EFFECTS OF SELECTED FOURTH INDUSTRIAL REVOLUTION SKILLS ON ENTREPRENEURIAL READINESS BEHAVIOUR: THE MEDIATION OF THE ENTREPRENEURIAL PROCESS

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DECLARATION

I, STEFAN ANTON STRAMPE, identity number ############ and student number #########, do hereby declare that this research project submitted to the Central University of Technology, Free State for the degree of Doctor of Business Administration, is my own independent work, and it complies with the Code of Academic Integrity, as well as other relevant policies, procedures and regulations of the Central University of Technology, Free State, and has not been submitted before to any institution by myself or any other person in fulfilment of the requirements of any qualification.

15/01/2024

SIGNATURE OF STUDENT **DATE**

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DEDICATION

I dedicate this thesis to God Almighty for His guidance and wisdom. He gave me strength to walk this academic path and helped me keep on course during difficult times.

Secondly, this study is dedicated to my parents, who have been a source of emotional, spiritual and financial support. May this achievement fulfil the dream they envisioned.

Lastly, I dedicate this study to my wife for her love, encouragement and support. May this thesis broaden our chances for a bright future together.

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ABSTRACT

The advent of the Fourth Industrial Revolution (4IR) has challenged higher educational institutions to nurture skills that are not only relevant to the world of work, but also create alternative pathways to gainful employment. Even though the pursuit of nascent entrepreneurship by university students constitutes one of the important pathways to income generation in emerging contexts such as South Africa, it remains unclear which combinations of 4IR skills are ideal and relevant to the generation of entrepreneurial readiness behaviours such as new venture creation, innovative financing and venture growth. A recent body of entrepreneurship research identified soft skills, technical skills, and entrepreneurial skills as germane 4IR skills to impact entrepreneurial readiness behaviours, particularly new venture creation, innovative financing and venture growth. In view of the growing literature that acknowledges entrepreneurial process, especially opportunity identification, opportunity validation, opportunity exploitation, and resource mobilisation as fundamental to the materialisation of entrepreneurial readiness behaviours on the one hand, the ability of 4IR skills to drive the entrepreneurial process on the other, the study sought to establish the extent to which the entrepreneurial process mediates the relationship between 4IR skills and entrepreneurial readiness behaviours. Therefore, the scientific gap this study sought to address is the extent to which the entrepreneurial process mediates the relationship between selected 4IR skills and entrepreneurial readiness behaviours.

To address direct predictive and indirect relationships among the aforesaid variables and to address the objectives and hypotheses of this study, a descriptive, exploratory and explanatory cross-sectional survey was conducted among students enrolled at two South African universities. Drawing on a sample of 300 students and a self-administered questionnaire whose items were developed from mainstream entrepreneurship literature, students' perceptions and perspectives on 4IR skills, entrepreneurial readiness behaviour and entrepreneurial process were examined, including their associative and predictive relationships.

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The direct relationships between all dimensions of entrepreneurial readiness behaviours and those of the entrepreneurial process were deemed positive and statistically significant. The mediating role of the dimensions of the entrepreneurial process on the relationship between dimensions of 4IR skills and the dimensions of entrepreneurial readiness behaviour was also investigated. Opportunity identification partially mediated the relationship between entrepreneurial skills and innovative financing, while resource mobilisation partially mediated the relationship between entrepreneurial skills and two dimensions of entrepreneurial readiness behaviours, namely innovative financing and venture growth. Resource mobilisation and opportunity identification fully mediated the relationship between entrepreneurial skills and venture creation. No mediation was confirmed between the remaining variables.

The major theoretical contribution of this study to the body of entrepreneurial literature is that it demonstrates how the Human Capital Theory provides a useful lens for understanding different ways through which several 4IR skills interact with the entrepreneurial process in shaping specific forms of entrepreneurial readiness behaviours. The study broadens understanding on the capacity of human capital competences such as entrepreneurial and technical skills to complement the Theory of Planned Behaviour in explaining how the entrepreneurial process levers the development of specific entrepreneurial readiness behaviours. Drawing on this theoretical lens, the study demonstrated how, of all dimensions of the entrepreneurial process, opportunity exploitation does not exert any form of mediation between the dimensions of selected 4IR skills and the dimensions of entrepreneurial readiness behaviours.

This research also contributes to policy by demonstrating how alternative funding strategies such as innovative financing should be developed, based on an audit of students' 4IR skills. Policy strategies that support aspects of the entrepreneurial process are investigated to identify opportunities that could be exploited to create new ventures. Policies to stimulate resource mobilisation are explored to lever the extent to which they mediate the relationship between selected 4IR skills and entrepreneurial readiness behaviour.

