiness) of incubatees and the selection strategy of incubators. This relationship was excluded from the revised model to reduce the clustering of relationships in the diagram. The argument is that as incubatees operate and navigate the pre-incubation phase and interact with experienced and qualified incubation staff, such staff is better positioned to identify entrepreneurs and startups that are incubation-ready and those that must stay longer in the pre-incubation phase. Having a pre-incubation phase also benefits the incubatee selection process as the TBI selects only those startup founders that have matured entrepreneurially for incubation. Therefore, while incubation support tends to contribute to closing the knowledge gaps on how to develop technology products during the incubation phase (Leca et al., 2014), the pre-incubation phase could avail the technical, managerial and entrepreneurial knowledge that increase the entrepreneurial preparedness of incubatees for the incubation phase.

At the institutional level, another proposition was that the TBI's development of clear selection criteria was instrumental in availing services tailored to incubatees' varying levels of knowledge and experience based on their prior exposure to entrepreneurship activities. Put differently, selection criteria exert an impact on the quality of professional and specialised services offered (especially knowledge of technology commercialisation and market knowledge). In view of the increasing complexity of business incubation projects coupled with the difficulty of dealing with multiple technological innovations, the need to develop stringent selection criteria has been recommended (Swartz & Hornych, 2008) to retain a limited number of services and projects of high quality in a specific field (Bakkali et al., 2021). Such strict selection criteria often undermine the need to accommodate incubatees with varying knowledge and experience in technology innovation and commercialisation when providing specialised and professional services.

Drawing on another proposition, the study also established that a selection criterion for incubatees founded on diversified specialisation positively impacted the cross-collaboration and co-creation of knowledge (i.e., business and social networking) compared to one premised on the narrow specialisation of incubatees. Incubation selection criteria that accommodate entrepreneurs from various specialisations were more productive for cross-collaboration and co-creation of knowledge than admitting entrepreneurs within the same line of business (relationship between incubation strategy, knowledge co-creation and cross collaboration). According to the Jack-of-all-Trades-Theory, individuals with a balanced set of knowledge and skills are most suitable for pursuing entrepreneurship (Alden, Hammarstedt & Neuman, 2017) and require knowledge, skills and experience in various specialties especially those with networking and marketing for their startups to succeed (Saiz- Alveraz, 2019). The wide range of actors that need to facilitate TBI to realise innovation and TE (Cohen, 2013) coupled with a diverse range of knowledge (e.g. business knowledge, entrepreneurial knowledge, market knowledge, product knowledge and sector-specific knowledge) (Ahmad, 2021) implies that selecting incubatees with diverse specialisations created greater chances of cross-fertilisation and hybridisation of innovative ideas and experiences by incubatees than would be the case with incubatees from narrow specialisations.

Lastly, another proposition based on the findings was that the provision of superior targeted services linked to incubatees' entrepreneurial development needs (e.g., the intellectual capital) and the startups' development stages was informed by the incubation selection strategy for startups (i.e., the incubators' incubation selection strategy influenced the targeted provision of services). While this is a direct relationship between two variables, when interpreted differently, this connection can also be interpreted as a triangular relationship between incubation strategy, professional service provision, incubatees' entrepreneurial development needs based the development lifecycle of their technology startups. This means that although the interaction between these variables is recursive, each of these variables is not mutually exclusive but is dependent on the other. For instance, while the application of this incubation strategy required the appropriate pitching of professional services content to suit entrepreneurial needs of the incubatees (e.g., need for venture funding, markets, to meet product development requirements or entrepreneurial processes), this could not unfold at the expense of the development stages of the technology startups that must benefit from the provision of such services. While specialising in the incubation of certain types of startups allows the narrow targeting of advice, training and resources (Colombo & Delmastro, 2002; Bøllingtoft & Ulhøi, 2005), such targeting must take cognisance of the entrepreneurial journeys of incubatees.

9.10.2.2. Indirect relationships between variables

Some factors interacted among themselves and with TBI and TE via other variables. These point to different mechanisms through which factors shaped the response variables (what is termed mediation in quantitative studies). For instance, one proposition based on the findings was a chain interaction in which heuristic biases (e.g., optimism bias and the illusion of control) had the potential to accelerate speed to the market (i.e., create situations where unviable and untested products are pushed to the market) leading to revenue losses (i.e., a failure to realise technology entrepreneurship). This scenario unfolded when entrepreneurs' use of heuristic biases convinced them to push their innovative ideas and products to the market despite their lack of knowledge of the market. Such decisions lead to the loss of revenue when products had no market or buyers. Due to complex decision-making in highly uncertain environments that strain information processing capabilities, entrepreneurs may employ heuristics and systematic biases that minimise effort (Gilbert et al., 1992). In spite of minimising effort, these heuristics and systematic biases contribute to greater susceptibility to cognitive errors (Ahmad, 2021), culminating in the loss of revenue. This is a relationship between heuristic biases and technology entrepreneurship (i.e., revenue loss) shaped by (i.e., mediated by) speed to market. This relationship has been excluded from the model to reduce congestion and further complexity of the model.

Another proposition derived from the findings was that arrangement and ability scripts promote high revenue generation by facilitating calculated risk-taking during product development. This allows the incubatees to invest in viable products. Put differently, scripts influence the generation of high revenue (i.e., technology entrepreneurship outcome) among technology ventures via calculated risks taken during product development. The execution of technology entrepreneurship that delivers greater revenue for firms requires risk-taking activities that create, communicate and deliver value to customers, entrepreneurs and the broader society (Whalen et al, 2016; Kerrigan, Luong & Shannon, 2020). Moreover, scripts facilitated the development of cost-saving business logistics. This was evident in understanding market logistics and dynamics, which enabled sustainable revenue streams for technology-based startups. Therefore, scripts also enhanced the realisation of sustainable revenue streams (that is a technology entrepreneurship outcome) through their facilitation of business logistics, particularly the grasping of market dynamics (e.g., product supply and demand, product pricing and nature of markets). This relationship was excluded from the model to reduce the dense clustering of relationships and to increase the accessibility of the model. Since all technology startups tend to undergo technology development, production, and sales and marketing stages (Pettersen et al., 2016), it is logical to expect such firms to use their arrangement scripts to grasp the dynamics of the market (i.e., develop the marketing and sales scripts) to increase their competitive edge and chances of boosting sales. This gels with the view that entrepreneurial experts frame their decisions using scripts such as "effectual logic" when identifying more potential markets for building and expanding their ventures including working with minimal resources to reduce the risk of big losses (Dew, Read, Sarasvathy & Wiltbank, 2009). Moreover, scripting enables a structured process of cogitation and learning about the technology venture creation process (e.g., identification of technology opportunities, access to technology markets) that makes revenue and profit generation, and developing technology innovations (i.e., technology entrepreneurship outcomes) possible. In other words, scripting interacts with technology entrepreneurship via entrepreneurial learning about venture creation. This view resonates with Dew et al.'s (2009) assertion that scripts enable learning about building the venture in its entirety, exploiting opportunities through doing more with limited resources and stitching together networks of partnerships to exploit identified markets for products and services.

At the institutional level, the study established that the mechanism through which the relationship between the TBI processes and the transition to a sophisticated innovation culture unfolded was the diversification of innovation funding sources. Put differently, incubation processes facilitate the generation of a strong regional innovation culture when incubatees have different choices of securing funding compared to relying on one funding source. Therefore, where funding options are limited, the implementation of the TBI process may not create a strong and mature innovation culture. The metaphor of life support is often used to explain a condition where incubation processes exclusively over-rely on government grants as bailouts leading to the inefficient deployment of public resources (Phan, Siegel & Wright, 2016) and difficulties in translating public resources to build more cohesive and mature innovation cultures due to resource deficiencies.

At the environmental level, the decentralisation of the innovation ecosystem (i.e., from the national system of innovation to regional levels) facilitates some resource (e.g., knowledge transfer, skills transfer and the sharing of financial resources) spillovers that indirectly benefit the incubation processes. This implies that resource spillovers are the main mechanism through which the decentralisation of the innovation ecosystem to the regional level affects the implementation of incubation processes. As literature rightly points out, the fostering of localised innovation ecosystems through linkages and collaborations between incubators, research centres and universities facilitate knowledge spillovers that improve incubation processes and the performance of incubated companies (Rothaermel & Thursby, 2005, Hichri, M'chirgui & Lamine, 2016).

9.10.2.3. Situational conditions under which two or more variables interact

The situational conditions under which two or more variables interact can be conceived as when and how two or more variables interact (what can either be moderation or intervening variable in quantitative studies). The third variable that lies perpendicular to a relationship between two variables is employed as an explanatory variable for the causal link between two variables (or influence of one variable on another). For instance, at the institutional level, the extent to which incubation mechanisms of TBIs enhanced the development of their human capital (e.g., entrepreneurial and technical knowledge) depended on the richness of entrepreneurial learning opportunities they avail to incubatees. In other words, the entrepreneurial learning opportunities that TBIs availed to incubatees explained the interaction between TBI mechanisms and the development of human capital. Building on insights from experience-based learning theories (e.g., Kolb, 1984), participation in the incubation process creates learning opportunities such as the recognition of entrepreneurial opportunities, planning of entrepreneurial activities and marshalling resources, which are integral to building entrepreneurs' human capital assets drawing from the incubator (Aaboen et al., 2021).

Another context-informed relationship was that the success of TBI processes in generating the expected incubation outcomes (i.e., TE) partly depended on the nature and quality of business networks (e.g., resources shared, frequency and intensity of interactions) and incubatees' commitment (e.g., time, resources and effort invested to the network) to the innovation and entrepreneurial ecosystem. Therefore, the nature of business networks together with incubatees' affinity to innovation and entrepreneurial ecosystem shaped how TBI interacted with TE. As Soentano and Klofsten (2021) observe, the quality, relevance and extent of business and social networks availed by the incubators, over and above the provision of physical space for availing resources (e.g., finance and infrastructure) in the incubation environment, are fundamental to incubatees' engagement in entrepreneurial action to realise entrepreneurial outcomes (e.g., technology entrepreneurship).

The study also established that the impact of innovation policy on TBI is a function of the type and nature of partnerships that are nurtured within the innovation and entrepreneurial ecosystem. This means the ability of innovation policy to facilitate the incubation strategies, processes and programmes depends on the type (e.g., incubatee-peer, incubatee-team, incubatee-incubator staff, incubatee-external partners) and nature (e.g., social partnerships, business partnerships, institutional partnerships) of partnerships /relationships created within the incubation environment. For instance, while incubator-initiated partnerships tend to be generic and professionally oriented, the innovation-driven, value-creating and value-enhancing partnerships tend to be those created by incubatees with their peers, teams and external partners. The evidence of the capacity of an innovation culture to facilitate TBI being dependent on business and social networks is inconsistent with the view that it is the improvision and co-production of creative entrepreneurial/intrapreneurial activities by individual entrepreneurs that generate an innovation culture for the organisation (Dennis & Macaulay, 2020).

Another situational relationship was that the perception of the startup founder regarding gainfully deploying their entrepreneurial knowledge to promote the sustained growth of the firm depended on the source of the entrepreneurial finance. In other words, incubatees' perceptions about the utilisation of their knowledge to support the growth of startups (i.e., a dimension of technology entrepreneurship) depended on how their business was financed (i.e., whether the funding was internally generated or externally sourced). The startup founder had a positive perception of the potential of utilising their knowledge to generate firm growth when startup funds were externally sourced (as there was no heavy financial burden incurred by the entrepreneur instantly) than when finance was internally generated (a situation where the entrepreneur bore the immediate cost of sourcing the money). Literature affirms the challenges of generating entrepreneurial finance internally (Atiase & Dzansi, 2019) even though sourcing external funding is no less feat (Madichie, Mpiti & Rambe, 2019).

Lastly, the exploitation of entrepreneurial knowledge in facilitating TE (e.g., promoting greater capitalisation, increasing profit margins and sustainable technology innovations) was influenced by the nature of the discipline from which the entrepreneur came. For instance, disciplines with a stronger technical and conceptual focus positioned incubatees better for the exploitation of their entrepreneurial knowledge to facilitate the realisation of TE than those with weaker technical and conceptual foci. It is important to mention that once the conceptual framework was developed, two experts (an expert in entrepreneurship in small businesses and another on university ecosystems) were consulted to validate it. The feedback of these experts was subsequently incorporated into the final framework.

9.10.3. Contribution to methodological approaches

At the research participant level, an integrated approach bridging the supply-side (technology business incubators perspectives) and demand-side approaches (technology business incubatees perspectives) provided a more inclusive, comprehensive perspective on the dynamics of the incubation process and incubation performance outcomes. This responds to literature's call for TBI success to transcend provision of diverse support to include the skilful integration of personalities, capabilities, and culture of service providers and clients and access to multiple gateways to the innovative scientific community (Walshok, 2013; Matejun, 2016). The integrated approach founded on data triangulation covering incubation funders, TBIs, technology business incubatees, technology innovation and entrepreneurial champions contributes to filling the academic gap arising from a preoccupation with incubators to the exclusion of incubator tenant experiences in previous research. Albort-Morant and Oghazi (2016) observe that the limited research on incubator tenants raise perplexing questions on the traits of entrepreneurs who develop their businesses with the help of business incubators. Therefore, the study contributes to broadening literature on incubators and tenants, which is scarce, lacks analytical cohesion, and thereby frustrating attempts at reviewing the literature on this issue (Albort-Morant & Oghazi, 2016).

At data collection level, the appropriation of literature, raw data, multiple theories, data collection instruments, and data analysis frameworks provides an effective research methodology ensuring the convergence of enquiry, evidence and corroboration of research fundings. Moreover, drawing on a pilot survey as a point of departure for the study and empirical evidence from two university TBI ecosystem provided a useful platform for the comparability of results while acknowledging their distinctiveness based on the situated conditions that obtain in each individual milieu.

9.10.4. Contribution to policy

The current study makes the following policy recommendations:

9.10.4.1. Developing resource mobilisation policy for incubatees aligned to their preferred funding mechanisms

The findings suggest that external funding availed to incubatees through the incubator structures (e.g., TTOs) has greater chances of being utilised for the purpose for which it was acquired by incubatees compared to funding availed to startups operating outside the incubation structures. It is, therefore, recommended that incubators must develop resource mobilisation policies (e.g., funding policies) that strongly emphasise the involvement of incubators in external funding applications to increase chances of funding success and encourage funding agencies to channel incubatee funding through the incubators. This would ensure that funding disbursed by incubation funders would be deployed for the purpose for which it was approved and the risk of misappropriation of funds would be curtailed. Moreover, since incubators often have key performance areas and milestones for monitoring progress of incubatees, the disbursement of funds would be based on incubatees' attainment of specific milestones.