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The study contributes to entrepreneurship practice by devising mechanisms of funding tailored to the entrepreneurial skills and entrepreneurial readiness behaviour of students. The study also discusses practical implications of compulsory entrepreneurial education for the development of entrepreneurship among students enrolled at different higher education institutions.

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ABBREVIATIONS AND KEY TERMS

4IR	Fourth Industrial Revolution
AI	Artificial Intelligence
CUT	Central University of Technology
EE	Entrepreneurial Education
HC	Human Capital
HEIs	Higher Education Institutions
IoT	Internet of Things
TPB	Theory of Planned Behaviour
UFS	University of the Free State
VC	Venture Capital

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CHAPTER 1 INTRODUCTION

1.1 INTRODUCTION

This study explores Fourth Industrial Revolution (4IR) skills that have the potential to facilitate student engagement in specific entrepreneurial readiness behaviours. For this study, 4IR skills denote skill categories that were inaugurated by the advent of 4IR and have a significant impact on universities preparing students for future occupations and lifelong learning. Such skills are critical for personal growth and entrepreneurial success (Deloitte, 2018b). Since entrepreneurial readiness describes a mental state that influences the tendency of a perspective entrepreneur to establish a business (Akolgo et al., 2018; Raza et al., 2019), entrepreneurial readiness behaviours constitute ways of acting, engaging and creating that exhibit student preparedness to participate in entrepreneurship and becoming entrepreneurs. There is a strong relationship between entrepreneurial readiness and entrepreneurial behaviour, specifically opportunity-based entrepreneurship (Raza et al., 2019). The conclusion is that one needs to demonstrate entrepreneurial readiness to effectively executive entrepreneurial behaviours.

Despite the logical connection between 4IR skills and entrepreneurial readiness behaviours (McAdam & Cunningham, 2019), it remains unclear how the entrepreneurial process shapes this relationship and the extent to which it does this (Mamabolo & Myers, 2020). For instance, the high incidences of high unemployment among graduates upon completion of their university education notwithstanding their possession of specific 4IR skills (Hu, 2019; Wu & Wu 2019) suggests that the 4IR skills-entrepreneurial readiness behaviours relationship might not be a direct one. This researcher argues that knowledge of the entrepreneurship process is critical for the translation of 4IR skills into precise behaviours that support entrepreneurial readiness. Although there are many issues embedded in the entrepreneurship process, those targeted in this study are opportunity identification, validation, exploitation and resource mobilisation (Urban 2016; Mokgosi, 2017; Clough et al., 2019) due to their quantifiable nature and their potential for empirical testing (Rambe, 2018; Clough et al., 2019).

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Although there are many skills which could be characterised as 4IR skills, including workforce readiness (Deloitte, 2018b; Gwata, 2019), complex problem solving, critical thinking and creativity (Reaves, 2019; Constantino & Rodzinka, 2022), the selected 4IR skills in this study are soft skills, technical skills and entrepreneurial skills (Deloitte, 2018b), which are considered critical in the new world of work (Wilson et al., 2017; Panah & Rusman, 2018) and potentially support the formation of behaviours that improve small business development (Demartini & Beretta, 2020). While previous research has examined current set of skills such as programming (Adendorff et al., 2018), job-specific skills (Ramraj & Marimuthu, 2021) and digital skills (Kunene et al., 2023) as broad skills that are fundamental for university students' readiness for the world of work, much of this literature (Amire et al., 2016; Xu et al., 2018; Kamaruzaman et al., 2019) takes an employment ready perspective. The current study is a sharp variation from this body of work and shifts attention from work-readiness towards entrepreneurial readiness. Although there has been an independent examination of 4IR skills, such as soft skills (Kirkley, 2016b), technical skills (Deloitte, 2018a) and entrepreneurial skills (Mamabolo & Myers, 2020), new literature has begun to emerge that suggests that an integrated approach that considers these skills collectively with reference to entrepreneurial behaviours is a more insightful and more effective approach to entrepreneurial research (McAdam & Cunningham; Raza et al., 2019). This holistic approach has been deemed critical to the greater resilience of university entrepreneurship students given the many disruptions of technological advancement and is useful for effective student engagement in future entrepreneurial careers (Naidu, 2018).