However, since some TBIs withheld external funding until incubatees' established proper business structures to ensure greater financial accountability, incubatees complained about missing business opportunities because of these inflexible internal financial controls. The recommendation is a stopgap measure where incubatees must employ bootstrapping and bricolage strategies for raising funding in lieu of the development of proper business structures (e.g., accounting departments) for their startups. This would ensure that incubatees do not miss on exploiting entrepreneurial opportunities just because their business structures are yet to be fully formalised.

9.10.4.2. Comprehensive policy models on funding alternatives

The trade-offs which participants conceived between grants and loans had implications for funding policies. For instance, while grants are interest free, non-repayable and have flexible business performance conditionalities, they create a dependence syndrome where incubatees would anticipate persistent financial assistance from public funding institutions. On the contrary, while high interests charged on loans depending on the repayment period were considered undesirable for incubatees' growth trajectory, in situations where such loans imposed inflexible incubation performance conditionalities, they naturally compelled the incubatees to exercise financial discipline in fulfilling all important entrepreneurial decisions. In view of these benefits and challenges presented by different funding instruments, incubators and public and private funding agencies must develop comprehensive policies explaining different funding models, mechanisms, and instruments and their trade-offs. This would enable incubatees to draw on different combinations and sequences of funding instruments appropriate for their firms' development life cycle and growth trajectories.

9.10.4.3. Decentralisation of national funding instruments

Despite the prevalence of national institutions, funding structures and instruments to support SMME development, the funding structures and instruments were neither visible nor accessible to incubatees and incubators at regional and local levels to support TBI and TE. There was consensus among incubators, innovation champions and incubatees that to the extent that funding models and instruments supporting TE were concentrated at the national level, the decentralisation of these structures and instruments to the regional level would increase their accessibility to incubation stakeholders in support of TBI and TE.

Since some private and public funders of TBI did not have common knowledge of incubatees that had been funded by either party, the development of a publicly accessible common database on funded incubatees, the projects funded, their estimated value and the years of funding would prevent duplication and asymmetry of funding across sectors by incubatees. This would also enable greater transparency, fairness and equitable access for applicants in need of funding, reduce the crowding out of funding opportunities and promote greater accountability of public and private funders for the funding they availed to incubatees.

9.10.4.4. A context-embedded approach to actuating innovation policy to stimulate local economic development

The public sponsor of the innovation ecosystem that supported the university TBI processes at university A presented the replication of national system of innovation at the regional and local levels as a coherent and effective strategy for supporting regional innovation ecosystem. However, evidence from incubatees, incubators, innovation and entrepreneurship champions exposed vast differences in economic development, financial support from venture capitalists and level of concentration of innovation between the two regional innovation ecosystems where university A and B were located. This means that innovation strategies that may work for regional innovation ecosystem A might not work for regional innovation ecosystem B. Since a one-size-fits-all-approach to employing innovation policy and strategies to drive and synergise local economic development (e.g., through incubation, business development) may not work in the two geographical areas due to the wide variations in contextual circumstances, a context-informed, resource dependent, contingent approach to modelling and implementing regional innovation ecosystem would be necessary for each region if the effectiveness of the innovation ecosystem for regional development, TBI and TE were to improve.

9.10.4.5. Pro-growth vs pro-poor policy strategies

The findings from this study demonstrate two clear policy strategies pursued by universities to support their incubation strategies, models and activities. For example, TBI A pursued a pro-growth strategy where incubation emphasised the development of different incubation portfolios for incubatees at different phases of their entrepreneurial journeys to support their financial growth, sustainable revenue generation and commercialisation of their innovations. TBI B pursued a pro-poor policy strategy where all incubatees, regardless of their financial base, knowledge, experience and skills were admitted to the incubator provided they had a viable idea with potential for commercialisation. While incubatees in incubator A tended to have the support of venture capitalists and angel investors which reduced their dependence on government incentives and conformity to BBBEE policies, incubatees in incubator B tended to be supported financially by the incubator despite some performing below expected standards due to the "no incubatee left behind" (inclusive) stance of the incubation policy. Given the sub-standard performance of most incubatees in incubator B despite strong pro-poor orientation, it is critical to emphasise capacity building (especially capabilities, competencies and skills enhancement) initiatives among entrepreneurs and align them to incubation performance stipulations.

It should be emphasised that the pursuit of ideological considerations must not override the grasping of good incubation principles. While the need for incorporating entrepreneurs from previously disadvantaged groups into the mainstream economy cannot be ignored given South Africa's tumultuous history of underprivilege for the black majority, the remedying of historical disadvantage cannot be the sole consideration of incubation performance. Such a remedy founded solely on such an ideology might contribute to the reproduction of racial binaries (or reverse racism) where high-quality innovation ideas and projects from non-designated groups (e.g., historically advantaged groups) are not supported by government or funded by incubation structures exclusively on the grounds of race. Therefore, TBI's incubation strategies (whether growth-oriented strategy or pro-poor strategy involving financially supporting projects of incubatees from historically disadvantaged groups irrespective of their economic performance) must not override the pursuit of good business principles (e.g., feasibility, viability, and sustainability of business) which are the cornerstones of all business incubation practices and processes. In short, a performance scorecard in which incubatees are evaluated for funding and support must rank and score ideological (e.g., racially based economic redress) and business principles considerations to ensure the latter are not sacrificed to realise the former.

9.10.4.6. Increase national entrepreneurial policy accessibility at the bottom of the pyramid

Despite the multiple national policies, strategies and incentives for supporting entrepreneurship among SMMEs, many incubator managers and incubatees in university contexts were unaware of these policies and incentives. As such, both managers and incubatees could not effectively tap into these policies, strategies and incentives. Therefore, regional structures that support TBI and TE such as SEDA and NYDA are exhorted to run public awareness campaigns, entrepreneurship policy roadshows and knowledge exchange programmes to increase the visibility, availability and relevance of their interventions to incubation stakeholders.

9.10.4.7. Ecological policy framework ranking priorities of incubation factors in terms of importance, relevance and socio-economic impact

There was a concern that although incubation was a popular practice supported by government financially, there was little evidence of TBI performance and TE, raising questions as to whether incubation was not too popularised in the South African context. In view of the variations in regional contexts, resource endowments and incubation antecedents across regions, an ecological policy framework that ranks drivers and factors affecting incubation, resources and situated conditions of the incubation ecosystem in terms of importance, relevance and socio-economic impact of these factors, drivers, resources and situated conditions needs to be established. The development of such policy heuristics would help incubation stakeholders in determining priorities when developing incubation and innovation ecosystem in their situated environments. This would ensure policy instruments respond sufficiently to conditions that prevail in specific regions as well as promote broader socio-economic impact of such policy for the diverse incubation stakeholders.

9.10.4.8. Resource endowments and maturity of entrepreneurial and innovation ecosystems must be at the core of innovation ecosystem decentralisation strategies.

Attempts at decentralising the national system of innovation by establishing innovation support structures and networks at regional and local levels must acknowledge the differences in resource endowments (e.g., the availability of venture capital markets and human capital infrastructure) and the extent of maturity of entrepreneurial and innovation ecosystems (e.g., receptivity of innovation policies in society and level of economic development of surrounding communities). This means that when TBIs collaborate with ecosystem partners (e.g., universities, government, venture capitalists, non-governmental institutions and entrepreneurs) in decentralising national systems of innovation, the resource endowments and the maturity of the entrepreneurship and innovation ecosystems must be key considerations. Other key considerations under research endowments can be the number of research-intensive universities within the ecosystem, the volume and intensity of world class research from these institutions and the number of high-profile researchers at these institutions (e.g., those with National Research Foundation A rating, Nobel Price Laureates) participating in innovation policy development. Further considerations could be the number of venture capitalists in the region, the amounts of venture capital typically raised on average per an individual entrepreneur, the level of social inequality in the region and general level of economic development of the region under consideration for the decentralisation of the innovation ecosystem. This will ensure that different models of innovation and entrepreneurial ecosystem decentralisation are developed for different regions consistent with their situated conditions to ensure that systemic gaps in the innovation ecosystem such as unemployment, poverty, social inequality and historical disadvantage are not reproduced and exacerbated through context insensitive innovation ecosystem decentralisation strategies.

9.10.5 Implications for practice

The study has some implications for practice and these are summarised in the subsequent sections.

9.10.5.1. Embrace diverse understandings and philosophies on the relevance of gut feelings

Although there was a shared understanding on the limited relevance of gut feeling to the venture creation process (including the entrepreneurial process) among senior executive managers of TBI A and B, middle managers felt that guts feeling were critical to venture development. Moreover, while senior executive managers were convinced of the capacity of empirical evidence-based decision making, business principles and processes to shape incubation and venture creation, some middle managers conceived scientific data-driven decision making to be just as important as the gut feeling of their incubatees. This polarity of views between senior executive and middle managers of TBIs necessitates incubators to evaluate the merits of the diverse understandings and philosophies on the relevance of gut feelings in the venture creation and entrepreneurial process to ensure that they nurture entrepreneurial cognition approaches that work for their incubatees. Therefore, different incubation platforms, strategies and conditions under which specific gut feeling could work and the stage of the venture creation process for which and for whom they work must be appreciated. To develop a shared understanding, TBI management may need to provide exemplars, case studies and scenarios of successful use of gut feelings to model the cognitive behaviours incubatees for their effective use in incubation and venture creation.

9.10.5.2. Identification of scenarios where scripts are most valuable and could be optimised

The general sentiment was that there were different scenarios where the use of scripts was deemed to be germane. On the one hand, TBI financiers recognised risk calculation and mitigation during opportunity identification, validation and resource mobilisation as entrepreneurial tasks where scripts were most ideal. On the other hand, incubator managers recognised business incubation models, design thinking courses, business process methodology (e.g., lean business process)," "business clinic processes" as representing different scripts that incubators employed for training incubatees in venture creation and entrepreneurial decision making. Incubatees also deployed scripts for taking risks, securing resources and making unconventional decisions. Drawing on these different applications of scripts in entrepreneurial decision making, it is recommended that TBIs must identify different scenarios where scripts are being ideally employed by different actors (especially incubatees, incubator management) to develop an inventory of scripts that are relevant to particular venture creation and entrepreneurial decision making.

9.10.5.3. Remedy the inappropriate use of heuristics for resource mobilisation and exploitation

Given that some incubatees employed heuristics to manipulate procurement processes (e.g., the use of unsanctioned databases to access government tenders), which contributed to their loss of funding opportunities when government declined to fund them, such inappropriate use of shortcuts served as a liability to effective resource mobilisation. Therefore, incubatees need training in how they can deploy heuristics in more appropriate, relevant and consistent ways during resource mobilisation and exploitation and other entrepreneurial scenarios where the use of heuristics would be ideal.

9.10.5.4. Digital storytelling of exemplars of entrepreneurial grit

Since entrepreneurial grit was conceived to shape the interaction between gut feel and the survival of rate of startups, TBIs are strongly encouraged to elicit, document and curate success stories of entrepreneurial resilience from their current cohorts of incubatees. These success stories of resilience and how such resilience shapes the translation of gutfeel into sustainable business startups can be uploaded on the TBI's digital repository (such as digital storytelling platforms) or captured as YouTube videos to preserve institutional memory for future cohorts of entrepreneurs. Subsequently, these cohorts can learn about how tough business situations are navigated at the individual entrepreneur level and or are socially negotiated by entrepreneurial teams to achieve startup success. Altmetrics (alternative metrics based on evidence from the social web) (Piwowar, 2013) such as YouTube video views and downloads, Twitter mentions, Facebook posts and sharing of such stories (Adie & Roe, 2013) can be useful for enticing other entrepreneurs to use such stories of resilience to make sense of their entrepreneurial hurdles and journeys. Alternatively, incubation graduates that have successfully built their startups through resilience can serve as entrepreneurial role models who could invited to share their entrepreneurial journeys to incumbent cohorts to allow them to learn to navigate similar challenges or adapt to new complex challenges. This experiential approach to coaching and mentorship resembles Mindvalley's Premium Coaching Programme for Accelerated Transformation, where exemplars of deep learning and mental transformation could be imparted by serial entrepreneurs who have also undergone such deep learning through intense coaching and sharing of prior learning experiences.

9.10.5.5. Rigorous incubatee screening, proper identification of their entrepreneurial stages and development of skills inventories

Regarding entrepreneurship knowledge and expertise, there was general agreement among incubation sponsors, incubators and incubatees on the limited to average knowledge and expertise of incubatees in the entrepreneurial process. Only a few spinouts affiliated to the incubator community possessed more sophisticated knowledge and expertise in venture creation and the entrepreneurial processes. In view of the variations in knowledge and expertise levels among incubatees that entered the incubation process, it is recommended that TBIs must rigorously screen incubatees using a credible personal profile, knowledge and experience criterion to identify the stages in the entrepreneurial life cycle of each entrepreneur. This will customise their training and development needs to fit the needs of entrepreneurs relative to their respective entrepreneurial stages. The initial assessment of the training needs must ensure that the choice of training and development content, content pitching strategies and delivery strategies during training address the incubation needs, intentions and aspirations of incubatees.

The screening and identification of entrepreneurial stages of incubatees must be followed by the development of an inventory of training needs and prior knowledge of incubatees as the foundation for entrepreneurship training and development. Moreover, incubation staff must desist from providing generic training programmes to incubatees with different levels of knowledge but rather group incubatees with comparable knowledge and experience into the same cluster and avail them with content appropriate to their knowledge level and stages in the entrepreneurial life cycle. However, those entrepreneurs with advanced and sophisticated knowledge of entrepreneurship seeking business scaling opportunities might skip the incubation stage and be put on acceleration programmes that align better with their business expansion intentions. To the extent that entrepreneurs often build on their prior knowledge, the establishment of a pre-incubation training phase covering a clear duration (e.g., 6 months to a year) could accommodate incubatees with limited (or no) knowledge of entrepreneurship while those with a fairly developed knowledge of business development could be incubated.

The senior executive management of TBI must also conduct a skills inventory for their staff to establish the depth and breadth of their skills, knowledge, capabilities and competences to ensure that professional and specialised services availed to incubatees are aligned to the staff's skills, capabilities and competences. This will establish the existing skills gaps and deficiencies in the incumbent TBI staff while ensuring that skills and capabilities that are not available internally can be sourced through consultants and external experts in the short term. Research highlights that individuals (e.g., incubation staff) with diverse academic and occupational training and skills are more likely to support the entrepreneurial process by creating for-profit and non-profit ventures than narrowly educated and trained individuals (Cho & Orazem, 2014). Therefore, external consultants can only provide human capacity building (e.g., human resource training, development, coaching and mentoring) on the competencies, capabilities and skills not available in the organisation to sufficiently equip incubation management for new roles beyond their traditional areas of expertise.

9.10.5.6. Emphasise the selection of entrepreneurs from different specialisations, their incubation motivations and types of business

Given the complexity of the business environment including the benefits of cross-collaboration and co-creation of knowledge, TBIs are encouraged to consider the specialisation of incubatees including their industry and sectoral backgrounds in their selection criteria, in addition to the technical soundness and viability of incubatees' business ideas. This will ensure the clustering of incubatees from different areas of specialisation, industries and sectors to promote the cross-fertilisation of ideas, expertise and experiences during social and business networking sessions. According to the Jack-of-All-Trades Theory, only generalists are more qualified to become entrepreneurs as they are more ready to assemble production factors and possess knowledge, skills and working abilities in diverse specialties than narrowly specialised individuals (Saiz-Alveraz, 2019).

Since incubatees' entrepreneurial motivations determined the location of their startups, TBIs are encouraged to investigate the entrepreneurial motivations of their incubatees pre-admission to establish whether it would be ideal to admit them into TBIs, permit their startups to operate independently or just affiliate to the larger incubation community. Since the entrepreneurial motivations for incubation can vary widely, TBIs can offer different incubation options to incubatees with different needs. For instance, the incubatees that need physical space can be considered for incubation, while those that seek to contribute can just be affiliated to the business incubation community. Those that need to balance work with family commitments may be allowed to operate from home or in hybrid forms should their business operations permit such arrangements.

Given that the nature and size of the business operations determine whether a business can operate in an incubator, in the central business district, online or from home, incubator staff must fully understand the nature and size of operations of each startup before allocating space to incubatees to guarantee a suitable location for each startup. For instance, technology startups involved in large scientific experimental work (e.g., on genomics, additive manufacturing of bone implants and surgical materials) would require laboratory space for their operations while some digital marketing businesses can be operated fully online (i.e., without the need for physical space) or in hybrid formats.

9.10.5.7. Support knowledge needs of pre-incubation, incubation and acceleration stages of startups differently

Given that entrepreneurs have different knowledge needs and effective acquisition of entrepreneurial knowledge by incubatees depends on incubators' ability to develop credible and effective screening criteria that accommodate incubatees' current level of knowledge, the coaching, mentoring and training models applied at pre-incubation, incubation and post-incubation stages must accommodate incubatees' different knowledge needs. For instance, for product development startups, while the pre-incubation phase may involve imparting technical and technological knowledge on product development, product market assessment and product launches, the incubation stage can emphasise the knowledge of actual business development (e.g., setting up different business divisions, funding strategies and recruitment of right personnel). The acceleration stage can then cover knowledge on business growth strategies, new venture funding strategies (e.g., angel investment, venture capital funding and crowdfunding), establishing new markets and the internationalisation of startups. In short, TBIs cannot adopt a one-size-fits-all approach to knowledge acquisition for incubatees at different entrepreneurial stages, rather the nature and types of knowledge must be tailored to the entrepreneurial lifecycle stages of the incubatees. This means different scaffolding strategies may be required for nascent, established and serial entrepreneurs.

9.10.5.8. Simulations of real-world scenarios requiring pattern tracking and recognition

It has been established that entrepreneurial decision-making involves practical problem solving and the application of gut feeling for entrepreneurial decision-making is effective when incubatees can recognise and track patterns and connections in activities unfolding in their entrepreneurial environment. Therefore, TBIs are exhorted to develop simulations of real entrepreneurial problems that necessitate incubatees to develop practical solutions to real-world problems. The entrepreneurial problems could range from requiring incubatees to implement strategic business plans, develop resource mobilisation strategies relevant the nature of their business, secure customers for their startups and develop comprehensive marketing plans for new products and product launches. Drawing on experiences of practical problem solving, incubatees can identify and track patterns between a specific startup activity and other activities unfolding in the entrepreneurial environment to improve their entrepreneurial decision-making abilities.

9.11. IMPLICATIONS FOR FUTURE RESEARCH

Given that this study examined the multi-level factors that affect TBI and TE in university contexts, future studies can investigate if the findings that obtain for university-based TBI are comparable with those of government funded incubators (e.g., especially those sponsored by SEDA). This is critical to establishing possible areas of complementarity and convergence of incubation contexts to enable resource sharing and knowledge spillovers across the different incubators, as well as enhance the incubation performance of incubatees and incubators. Therefore, future studies should compare university-based TBI with government sanctioned incubators to establish if the impact of these factors is comparative across the different types of incubators.

Future research could also concentrate on the governance model, financing strategies, revenue generation models and financial growth trajectory of university-based TBIs. Since resource constraints in university-based TBIs is a perennial constraint to the financial growth and autonomy of these incubators, exploring these strategies and models would be pivotal to the growth, sustainability of new ventures including the financial autonomy of university-based TBIs.

Since this current study focused on the business incubation phase as it relates to TE, future studies may consider the pre-incubation and post incubation phases to complete the incubation life cycle. For instance, the fact that some startups still fail post incubation for various reasons necessitates the entire incubation life cycle to be considered to determine the type, nature and quantity of resources, capabilities and competences required in the entire incubation life cycle value chain.

9.12. LIMITATIONS OF THE STUDY

Although all efforts were made to ensure sufficient rigour and coherent argumentation, this study is not without its limitations. For instance, while some detailed qualitative explanations were availed regarding the espoused relationships as described by different participants' narratives for the corroboration of the evidence, relying on qualitative data and evidence from literature deprived the research of some insights into the strengths of relationships between factors as espoused by respondents. Although a quantitative study (e.g., a survey) was inconceivable due to the small numbers of incubatees incubated by the two-university-based TBIs, a survey would have provided a more coherent logical flow of the relationships in a monological framework. However, the study employed CAQDAS to develop a detailed quantitative profile on how different TBI stakeholders responded to the different questions posed in the study.

Although the use of a phenomenological case-based approach was useful for rendering an in-depth examination of each case in its situated context, the subtleties of the phenomenon under investigation and how the relationships between variables unfolded, a longitudinal design would have provided more illuminating evidence on how the dynamic, fluid and complex relationships between various factors unfolded in their unique contexts over an extended period. While due care was devoted to analysing each concept in relation to other concepts, including their sequencing, a longitudinal perspective could have provided a long-range perspective on these matters. This would allow one to establish whether the relationships were merely parsimonious and accidental or were durable and self-sustaining, including ascertaining the corresponding interventions required at the strategic, managerial and operational levels.

Despite the sufficiency of two case studies of university-based TBIs and the diversity of their stakeholders, a consideration of all incubators in South Africa could have provided a more panoramic and holistic picture of incubation processes, dynamics and outcomes at the national level. However, adopting such an approach required abundance of resources (i.e., money, time and human resources) to execute the national study successfully, which the researcher did not have. While a national perspective could have provided an overarching picture of the nature, complexion of the interactions and provided signals on the national, regional and local institutions whose behaviours, processes, practices and activities needed leveraging, refining and strategic alignment to attain the intended incubation performance imperatives, such a study would have lacked rigour and depth due to the diversity of issues covered at national level.

9.13. CONCLUDING REMARKS

This study explored the individual, institutional and environmental factors driving TBI and how they coalesced to influence TE. The study, which built on a multi-theoretical, multi-stakeholder and multi-level of analysis, examined factors affecting university-based TBI, environments that draw on university community's capabilities, competences and resources to define, direct and refine incubation processes. The study contended that, although the TBI serves as a hub for processing the strategies, business models and resource generation strategies of incubator staff and incubatees, this structure also presented a black box where certain processes, behaviours, practices and activities needed to be demystified, disentangled, disaggregated and deconstructed to makes sense of how they interacted and synergised to shape TE. Appreciating the complexity and multi-layered nature of TE, the study adopted an evidence-based approach where TE dimensions were restricted to the high growth orientation, commercialisation of technology innovations and generation of sustained revenue for startups. While this does not represent an exhaustive operationalisation of TE, it represents a relevant way of understanding TE and its antecedents in resource constrained contexts.

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APPENDIX 1A

CONSENT TO PARTICIPATE IN THIS STUDY

I, _____________________________________ (participant name), confirm that the principal investigator has informed me about the objectives, process, potential benefits, and limitations of participating in this study.

I have read (or have been informed) and understood the study as explained to me in the information sheet. I was given sufficient time to ask questions and participate in the study voluntarily. I understand that I have full right to withdraw at any time without sanctions. I have been informed that the results of this study shall be processed anonymously in the development of the research report and journal articles.

I agree to the recording of the [*insert specific data collection method*].

I have received a signed copy of the informed consent agreement.

Full Name of Participant: ____

Signature of Participant: ____________________________________ Date: ____________________

Full Name(s) of PI(s): _Patient Rambe ____

APPENDIX 2A: SAMPLE OF RESEARCH INSTRUMENTS

IN-DEPTH INTERVIEW GUIDE FOR NEW TECHNOLOGY BASED INCUBATEE (SHORTER VERSION)

Dear Participant

My name is Patient Rambe, a PhD candidate in the Department of Business Management at the University of the Free State, South Africa. My study strives to understand factors that affect technology entrepreneurship of university-incubated star-ups and spinoffs. I am soliciting your participation in this study.

Please be advised that your participation in this study is voluntary and that you are free to withdraw any time without any consequences. Nevertheless, your participation will be critical to developing a deep understanding of the individual, organisational and systemic factors that shape technology entrepreneurship, thereby contributing to growth and sustainability of new startups in South Africa.

Please be advised that your responses shall be anonymous and therefore, your personal information such as your name, cell phone number, ID number, or any contact details, are not required. Please be informed that information extracted from this study shall be confidential and therefore, will not be disclosed to third parties. Where identifying information such as age gender, occupational status has been extracted from participants, this information shall be aggregated and applied exclusively for academic purposes.

Should you have any queries concerning this study, please feel free to contact my study promoter: Professor Neneh Brownhilder: NenehBN@ufs.ac.za. Phone number 051 401 2156

The interview guide could take approximately 60 minutes

1. PARTICIPANT DEMOGRAPHICS

Entrepreneurs' age						
Entrepreneurs' gender	Female					
Entrepreneurs' race	Black African					
Level of education	Below Matric	Matric	Certificate	Diploma X	Degree	Postgraduate Qualification
Years of entrepreneur experience						
Years of industry experience						
Firm type	IT	Electronics	Engineering		Other [specify]	
Form of organisation	Sole trader	Trustee	Company		Cooperation	
Age of business	Less than a year	1-5 years	6-10 years		Over 10 years	
Firm sector	IT	Engineering & construction	Tourism		Other specify Construction	

Previous occupation

2. BACKGROUND INFORMATION

Please reflect on your professional interactions with your incubator (if any).

a. Why did you choose to interact with your incubator?
b. What kind of interactions unfold between yourself and your incubator?
c. During the technology business incubation (TBI) process with which you have been supported, what type of representatives interact (e.g., founders, educators, researchers, TTO managers)?
d. How are interactions between yourself and your incubator established (e.g., through incubator, TTOs, networking events)?
e. How do these interactions contribute to startup activities (e.g., idea generation, business concept development, founding a physical organization, developing, production technology etc.)?
f. What criteria did your incubator use to admit your business into their incubation programme?
g. In your view, how effective was this criterion in realising your incubation goals?
h. On average, how long did you stay in your incubator?

Research Question 3: Which dimensions of individual (i.e., EC, PEC) factors are fundamental to the incubation of technology businesses and technology entrepreneurship?

ENTREPRENEURIAL COGNITION DIMENSIONS

SECTION A: INTUITIVE THINKING

1. Some owners of new technology-ventures often rely on "instincts," or "gut feelings" (guesses) to explore, evaluate and make business incubation decisions.

To what extent do you use "gut feelings" when engaging in (i.e., exploring, evaluating and making) business incubation decisions? Please elaborate.

Intuitive thinking-TBI relationship

2. From your experience, how have your "instincts" or "gut feelings" shaped your engagement in business incubation processes?

3. How have your "instincts" or gut feelings" affected your business incubation outcomes?

SECTION B: HEURISTICS

4. Entrepreneurs are often confronted with information overload, new situations and uncertainty. To deal with these situations, they may use "simplifying strategies to making judgement decisions" or "shortcuts" (*heuristics*).

To what extent do you use "shortcuts" when engaging in business incubation decisions? Please elaborate.

Heuristics- TBI relationship

5. Please elaborate on how you use short cuts to engage in your business incubation decisions.

Heuristics- and technology entrepreneurship

6. Please describe how your use of shortcuts have shaped your business incubation outcomes.

SCRIPTS

7. Some entrepreneurs claim that through experience in business, they develop some mental techniques for determining the likely order (i.e., sequence) of business events (i.e., scripts).

How have you used scripts in any of business incubation decisions?

Scripts-TBI relationship

Arrangement scripts

7a. In your view, how have you used "scripts" to secure critical resources you need for incubating your business?

Willingness scripts

7b. From your experience, how do you use "scripts" when taking risks and implementing incubation decisions?

Ability scripts

7c. In your own view, how do you use "scripts" to demonstrate your venture creation capabilities?

Scripts and technology entrepreneurship

7d. In what ways have your use of scripts affected your business incubation outcomes?

PERCEIVED ENTREPRENEURIAL CAPABILITIES

8a. What **entrepreneurial knowledge** did you have when you made the decision to have your business incubated?

8b. What **entrepreneurial experience** did you have when you made the decision to have your business incubated?

8c. What **entrepreneurial skill** did you have when you made the decision to have your business incubated?

PEC-TBI relationship

8d. To what extent do you have the requisite **entrepreneurial knowledge** to engage in technology business incubation? Please elaborate.

8e. To what extent do you have the requisite **entrepreneurial skills** to engage in technology business incubation? Please elaborate.

8f. To what extent do have the requisite **entrepreneurial experience** to engage in technology business incubation? Please elaborate.

PEC -Technology entrepreneurship relationship

8g. How has your perception of your **entrepreneurial knowledge** affected business incubation outcomes?

8h. How has your perception of your **entrepreneurial skills** affected business incubation outcomes?

8i. How has your perception of your **entrepreneurial experience** affected business incubation outcomes?

Research Question 4: What is the role of institutional (i.e., incubation support and resources rendered by incubators) factors in the successful incubation of technology businesses and technology entrepreneurship?

INCUBATION SUPPORT AND INCENTIVE REGIME

Physical capital
9a. What range of physical resources are availed by your business incubator?

Physical capital- TBI relationship
9b. How has the incubators' provision of physical resources affected **your knowledge** of incubation processes?

9c. How has the incubators' provision of **physical resources** affected **your participation** in incubation processes?

Social capital
9d. What range of **networking resources** (i.e., internal networks, external networks, agglomeration with stakeholders-customers, suppliers, investors) are availed by your business incubator?

Social capital-TBI relationship
9e. How has the incubators' provision of networking resources affected **your knowledge** of incubation processes?

9f. How has the incubators' provision of networking resources affected your **participation** in incubation processes?

Intellectual capital
9g. What range of **intellectual resources** (i.e., training and development services, business advisory services, mentoring, field collaborations) are availed by your business incubator?