It has been argued that knowledge of these selected 4IR skills will further equip students with relevant entrepreneurial readiness behaviours (Pathak & Goltz, 2021) and prepares them to actively participate in entrepreneurship. The deep concern about the lack of student entrepreneurial readiness has been attributed to the lack of soft skills for future work (Stapleton, 2017). As such, the advent of 4IR has heightened the need to develop soft skills especially that of university students and graduates (Turner & Mulholland, 2017). It is common knowledge that digital disruptions have also necessitated the need for soft skills especially interpersonal interactions and social skills (Jameson et al., 2016; Teng et al., 2019) and human engagement-related skills (Gray, 2016; Chandy, 2017). Therefore, HEIs must impart nascent entrepreneurs such

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as university students with soft skills to enhance their entrepreneurial readiness, which can be occasioned by opportunity identification and opportunity exploitation (Barringer & Ireland, 2015)

OECD (2014) identifies technical skills as essential skills for entrepreneurs and entrepreneurial success (Almahry et al., 2018). Technical skills are those skills emphasising the application of technical know-how and technological expertise to work-related tasks, activities and actions. Furthermore, technical skills such as financial management skills equip youth with technical expertise to complete job-specific tasks (Deloitte, 2018a), which may sustain engagement in entrepreneurship (Crampton, 2018). Sariwulan et al. (2020) argue that technical skills are required to nurture entrepreneurship, while Almahry et al. (2018) state that technical skills include marketing, accounting, finance, growth management and goal setting to shape an entrepreneur's behaviour and attitude towards taking entrepreneurial action.

Entrepreneurial skills assist entrepreneurs to adapt to changes in the volatile landscape of 4IR. Olugbola (2017) suggests that motivational factors, identification of opportunities, and resources are important entrepreneurial skills that serve as key determinants of entrepreneurial readiness of humans. Entrepreneurial skills are those business and job creating skills occasioned by the identification and exploitation of economic opportunities (Deloitte, 2018a). Therefore, these are germane skills deemed critical to engagement in specific entrepreneurial behaviours (Ndofirepi & Rambe 2016; Modise, 2018; Putra et al., 2021; Rakićević et al., 2022).

This study locates the generation of appropriate entrepreneurial readiness behaviours within the discourses of the entrepreneurial process research and argues that possession of 4IR skills is important, but insufficient for the development of entrepreneurial readiness behaviours (Urban, 2016; Modise, 2018). The study, therefore, argues that students who possess the different sets of 4IR skills may exhibit entrepreneurial behaviours when they have sufficient knowledge of the entrepreneurial process. Moreover, evidence suggests that entrepreneurial readiness behaviours such as entrepreneurship learning are encouraged by knowledge of the entrepreneurial process (Rajasinghe & Mansour, 2018).

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By facilitating entrepreneurial readiness behaviours, this study addresses Sustainable Development Goals (SDGs) 1 (eliminating poverty, promoting decent work) and 8 (promoting economic growth), respectively. Entrepreneurship is important in eliminating poverty by developing skills that are indicative of excellent reliability and achieve the highest value amongst unemployed individuals (Meyer & Synodinos, 2019). Moreover, this study also addresses the Centre for Enterprise and Entrepreneurship (CEES) at the Central University of Technology's (CUT's) goal of supporting entrepreneurship research in academic communities. Addressing these SDG and CEE goals constitute a direct response to the call for HEIs to prepare students for 4IR challenges by formulating education strategies that fill the skills gaps demanded in their future careers (Grand-Clement, 2017; Boldureanu et al., 2020).

1.2 BACKGROUND TO THE RESEARCH PROBLEM

The advent of 4IR, which has been wrought by a wave of technological and industrial change (Marivate et al., 2021), has introduced profound changes to society and steered transformation of the job market. Therefore, higher educational institutions (HEIs) are struggling to grasp the impact of 4IR on students' future occupations. One area where these radical changes were introduced by 4IR is challenging students' current set of skills, which necessitates their increased preparedness for the world of work (Adendorff et al., 2018; Ramraj & Marimuthu, 2021; Kunene et al., 2023). There is an increased call for university students' awareness of the implications of 4IR as new skills shall be required in their new careers and transformed work environments (World Bank, 2016; Scepanovič, 2019; Li, 2022).