Intellectual capital-TBI relationship
9h. How has the incubators' provision of **intellectual resources** affected your **knowledge** of incubation processes?

9i. How has the incubators' provision of **intellectual resources** affected your **participation** in incubation processes?

Physical capital- technology entrepreneurship relationship
9j. How has the incubator's provision of **physical resources** affected your firm's realisation of innovative and enterprising **technology incubation outcomes**?

Social capital- technology entrepreneurship relationship
9k. How has the incubators' provision of **networking resources** affected your firm's realisation of innovative and enterprising **technology incubation outcomes**?

Intellectual capital- technology entrepreneurship relationship

9l. How has the incubators' provision of **intellectual resources** affected your firm's realisation of innovative and enterprising **technology incubation outcomes**?

INCUBATION ECOSYSTEM DYNAMISM

Research Question 5: Which aspects of the environment (i.e., entrepreneurship ecosystem) have facilitated (or undermined) the successful incubation of your technology business?

Incubation ecosystem dynamism-TBI relationship

National policy- TBI relationship

10a. New technology-based firms are perceived as operating in a complex and dynamic entrepreneurial environment. How has national entrepreneurship policy affected your involvement in technology business incubation processes?

Regional SMME funding-TBI relationship

10b. In what ways do you think SMME funding of the region has affected your involvement in technology business incubation processes?

Regional innovation culture-TBI relationship

10c. In what ways do you think the culture of innovation of the region has affected your involvement in technology business incubation processes?

Incubation legitimacy-TBI relationship

10d. How has the social acceptance of business incubation in general influenced your involvement in technology business incubation processes?

Research Question 6: Which aspects of the environment facilitate (or undermine) the realisation of technology entrepreneurship among university-incubated businesses?

Incubation ecosystem dynamism-technology entrepreneurship relationship

11a. How has national SMME policy affected your firm's development of innovative and enterprising technology solutions (i.e., technology entrepreneurship) in the region?

11b. In what way has SMME funding of the region affected your firm's development of innovative and enterprising technology solutions in the region?

11c. How has the culture of innovation of the region affected your firm's development of innovative and enterprising technology solutions in the region?

11d. How has the social acceptance of business incubation in general affected your firm's development of innovative and enterprising technology solutions in the region?

INTERVIEW GUIDE FOR NEW TECHNOLOGY BASED INCUBATOR MANAGERS (SHORT VERSION)

Dear Participant

My name is Patient Rambe, a PhD candidate in the Department of Business Management at the University of the Free State, South Africa. My study strives to understand factors that affect technology entrepreneurship of university-incubated star-ups and spinoffs. I am soliciting your participation in this study.

Please be advised that your participation in this study is voluntary and that you are free to withdraw any time without any consequences. Nevertheless, your participation will be critical to developing a deeper understanding of the individual, organisational and systemic factors that shape technology entrepreneurship, thereby contributing to growth and sustainability of new startups in South Africa.

Please be advised that your responses will be anonymous and therefore, your personal information such as your name, cell phone number, ID number, or any contact details, will not be required. Please be informed that information extracted from this study will be confidential and therefore, will not be disclosed to third parties. Where identifying information such as age gender, occupational status has been extracted from participants, this information shall be aggregated and be applied for academic purposes.

Should you have any queries concerning this study, please feel free to contact my study promoter: Professor Neneh Brownhilder: NenehBN@ufs.ac.za. Phone number: 0514012156

The interview guide will take approximately 60 minutes

1. **PERSONAL DEMOGRAPHICS**

Age				
Gender				
Race				
BUSINESS INFORMATION				
Year of establishment of incubator				
Age of the incubator	Less than 1 year	1-5 years	6-10 years	Over 10 years
Industry of operation of incubator	IT	Engineering & construction	Tourism	Other specify
Annual turnover of incubator				

2. BACKGROUND INFORMATION

Please reflect on your professional interactions with new technology-based firms (if any).

a. Why do new technology-based firms interact with your incubator?

b. What kind of interactions unfold between yourself and new technology-based firms (NTBFs)?

c. During the technology business incubation (TBI) you have supported, what type of representatives interact (e.g., founders, educators, researchers, TTO managers)?

d. How are interactions between yourself and NTBFs established (e.g., through incubator, TTOs, networking events)?

e. How do these interactions contribute to startup activities (e.g., idea generation, business concept development, founding a physical organisation, developing, production technology etc.)?

f. What criteria do you use to admit incubatees into your incubator?

g. In your view, how effective are these criteria judging from their benefits?

h. On average, how long do incubatees (TBIs) stay in your incubator?

Research Question 3: Which dimensions of individual (i.e., EC, PEC) factors are fundamental to the incubation of technology businesses and technology entrepreneurship?

ENTREPRENEURIAL COGNITION DIMENSIONS

SECTION A: INTUITIVE THINKING

1. Some entrepreneurs often claim that they rely on "instincts," or "gut feelings" (guesses) to explore, evaluate and exploit business opportunities. From your experience of working with new technology-ventures, how do they use such instincts to explore, evaluate and make business opportunities? Please elaborate.

To what extent do entrepreneurs whose startups you have incubated use "gut feelings" when engaging in (i.e., exploring, evaluating and making) business incubation decisions? Please elaborate

Intuitive thinking-TBI relationship

2. From your business incubation experience, how have the "instincts" or "gut feelings" of these entrepreneurs shaped their engagement in business incubation processes?

Intuitive thinking-technology entrepreneurship relationship

3. In your view, how have the entrepreneurs' "instincts" or gut feelings" affected their business incubation outcomes such as technology entrepreneurship (e.g. strong growth orientation, commercialisation of applications/outcomes, large financial outlays)?

SECTION B: HEURISTICS

4. Entrepreneurs are often confronted with information overload, new situations and uncertainty. To deal with these situations, they may use "simplifying strategies to making judgement decisions" or "shortcuts" (*heuristics*).

To what extent do entrepreneurs whose businesses you have incubated use "shortcuts" when engaging in business incubation decisions (e.g., formulating ideas, identification of opportunities, mobilisation of resources, their exploitation of opportunities, launching and development of ventures)? Please elaborate.

Heuristics- TBI relationship

5. Please elaborate on how these incubation tenants' use shortcuts to engage in business incubation decisions.

Heuristics- and technology entrepreneurship

6. Please describe how your incubation tenants' use of shortcuts has shaped their business incubation outcomes.

SCRIPTS

7. Some entrepreneurs claim that through experience in business, they develop some mental techniques for determining the likely sequence of business events (i.e., scripts).

From your business incubation experience, how have your incubation tenants used scripts in their business incubation decisions (i.e., identifying business opportunities, validating opportunities, exploiting opportunities or implementing business decisions)?

Arrangement scripts

7a. In your view, how have your incubation tenants used "scripts" to secure critical resources they need for incubating their business?

Willingness scripts

7b. From your business incubation experience, how do incubation tenants use "scripts" when taking risks and implementing incubation decisions?

Ability scripts

7c. In your own view, how do your incubator tenants use "scripts" to demonstrate their venture creation capabilities?

Scripts and technology entrepreneurship

7d. In what ways has incubation tenants' use of scripts affected their business incubation outcomes, especially technology entrepreneurship?

PERCEIVED ENTREPRENEURIAL CAPABILITIES (PEC)

8a (i) On average, how much entrepreneurial knowledge do your incubation tenants have when they come into your incubator?

8a(ii) On average, how much entrepreneurial skills do your incubation tenants have when they come into your incubator?

8a(iii) On average, how much entrepreneurial experience do your incubation tenants have when they come into your incubator?

PEC-Technology business incubation relationship

8bTo what extent do you think incubator tenants have the requisite **entrepreneurial knowledge** to engage in technology business incubation? Please elaborate.

8c. To what extent do tenants you incubated have the requisite **entrepreneurial skills** to engage in technology business incubation? Please elaborate.

8d. To what extent do tenants have the requisite **entrepreneurial experience** to engage in technology business incubation? Please elaborate.

PEC -Technology entrepreneurship relationship

8e. How has your perception of your **entrepreneurial knowledge** affected business incubation outcomes?

8f. How has your perception of your **entrepreneurial skills** affected business incubation outcomes?

8g. How has your perception of your **entrepreneurial experience** affected business incubation outcomes?

Research Question 4: What is the role of institutional (i.e. incubation support and resources rendered by incubators) factors in the successful incubation of technology businesses and technology entrepreneurship?

INCUBATION SUPPORT AND INCENTIVE REGIME

Physical capital
9a. What range of physical resources are availed by your business incubator?

Physical capital- TBI relationship
9b. How has the incubators' provision of physical resources affected **your knowledge** of incubation processes?

9c. How has the incubators' provision of **physical resources** affected **your participation** in incubation processes?

Social capital
9d. What range of **networking resources** are availed by your business incubator?

Social capital-TBI relationship
9e. How has the incubators' provision of networking resources affected **your knowledge** of incubation processes?

9f. How has the incubators' provision of networking resources affected your **participation** in incubation processes?

Intellectual capital
9g. What range of **intellectual resources** (i.e., training and development services, business advisory services, mentoring, field collaborations) are availed by your business incubator?

Intellectual capital-TBI relationship
9h. How has the incubators' provision of **intellectual resources** affected your **knowledge** of incubation processes?

9i. How has the incubators' provision of **intellectual resources** affected your **participation** in incubation processes?

Physical capital- technology entrepreneurship relationship
9j. How has the incubators' provision of **physical resources** affected your firm's realisation of innovative and enterprising **technology incubation outcomes**?

Social capital- technology entrepreneurship relationship

9k. How has the incubators' provision of **networking resources** affected your firm's realisation of innovative and enterprising **technology incubation outcomes**?

Intellectual capital- technology entrepreneurship relationship
9l. How has the incubators' provision of **intellectual resources** affected your firm's realisation of innovative and enterprising **technology incubation outcomes**?

INCUBATION ECOSYSTEM DYNAMISM
Research Question 5: Which aspects of the environment (i.e., entrepreneurship ecosystem) facilitate (or undermine) the successful incubation of technology businesses?

Incubation ecosystem dynamism-TBI relationship

National policy- TBI relationship
10a. New technology-based firms are perceived as operating in a complex and dynamic entrepreneurial environment. How has national entrepreneurship policy affected your involvement in technology business incubation processes?

Regional SMME funding-TBI relationship
10b. In what way do you think SMME funding of the region affected your involvement in technology business incubation processes?

Regional innovation culture-TBI relationship
10c. In what way do you think the culture of innovation of the region affected your involvement in technology business incubation processes?

Incubation legitimacy-TBI relationship
10d. How has the social acceptance of business incubation in general influenced your involvement in technology business incubation processes?

INCUBATION ECOSYSTEM DYNAMISM
Research Question 6: Which aspects of the environment facilitate (or undermine) the realisation of technology entrepreneurship among university-incubated businesses?

Incubation ecosystem dynamism-technology entrepreneurship relationship
11a. How has national SMME policy affected your firm's development of innovative and enterprising technology solutions in the region?

11b. In what way has SMME funding of the region affected your firm's development of innovative and enterprising technology solutions in the region?

11c. How has the culture of innovation of the region affected your firm's development of innovative and enterprising technology solutions in the region?

11d. How has the social acceptance of business incubation in general affected your firm's development of innovative and enterprising technology solutions in the region?

APPENDIX 2B: SAMPLE OF RESEARCH INSTRUMENTS

FOCUS GROUP DISCUSSION GUIDE FOR FUNDERS OF TECHNOLOGY BUSINESS INCUBATORS AND TENANTS (SHORT VERSION)

Dear Participant

My name is Patient Rambe, a PhD candidate in the Department of Business Management at the University of the Free State, in South Africa. My study strives to understand factors that affect technology entrepreneurship of university-incubated star-ups and spinoffs. I am soliciting your participation in this study.

Please be advised that your participation in this study is voluntary and that you are free to withdraw your participation any time without any consequences. Nevertheless, your participation will be critical to developing a deeper understanding of the individual, organisational and systemic factors that shape technology entrepreneurship, thereby contributing to growth and sustainability of new startups in South Africa.

Please be advised that your responses will be anonymous and therefore, your personal information such as your name, cell phone number, ID number, or any contact details, will not be required. Please be informed that information extracted from this study will be confidential and therefore, will not be disclosed to third parties. Where identifying information such as age gender, occupational status has been extracted from participants, this information will be aggregated to and be applied for exclusively for academic purposes.

Should you have any queries concerning this study, please feel free to contact my study promoter: Professor Neneh Brownhilder: NenehBN@ufs.ac.za. Phone number: 0514012156

The interview guide should take approximately 60 minutes. Please complete all questions in full and as honestly as possible.

Year of establishment of funding agency				
Domain of funding of agency				
Age of the businesses supported	Less than 1 year	1-5 years	6-10 years	Over 10 years
Industries supported by funding	IT	Construction & construction	Tourism	Other specify
Total value of funding disbursed to				

incubation tenants in the past 5 years	

BACKGROUND INFORMATION

Please reflect on your professional interactions with new technology-based firms and the incubator (if any).

i. Why do new technology-based firms and incubators interact with you?
j. What kind of interactions unfold between yourself, incubators and new technology-based firms (NTBFs)?
k. During the technology business incubation (TBI) you have supported, what type of representatives interact (e.g., founders, educators, researchers, TTO managers)?
l. How are interactions between yourself, NTBFs and incubators established (e.g., through incubator, TTO's, networking events)?
m. How do these interactions contribute to startup activities (e.g., idea generation, business concept development, founding a physical organization, developing, production technology etc.)?
n. What criteria do incubators you have supported use to admit incubatees into their programmes?
o. In your view, how effective are these criteria in realising their incubation goals?
p. On average, how long do incubatees (TBIs) stay in the incubator?

RESEARCH QUESTION:

3. Which dimensions of individual (i.e., EC, PEC) factors are fundamental to the incubation of technology businesses and technology entrepreneurship?

INTUITIVE THINKING

1. Some owners of new technology-ventures often rely on "instincts," or "gut feelings" (guesses) to explore, evaluate and make business incubation decisions.
   a. From your experience of supporting business tenants, do business owners you support use gut feelings to explore, evaluate and make business incubation decisions?

Intuitive thinking-TBI relationship

   b. How do technology incubation tenants you support use gut "feelings" when exploring, evaluating and making business incubation decisions? Elaborate your answer

Intuitive thinking -technology entrepreneurship relationship

   c. In your view, how do incubation tenants' use of "instincts" or gut feelings" affect their venture creation outcomes?

HEURISTICS

2. Entrepreneurs are often confronted with information overload, new situations and uncertainty. To deal with these situations, they may use "simplifying strategies to making judgement decisions" or "shortcuts" (*heuristics*). From your experience of supporting incubatees, do incubatees use shortcuts?

Heuristics- TBI relationship

3. To what extent do you think incubation tenants in your institution have supported use "shortcuts" when taking business incubation decisions (e.g., formulating ideas, identification of

opportunities, mobilization of resources, their exploitation of opportunities, launching and development of ventures)? Elaborate your answer.

4. In your view, how have their use of “shortcuts affected business incubation processes?

Heuristics- and technology entrepreneurship

5. From your perspective, how do these tenants’ use of “shortcuts” affect technology business incubation outcomes such as technology entrepreneurship (i.e., commercialisation of applications/services, high growth orientation, large financial outlay)?

SCRIPTS

6. Some entrepreneurs claim that through experience in business, they develop some mental techniques for determining the likely order (i.e., sequence) of business events (i.e., *scripts*). How do they use scripts in any of business incubation decisions?

In your view, how do incubation tenants use “scripts to secure critical resources they need for incubation?

Scripts-TBI relationship

7. From your experience, how do they use “scripts” when taking risks and implementing incubation decisions?

8. In your own view, how do these tenants use “scripts” to demonstrate their venture creation capabilities?

Scripts and technology entrepreneurship

9. In what ways would incubation tenants’ use of scripts affect technology business incubation outcomes?

PERCEIVED ENTREPRENEURIAL CAPABILITIES

9a. What **knowledge** about business did tenants you have supported have when they made the decision to have their business incubated?

9b. What **skills** about business did tenants you have supported have when they made the decision to have their business incubated?

9c. What **experience** about business did tenants you have supported when they made the decision to have their business incubated?

PEC-TBI processes

Some owners of new technology-ventures often rely on their PEC (i.e., perceptions of their capabilities [i.e. knowledge, skills and experience]) to explore, evaluate and make business incubation decisions.

9d. How do technology incubation tenants you support use their **knowledge** when exploring, evaluating and making business incubation decisions? Elaborate your answer?

9e. How do technology incubation tenants you support use their **skills** when exploring, evaluating and making business incubation decisions? Elaborate your answer?

9f. How do technology incubation tenants you support use their **experience** when exploring, evaluating and making business incubation decisions? Elaborate your answer?

PEC-Technology entrepreneurship
9g. In what ways are PEC fundamental to the realisation of technology business outcomes, especially technology entrepreneurship (e.g., strong growth orientation of the business, commercialisation of products/services, large financial outlays)?

INCUBATION INCENTIVE AND SUPPORT REGIME

RESEARCH QUESTION:

4. **What is the role of institutional (i.e., incubation support and resources rendered by incubators) factors in the successful incubation of technology businesses and technology entrepreneurship?**

Incubation support and resources
10a. Please describe to me the **physical capital** that your give to:

I. . Technology business incubators, especially those operating at Universities.
II. . Technology business tenants.

10b. Please describe the form of **social support** that you give to incubators and their tenants.

10c. Please describe the **intellectual support** that you give to incubators and their tenants.

Physical capital-TBI relationship

10d. From your experience of supporting technology-based incubators and their incubation tenants, in what ways have your provision of **physical resources** (e.g., cash, loans, equity, tax incentives, equipment, and inventory) to incubatees affected their incubation processes?

Social capital-TBI relationship

10e. Please reflect on the social networking support you normally provide to business incubators and startups.

How has your provision of **social and business networking resources** (e.g., social networks, investment networks, collaborative working teams and networking communities with customers and suppliers, inter firm relationships, knowledge transfer networks) influenced incubation processes?

Intellectual capital-TBI relationship

10f. In what ways do you think your provision of **intellectual resources** (e.g. technical and practical knowledge, skills and experience on business networks, finance, business planning, and intellectual property) affects incubation processes?

10g. What are the other incentives that you give to incubation tenants and incubators to support their activities?

10h. How has the provision of these resources affected the incubation processes?

Incubation incentive and support – Technology entrepreneurship relation

One of the commonly discussed outcomes of technology business incubation is the exploitation of opportunities through new technology-based venture and commercialisation of new products (i.e., technology entrepreneurship).

11a. How does your institution facilitate new firms' exploitation of technological opportunities and product commercialisation?

Incubation ecosystem dynamism – Technology business incubation relationship

11b. How has your provision of various support (e.g., physical, social and intellectual support) affected the new firms' exploitation of technological opportunities and product commercialisation?

11c. How has your provision of various incentives affected the new firms' exploitation of technological opportunities and product commercialisation?

RESEARCH QUESTION:

5. **Which aspects of the environment (i.e. entrepreneurship ecosystem) facilitate (or undermine) the successful incubation of technology businesses?**

The favorability or hostility of the business environment (e.g., corporate taxes, tax incentives, SMME regulatory policies and municipal by laws, supply chain management policies) is perceived as affecting technology business incubation processes.

12a. In your view, how does national policy shape incubation processes?

12b. In your view, how does your funding affect business incubation processes?

12c. How has the innovation culture of the region affected incubation processes?

12d. In your view, how has social acceptance of incubation affected incubation processes?

INCUBATION ECOSYSTEM DYNAMISM AND TECHNOLOGY ENTREPRENEURSHIP RELATIONSHIP

RESEARCH QUESTION:

6. **Which aspects of the environment facilitate (or undermine) the realisation of technology entrepreneurship among university-incubated businesses?**

The favourability or hostility of the business environment can either positively affect exploitation of opportunities through new technology-based venture and commercialisation of new products (i.e. technology entrepreneurship).

13a. How has **national entrepreneurship policy** affected the realisation of technology entrepreneurship of incubators/business startups that you have supported?

14. How has **SMME funding** in the region affected the realisation of technology entrepreneurship of incubators/business startups that you have supported?

15. How has the **culture of innovation** in the region affected the realisation of technology entrepreneurship of incubators/business startups that you have supported?

16. How has the **social acceptance of incubation** affected the realisation of technology entrepreneurship of incubators/business startups that you have supported?

APPENDIX 3: ETHICAL CLEARANCE OF RESEARCH BY HOST INSTITUTION

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS
UV

GENERAL/HUMAN RESEARCH ETHICS COMMITTEE (GHREC)

29-Jun-2020

Dear Prof Patient Rambe

Application Approved

Research Project Title:
Factors affecting technology entrepreneurship of university-incubated firms

Ethical Clearance number:
UFS-HSD2020/0856/2906

We are pleased to inform you that your application for ethical clearance has been approved. Your ethical clearance is valid for twelve (12) months from the date of issue. We request that any changes that may take place during the course of your study/research project be submitted to the ethics office to ensure ethical transparency. furthermore, you are requested to submit the final report of your study/research project to the ethics office. Should you require more time to complete this research, please apply for an extension. Thank you for submitting your proposal for ethical clearance; we wish you the best of luck and success with your research.

Yours sincerely

Dr Adri Du Plessis
Chairperson: General/Human Research Ethics Committee

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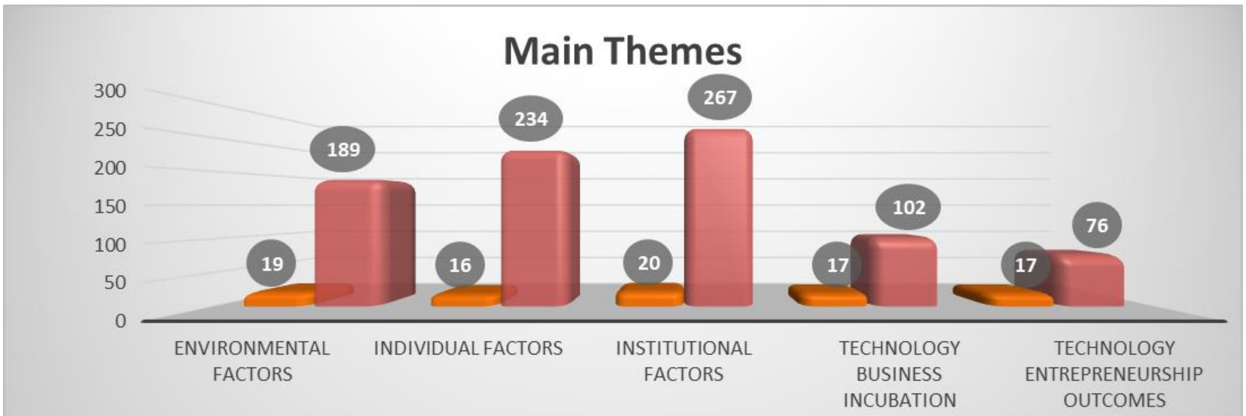
Please note that ethical clearance letters from University incubators A and B (sites of the main study) have not been availed as this would violate the anonymity of the two universities. The letters had letterheads, names and designations and contact details of the signatories

APPENDIX 4: QUALITATIVE DATA ANALYSIS

Computer-Assisted Qualitative Data Analysis Software (CAQDAS) was used to code, organise and manage the data from the first round of data analysis. Please note that data collected in the second round was not subjected to CAQDAS as data saturation was deemed to have been attained in the first round of data collection. Individual, institutional and environmental factors, including their sub-dimensions are discussed alongside technology business incubation, particularly how all these factors merge to affect technology entrepreneurship outcomes. The main themes and number of quotations are described in sections below.



	ENVIRONMENTAL FACTORS	INDIVIDUAL FACTORS	INSTITUTIONAL FACTORS	TECHNOLOGY BUSINESS INCUBATION	TECHNOLOGY ENTREPRENEURSHIP OUTCOMES
Number of Sources	19	16	20	17	17
Number of Quotations	189	234	267	102	76

Figure A: Main themes of the study

INDIVIDUAL FACTORS

Data was analysed to establish individual factors that affect TBI and TE. **Entrepreneurship cognition** and **perceived entrepreneurship capabilities** comprised the two individual entrepreneur variables explored in the study.

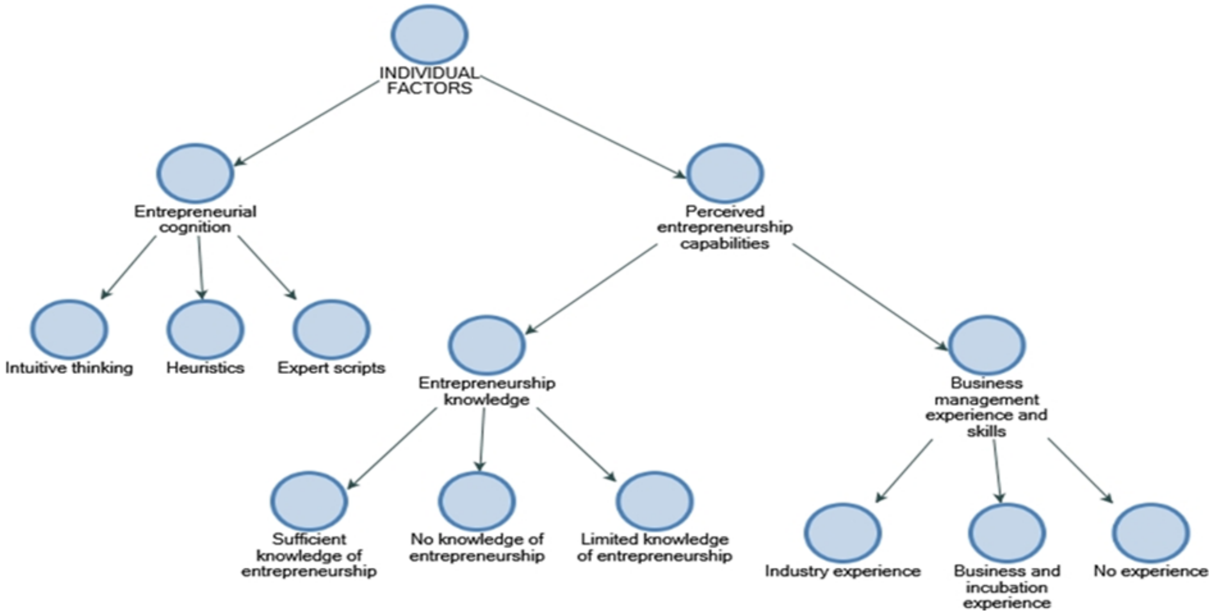


Figure B: Individual factors theme and categories

Entrepreneurial cognition counted for the most discussed code with 145 quotations contributed by 15 participants, followed by perceived entrepreneurship capabilities with 89 quotations contributed by 14 participants.

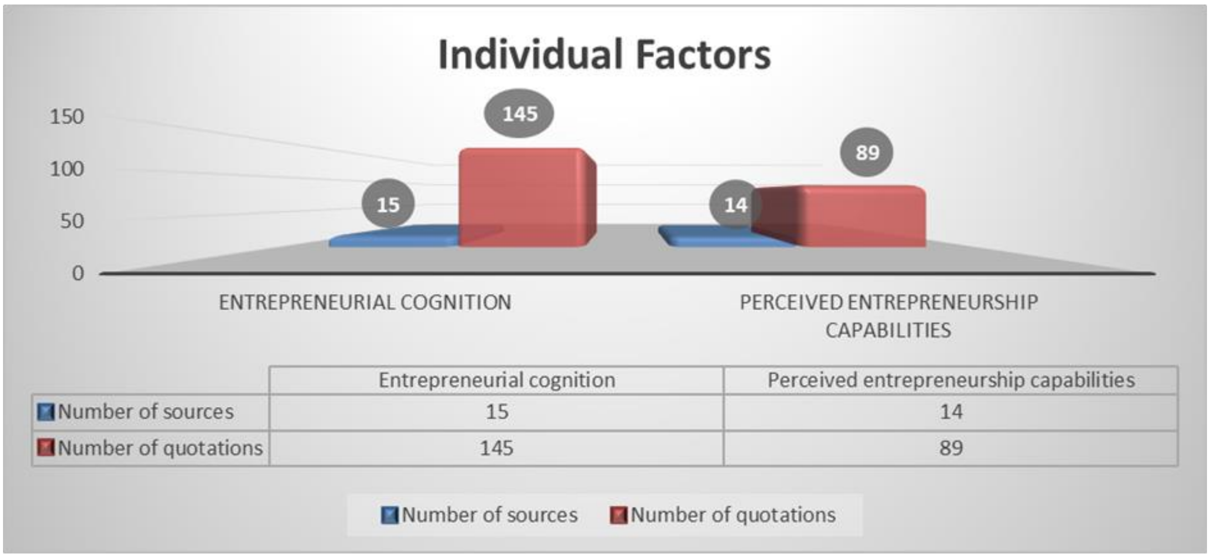


Figure C: Number of quotations from transcripts and individuals that contributed to these quotations.

Entrepreneurial cognition

From the entrepreneurship cognition information presented, the most discussed code/subtheme is split asymmetrically between expert scripts and intuitive thinking with 57 quotations extracted from 15 participants. Heuristics had the least discussed themes, accounting for 31 quotations.

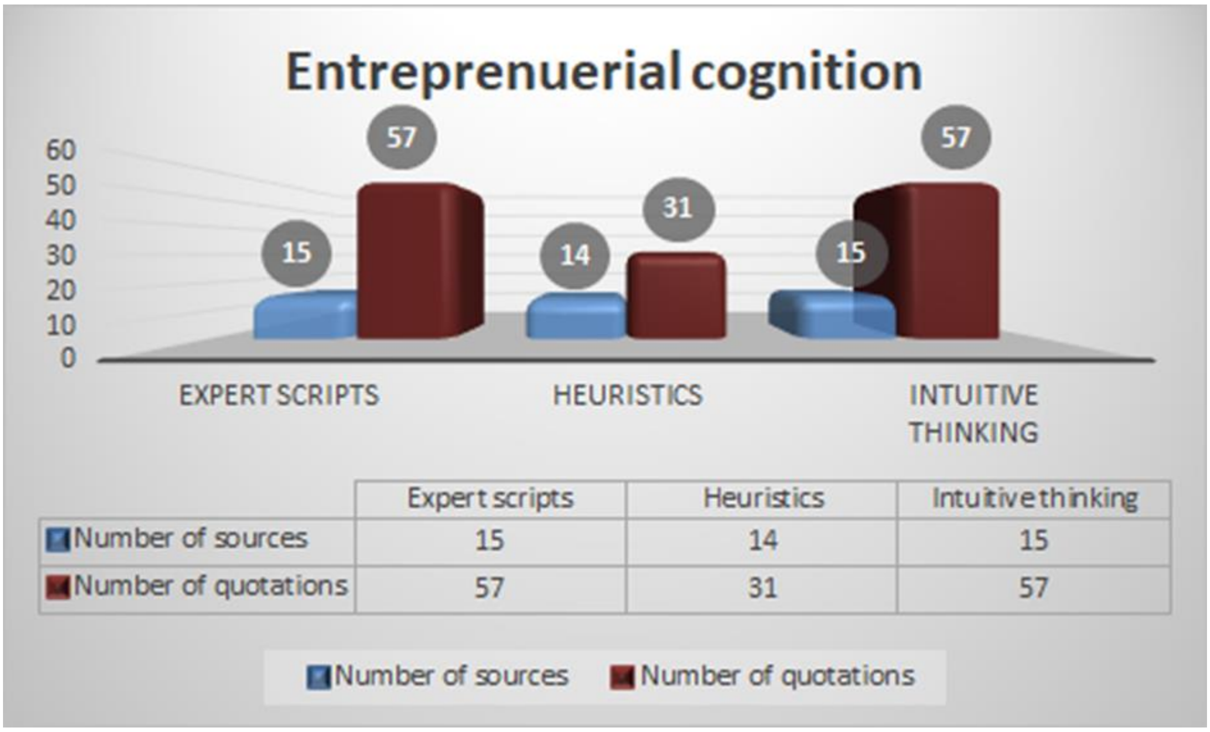


Figure D: Number of individuals (sources) and number of quotations from transcripts on EC

Business management experience and skills

From information presented, the most discussed theme is entrepreneurship knowledge with 27 quotations extracted from 13 participants. However, business and incubation experience were discussed by 7 participants who contributed 26 quotations.

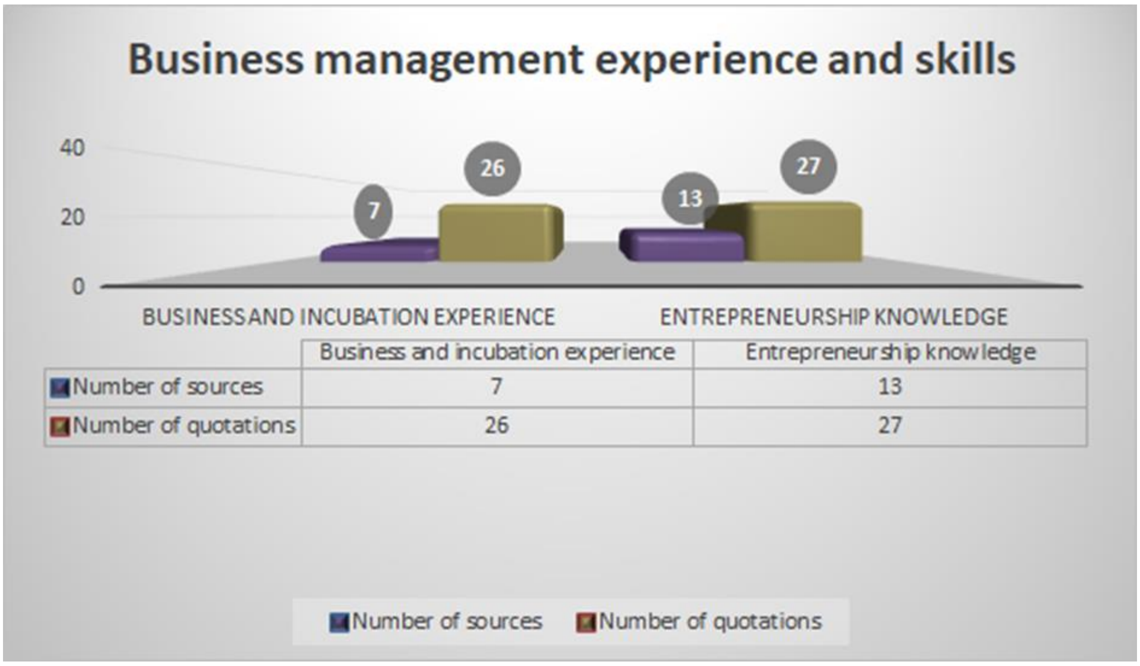


Figure E. Business Management Experience and Skills

INSTITUTIONAL FACTORS

Insights into the institutional factors influencing effective participation of stakeholders in TBI and TE were gathered. Participants established that, broadly, incubation incentives and support regime of incubators and incubator sponsors ranged from **intellectual capital**, **physical capital,** and **social capital**. Some participants also highlighted **insufficient support** availed through these structures. The coding structure of institutional factors theme is presented in the diagram below.

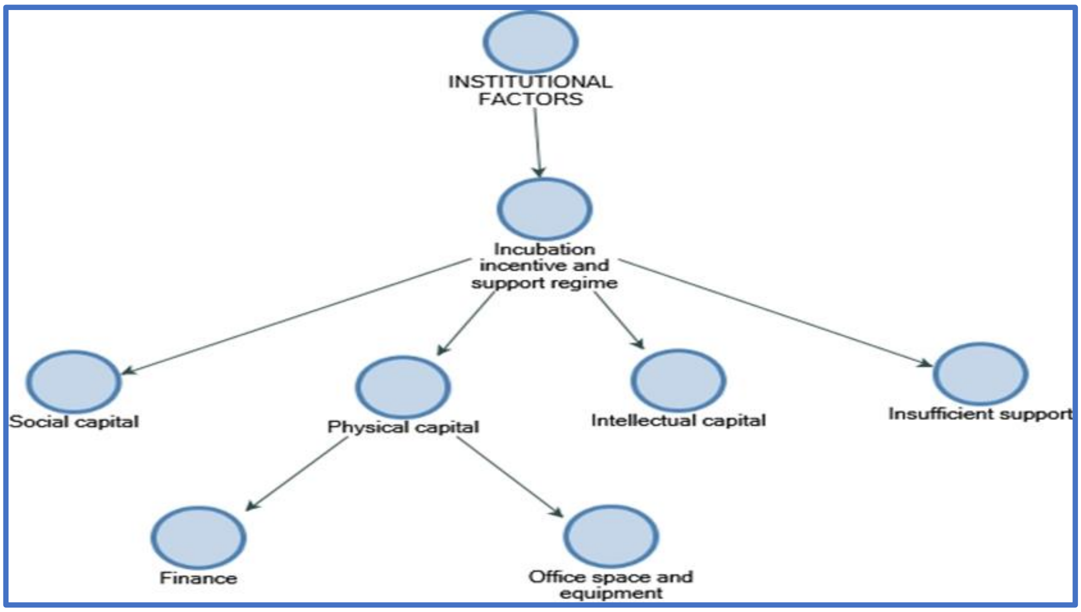


Figure F: Categories and codes emerging from the institutional factors theme

Institutional factors affecting TBI and TE

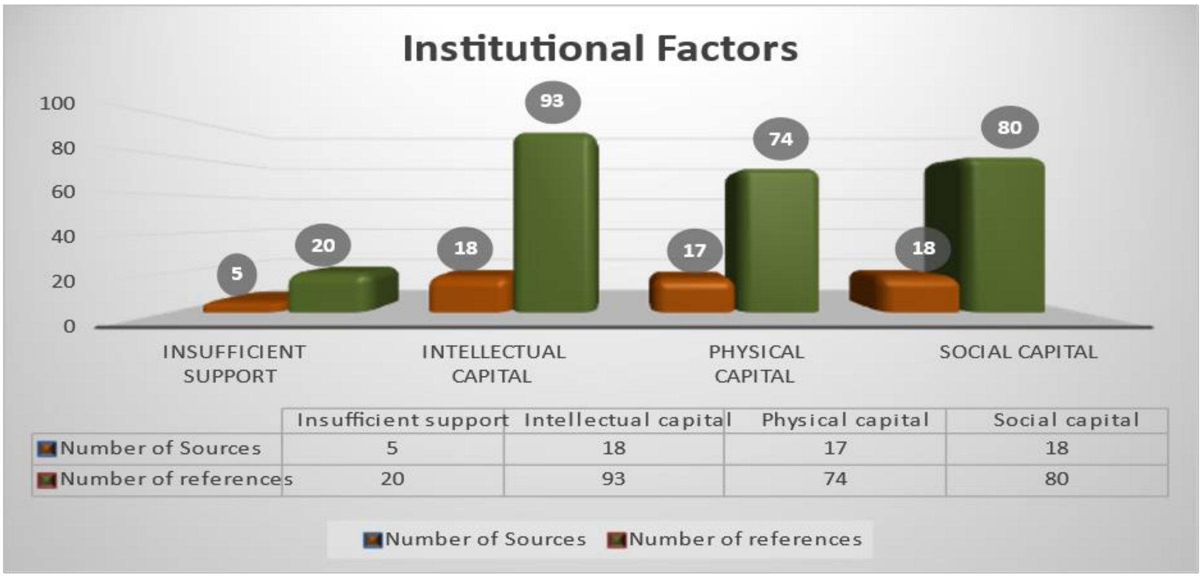


Figure G: Incubation incentive and support regime

Interview transcripts regarding institutional factors that affect TBI and TE revealed physical, social and intellectual capital as the main institutional drivers of TBI and TE. A total of 18 participants contributed 93 quotations on the intellectual capital subject. **Social capital** received significant attention from participants with 80 quotations generated by 18 participants. **Physical capital** was discussed by 17 participants and a total of 74 quotations were generated. **Insufficient support** was cited by 5 participants who rendered 20 references regarding lack of incentives and support demonstrated by their institutions.

Physical capital affecting TBI and TE

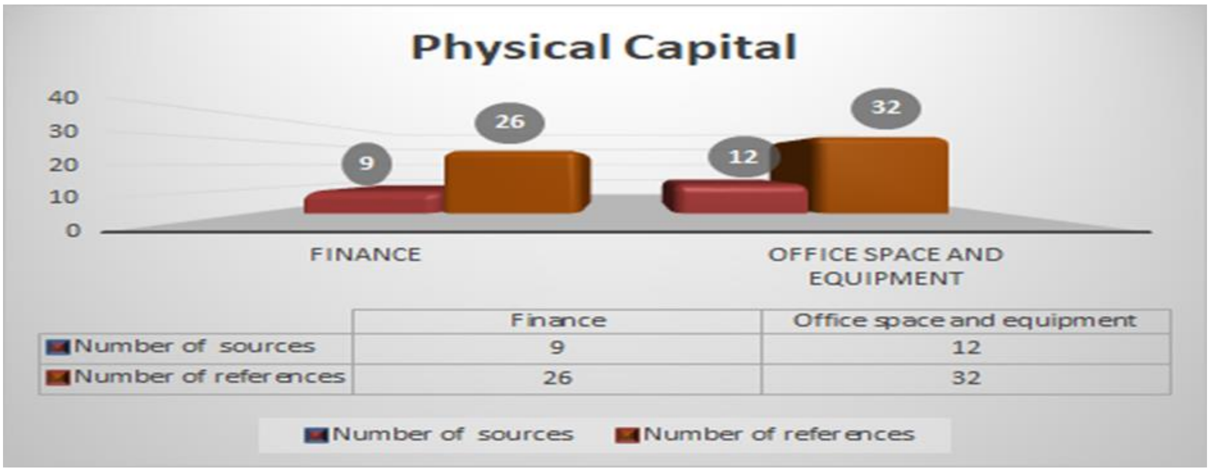


Figure H: Transcripts that spoke extensively on physical capital

Figure H shows that 32 references were generated from 12 participants who reported on office space and equipment. A further 26 references were generated from 9 participants who discussed financial resources.

Environmental factors

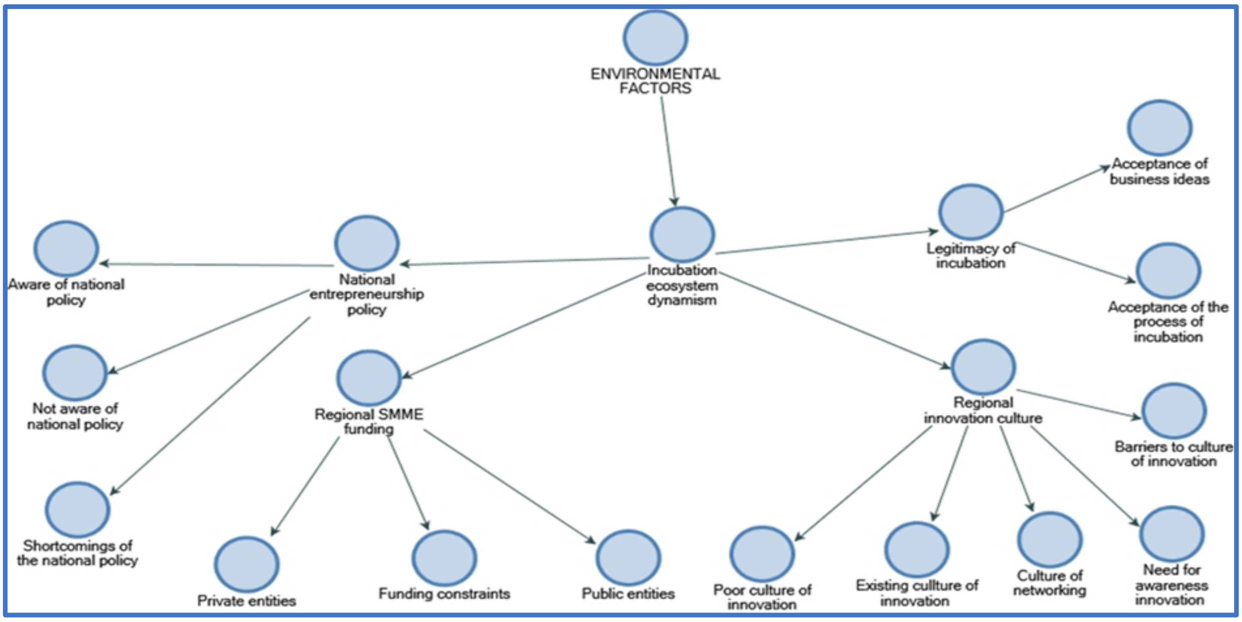
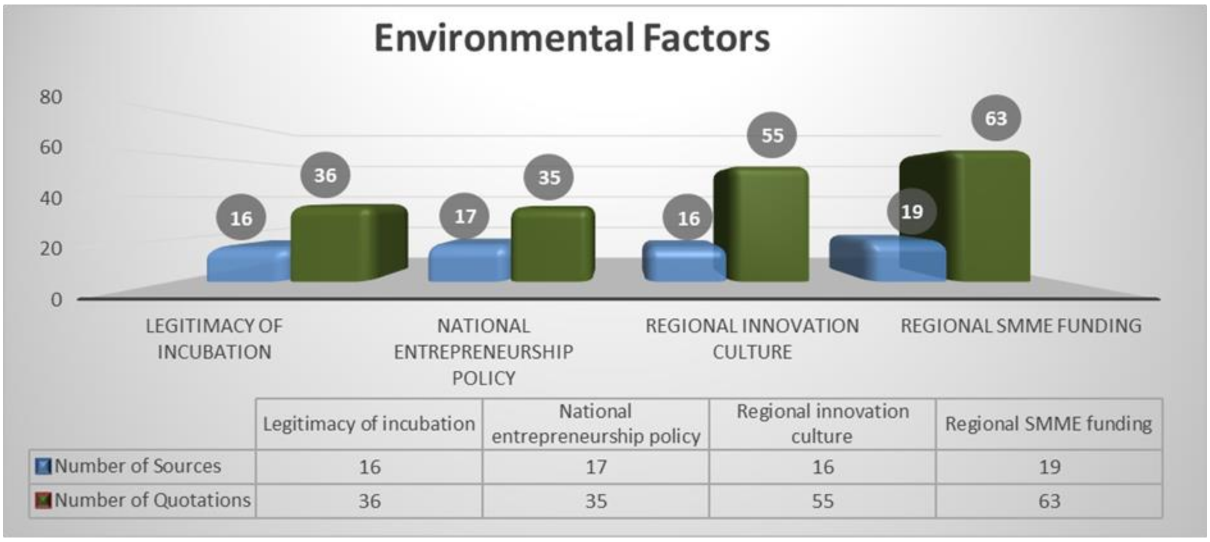


Figure I: Categories, codes and sub-codes that emerged from the environmental factors that affect TBI and TE

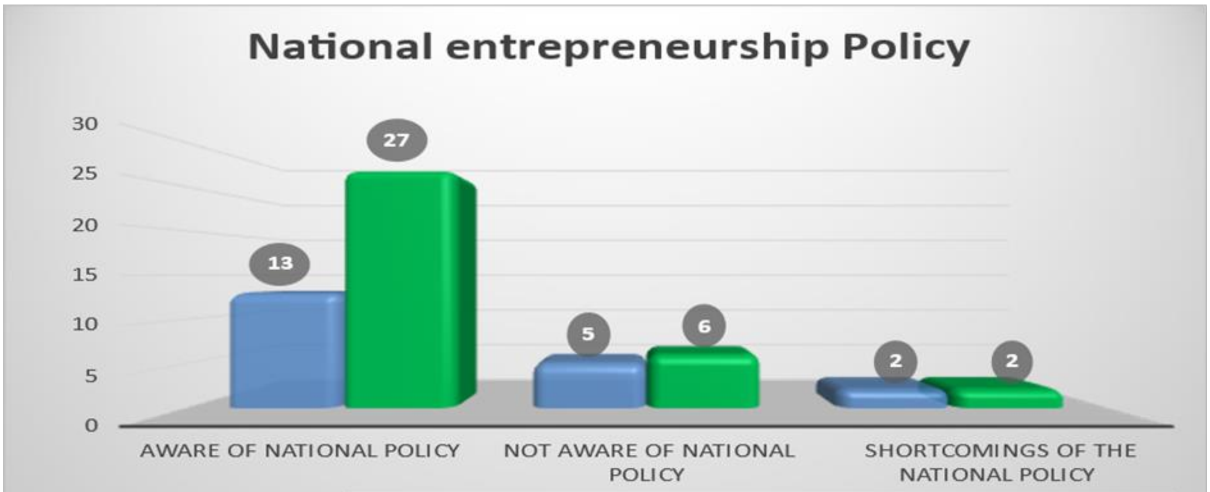
The environmental factors that affected TBI and TE were examined. The transcripts on environmental factors affecting technology business incubation and incubation outcomes focused on incubation ecosystem dynamism with an emphasis on factors such as national entrepreneurship policy, regional funding policies for SMMEs, regional innovation culture and the legitimacy of incubation processes from the perspective of stakeholders. The categories, codes and sub-codes that emerged from the environmental factors theme are summarised in Figure I.



	Legitimacy of incubation	National entrepreneurship policy	Regional innovation culture	Regional SMME funding
Number of Sources	16	17	16	19
Number of Quotations	36	35	55	63

Figure J: Number of sources that commented extensively on environmental factors and the quotations

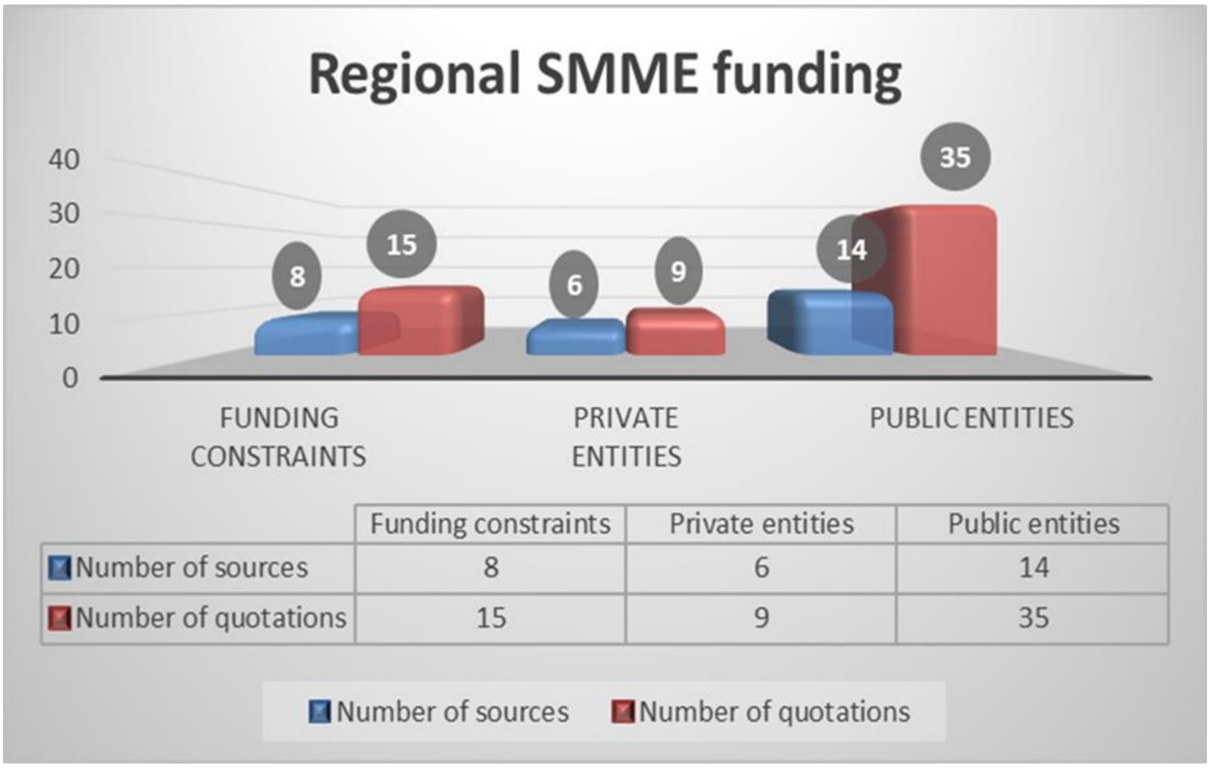
Figure J presents the responses of participants on environmental factors. It illustrates that participants responded the most on the category of regional SMME Funding, which has (63) quotations by (19) participants. The category participants engaged with the least on is national entrepreneurship policy, with (35) quotations by (17) participants.



	Aware of national policy	Not aware of national policy	Shortcomings of the national policy
Number of sources	13	5	2
Number of quotations	27	6	2

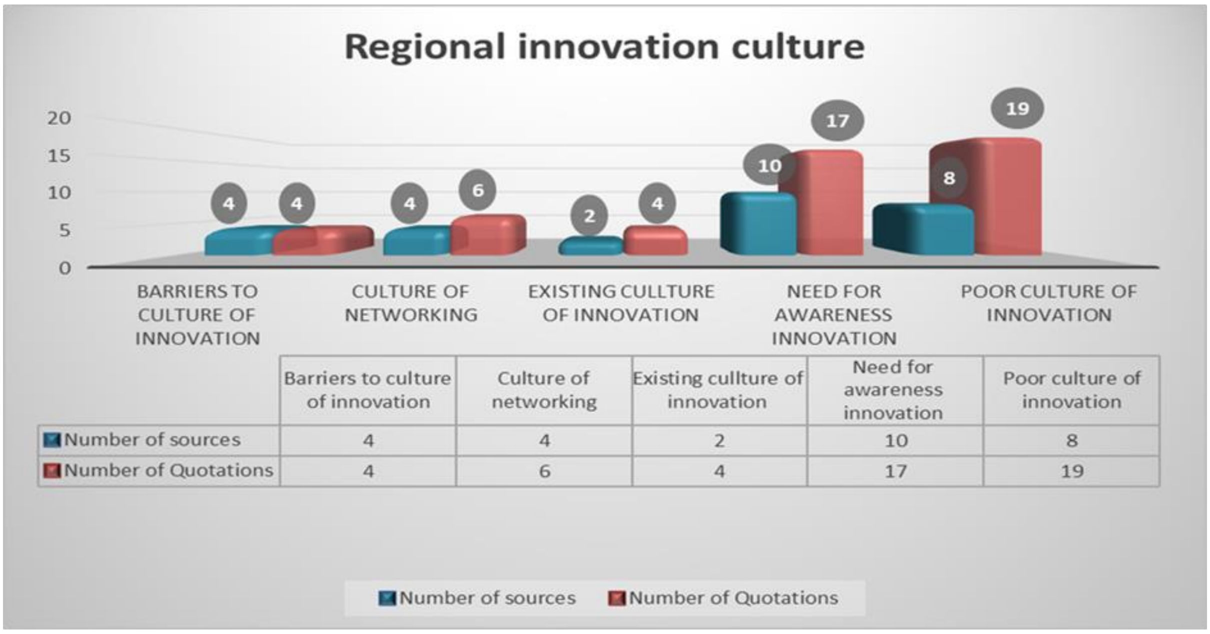
Figure K: Participants (sources) that commented extensively on national policy and their quotations

Figure K illustrates that participants deliberated the most on their awareness of national policy, judging from (27) quotations that were presented by (13) participants. This is followed by participants who professed that they were not aware of national policy, comprising (5) participants that contributed (6) quotations. The least number of quotations (2) come from (2) participants who expressed the shortcomings of national entrepreneurship policies.



	Funding constraints	Private entities	Public entities
Number of sources	8	6	14
Number of quotations	15	9	35

Figure L: Participants that commented extensively on regional SMME funding and their quotations



	Barriers to culture of innovation	Culture of networking	Existing cullture of innovation	Need for awareness innovation	Poor culture of innovation
Number of sources	4	4	2	10	8
Number of Quotations	4	6	4	17	19

Figure L: Participants that commented extensively on regional culture and their quotations

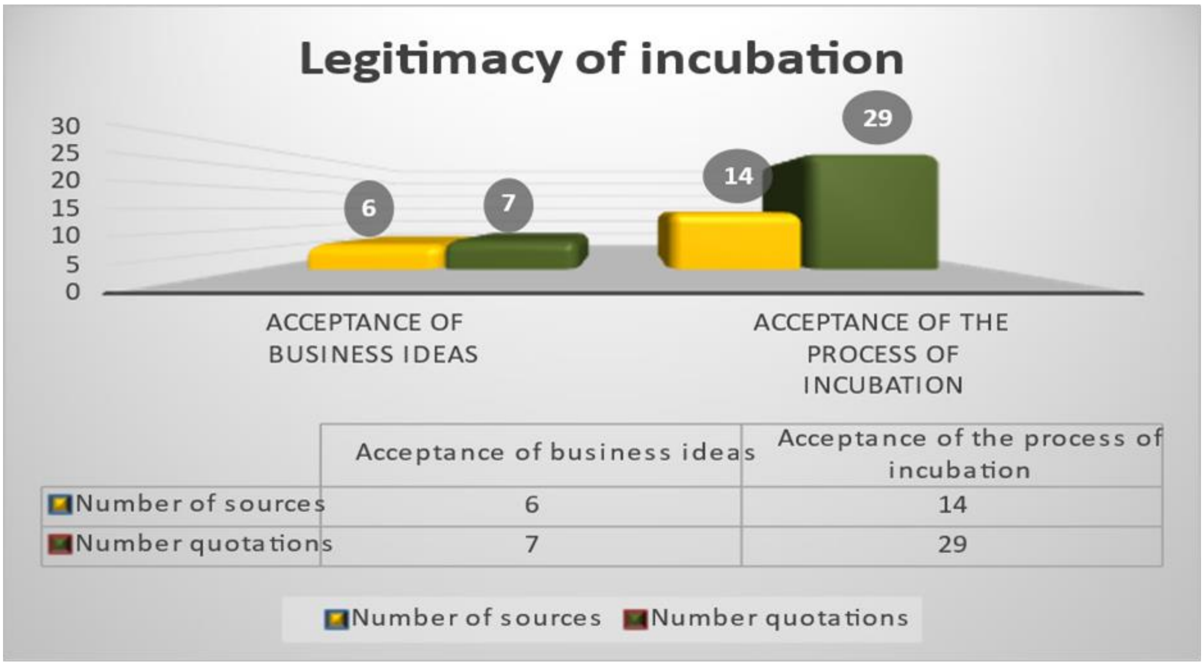


Figure M: Participants that comment extensively on legitimacy of incubation and their quotations

Technology business incubation

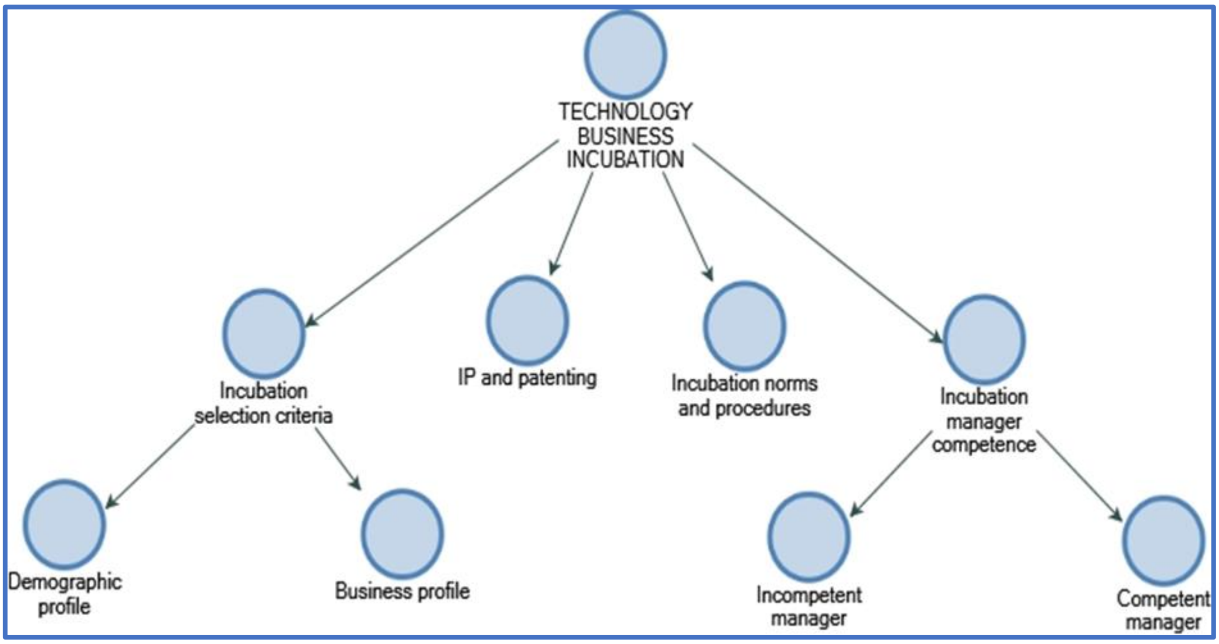
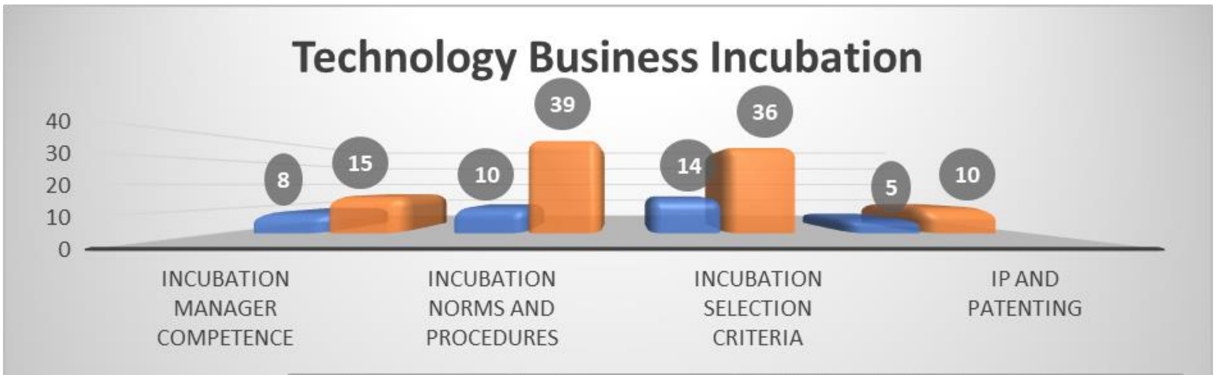


Figure N: Categories and codes derived from TBI theme



	Incubation manager competence	Incubation norms and procedures	Incubation selection criteria	IP and patenting
Number of Sources	8	10	14	5
Number of Quotations	15	39	36	10

Figure O: Participants that commented extensively on TBI and their number of quotations generated

Technology entrepreneurship

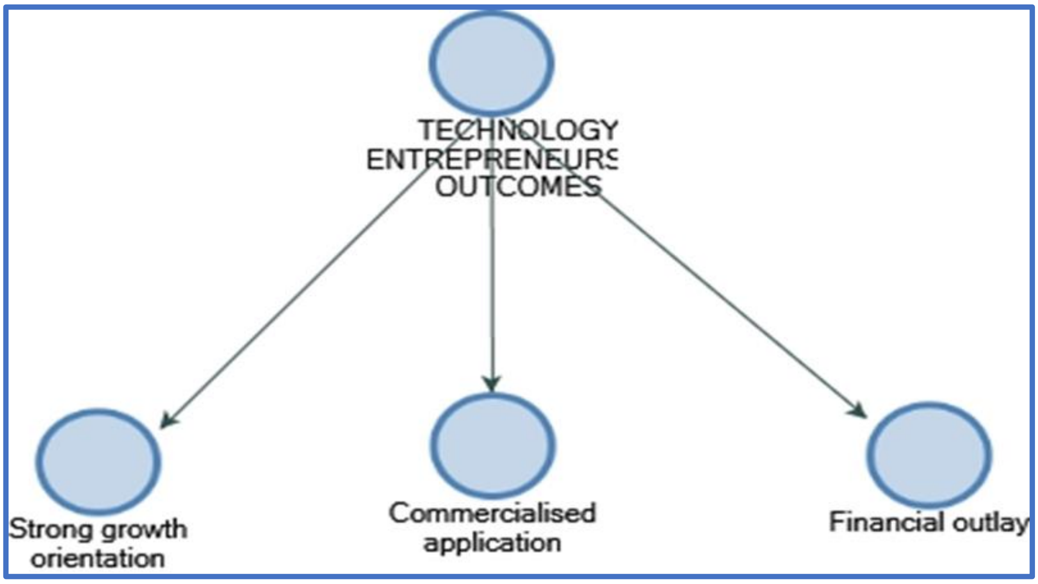


Figure P. The categories generated from the TE theme

Figure Q: Proof of language editing

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TO WHOM IT MAY CONCERN

CERTIFICATE OF EDITING

I, Muchativugwa Liberty Hove, confirm and certify that I have read and edited the entire thesis, **Understanding factors affecting technology entrepreneurship of university-incubated firms,** submitted by **Patient Rambe, Student number 2011162522,** in fulfilment of the requirements for the degree of **DOCTOR OF PHILOSOPHY (PhD) COMMERCII** to the Department of Business Management, Faculty of Economic and Management Sciences at the University of the Free State, Bloemfontein, South Africa.

Patient Rambe was supervised by **Professor Brownhilder Neneh.**

I hold a PhD in English Language and Literature in English and am qualified to edit such a thesis for cohesion and coherence. The views expressed herein, however, remain those of the researcher/s.

Yours sincerely

Professor M.L. Hove (PhD, MA, PGDE, PGCE, BA Honours – English)

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Figure R: Turnitin report of the thesis

Understanding factors affecting technology entrepreneurship of university-incubated firms

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Table A: Summary of policy, legislation and institutional documents reviewed

Name of Document	Focus of policy, legislation or document	Summary of findings
Preferential Procurement Policy Framework Act 5 of 2000	Public procurement for government departments by startups	Sets out the guidelines and principles of transparent, fair, and equitable procurement of goods and public contracting (i.e. tendering) for government departments and agencies by startups and small, micro, and medium enterprises. ▪ Facilitates the implementation of public contracts on procurement with persons from historically disadvantaged groups based on gender, race and disability based on a prescribed BBBEE formula. ▪ Contract is awarded to the tenderer who scores the highest based on criteria that are measurable, quantifiable and amenable to monitoring for compliance.
Broad-based Black Economic Empowerment Act 53 of 2003	Empowerment of entrepreneurs from previously marginalized backgrounds	Stipulates strategies for mainstreaming black-owned businesses in the economy, renders funding strategies for such businesses, and reiterates support systems from the government available for such businesses. These include: ▪ Increasing the number of black people that manage, own and control enterprises and productive assets. ▪ Facilitating ownership and management of enterprises and productive assets by communities, workers, cooperatives and other collective enterprises; ▪ Human resource and skills development ▪ achieving equitable representation in all occupational categories and levels in the workforce ▪ preferential procurement; and investment in enterprises that are owned or managed by black people
National Small Business Act Business Act (NSBA) of 1996 (as amended in 2003 and 2004)	Definitions of SMMEs and startups based on sectors of operation and their contribution to the economy (e.g., by staff employment, annual turnover and gross asset value	Provide a broad framework for the development of entrepreneurship in South Africa and the different ways through which SMMEs contribute to socio-economic transformation and local economic development -Specifies the contribution of small businesses to the economy, export promotion, rural development and incorporation of

		marginalized groups into the economy. Reports on the growth and decline of SMMEs by size, sector and regions. Specifies the progress made in the furtherance of the National Small Business Support Strategy
White Paper on the National Strategy for the Development and Promotion of Small Businesses of 1995	Promotion and development of SMMEs	Provided broad framework for the support of SMMEs including how they can contribute to the national economy. ▪ It details the role and contribution of the sector to national economic development including the constraints of the sector ▪ Outlines the objectives of the small business strategy, including the goals principles of the strategy and specifies the targeted supported needed for SMMEs. ▪ Details the support framework need to support SMMEs in terms of policy legislation, streamlining regulatory conditions, and increasing access to physical infrastructure, information and markets, marketing and procurement, finance and other forms of training
Accelerated and Shared Growth Initiative For South Africa, 2007	Support for infrastructural investment, public employment and youth programmes and skills development	Targeted support for small BEE firms by the Department of Labour Capacity development support of SMMEs partners such as municipalities
National Development Plan 2010	Multi-sectoral and multi-regional development through multi-pronged strategies – e.g. regional and local investment, export promotion and SMME development	Emphasises the role of entrepreneurship development in addressing the triple challenges of poverty, unemployment and social inequality. Emphasises the capacity of entrepreneurship and small business development in transforming the economy and promoting social transformation. Discusses support mechanisms that government can provided to render SMME development and business incubation possible
Broad-Based Black Economic Empowerment (BBBEE) 2013	Preferential treatment in public procurement by SMMEs owner by entrepreneurs from designated groups	BBBEE policy stipulates the preferential treatment of previously marginalised groups (e.g., black, Indian and coloured entrepreneurs) in the procurement of government services provided the emerging contractor (i.e., the startup) meets certain BBBEE scorecard criteria (Broad-Based Black Economic Empowerment Amendment Act, 2013).

10 Year Innovation Plan	Improving South Africa's global competitiveness based in its science and technology development and exploits. Deepen and accelerate South Africa's Innovation exploits	▪ Public procurement and innovation – government recognises the role of public procurement in supporting technology innovation for SMMEs and startups ▪ The government recognises the importance of developing a public procurement regulatory framework that supports local innovations, including SMMEs and technology startups. ▪ The importance of transitioning from an agro-based to a pharmaceutical economy by transforming value chains in biotechnology and the pharmaceutical firms, drawing on the nation's indigenous resources and expanding knowledge base.
White Paper on Science, Technology, and Innovation 2019	Decentralisation of the national system of innovation	▪ The decentralisation of the National System of Innovation to regional and local areas through the support for regional and local innovation ecosystems. ▪ The policy seeks to create local township economies and provide innovation funding in these areas through regional innovation development programmes that support local isles of innovation. ▪ Incubation ecosystems are expected to be spinoff benefits arising from creating regional systems of innovation.
Industrial Policy Action Plan 2018/2019-2020/2021	Targeted support of specific focal areas, public procurement and industrial financing	SMMEs collaboration with public agencies e.g. Denel Aerostructures during contact execution. SMMEs involvement during project execution projects allowed them to benefit from technology transfer and process improvement. ▪ The department of Trade and Industry reached an agreement with an obligor to provide a full suite of Product Lifecycle Management (PLM) software to the Council for Scientific and Industrial Research (CSIR). This will enable the CSIR to support SMME development through the various product lifecycle stages. It is estimated that 2,000 companies will be supported over a seven-year period.

		▪ Between 2013-2017, Technology Innovation Agency (TIA) disbursed R1.6 billion to support new technological developments; the emergence of 205 new knowledge innovation products (i.e. protectable intellectual property (IP) and technology demonstrators) among startups and SMMEs. TIA has also provided technical support to over 8,550 SMMEs to further develop and commercialise their products and services.
INSTITUTIONAL DOCUMENTS		
University A's Institutional Intent and Strategy 2013-2018	Recognises and supports the proposed outcomes of the global development goals and the National Development Plan as useful in realising its institutional intent and strategies	Emphasises the importance of fostering an environment of inclusivity, support entrepreneurship and innovation while embracing diversity
Division for Social Impact Collaboration Opportunities Report as at 2 November 2018	Summarises the collaboration opportunities underway for promoting social impact	Captures the details of inter-disciplinary collaborative opportunities at the institution – from ICT and genomics in farming systems, housing settlement projects, financial literacy projects, biochemistry projects to biodiversity projects
University A's Corporate Profile Document	Provides a detailed profile of the institution – from teaching and learning, student experience to partnerships	Emphasises the embedment of a culture of innovation and entrepreneurship, university-industry interaction and innovation platform for commercialisation of its assets, has a startup incubator and accelerator to scale up startups
University A's Research and Innovation Response to the COVID-19 Pandemic	Documents the numerous research activities related to various aspects of the Covid pandemic	Covers published inventions applicable to to COVID-19, completed research projects related to this pandemic and ongoing research projects at this university with a relevance to this pandemic.
University B's vision 2030	Maps the broad vision for becoming a leading University of Technology of choice in Africa	Advances innovation and entrepreneurship as one of the central pillars for the university to become an entrepreneurial university of choice in Africa.
University B's Strategy for Innovation and Entrepreneurship	Emphasises increasing staff and student exposure to entrepreneurship	Presents entrepreneurship education as vital to creating the right mind-set, knowledge and skills for entrepreneurship. Creating a climate that fosters innovative practices and entrepreneurial activity.

University B's Engagement Strategy 2021 – 2025 (January 2020)	Set the staff and student success targets for the institution	Envisions to develop a school of entrepreneurship as a key driver for self-employment and entrepreneurship. Strives to shape the future through innovation and commercialisation of research outcomes.
Policy and procedure for the Vice-Chancellor's excellence awards for academic and academic support staff	Sets the policy and procedure for the excellence awards for academic and support staff at the institution	Sets the procedures for the award of the entrepreneurship award.