1.2.1 University student focus

The focus on university students is explained by multiple factors. First, university students represent a significant proportion of potential entrepreneurs (Jovičić-Vuković et al., 2020) as they span students in public universities, colleges and Technical and Vocational Education Training institutions. For instance, Facebook, one of the largest social networking sites, was created by Harvard students in one of their university dormitories (Rambe, 2009). Second, previous studies demonstrate a significant correlation between entrepreneurship and investment in entrepreneurship education of students (Zhang et al., 2014). Third, there is growing literature that suggests that

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student exposure to entrepreneurship education has significant potential to hone their entrepreneurial intentions (Fekri et al., 2012; Wurthmann, 2014; Xu et al., 2018). Moreover, the acquisition of new skills shall be required for students to thrive in the new technological landscape created by 4IR (World Economic Forum, 2016; Rios et al., 2020). Lifelong learning has become the norm as automation in the work environment exponentially expands, compelling the workforce to improve skills on a regular basis to prevent job losses (Gwata, 2019).

1.2.2 Significance of entrepreneurship education

Entrepreneurial education is a good source of entrepreneurial behaviours as Arasti et al. (2014) found a correlation between skills development and successful ventures. Similarly, the significance of entrepreneurial education in shaping entrepreneurship dispositions is alluded to by Mamabolo et al. (2017a) and Lyons et al. (2020) who validated the impact of these skills on venture creation and venture growth. The consideration of a skills perspective enabled by entrepreneurship education is supported by Pratomo et al. (2018) who concluded that entrepreneurial readiness is an outcome of a combination of skills required for entrepreneurial activities and attitude. Consistent with this narrative, Wulandari et al. (2021) maintain that entrepreneurial readiness involves ability, motivation and identification of opportunities and mobilisation of resources for entrepreneurial performance. Entrepreneurial readiness is, therefore, a function of behaviour, attitude, skills and ability to discover business opportunities and to sustain successful entrepreneurial ventures (Adeniyi et al., 2023). In short, entrepreneurial readiness is an outcome of a specific set of skills and dispositions.

1.2.3 An integrated skills approach

Although there is much literature on skills required by entrepreneurs, most of it has focused on abilities and knowledge (Stowe et al., 2010; Purzer et al., 2016; Schleicher, 2018a). As such, there remains no clarity on the combination of specific skills required by entrepreneurs in the context of 4IR (Morales & Marquina, 2013). This study, therefore, investigates the selected 4IR skills namely soft skills, technical skills, and entrepreneurial skills (Deloitte, 2018b). The need to investigate the three sets of 4IR

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skills is predicated on growing pressure from the African National Congress (ANC) government for South African universities to embrace the fundamental changes brought by the 4IR to increase student readiness to engage in entrepreneurship as an alternative pathway to seeking employment. In 2020, the Entrepreneurship Development in Higher Education (EDHE) Community of Practice (CoP) for Entrepreneurial Universities launched the University Entrepreneurship Ecosystem Baseline Report, which articulates the importance of creating different career pathways for graduate students (National University Entrepreneurship Ecosystem Baseline Report, 2020). The Baseline Report also emphasises introducing youth to entrepreneurship curricula at an earlier stage and increasing awareness of entrepreneurship as the first option for economic participation endeavours (National University Entrepreneurship Ecosystem Baseline Report, 2020).

With the greater concerns globally that advances in automation shall alter the nature of work, ultimately causing widespread unemployment and disruption in the occupation environment (Omarjee, 2018; Ramraj & Marimuthu, 2021), there are increasing calls for HEIs to equip students with entrepreneurial skills in a rapidly evolving entrepreneurial and global environment. HEIs are expected to develop and nurture entrepreneurial behaviours (Bygrave, 2004; Wong, 2011; Darwish et al., 2018), whose readiness requires some knowledge of the entrepreneurial process. In short, as pathways to gainful employment get increasingly bleak, students are expected to create alternative pathways to employment through entrepreneurship.

1.2.4 The entrepreneurship process as a mediation mechanism

Despite the growing literature that show direct links between different skills and certain entrepreneurship behaviours (Schillo et al., 2016; McAdam & Cunningham; Raza et al., 2019), the diversity of outcomes of entrepreneurial readiness behaviours seems to suggest that there could be some mechanisms through which these different skills interact in shaping these behaviours. One widely discussed mechanism through which such skills would impact the entrepreneurial behaviours is the knowledge of the entrepreneurial process. The knowledge of the entrepreneurial process is, therefore, crucial to the conversion of skills into specific entrepreneurial behaviours (Martin et al., 2013; Youth Business International, 2019).

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The objective of this research is to synthesise selected 4IR skills and entrepreneurial behaviour into a framework that accommodates the entrepreneurial process towards growing student venture. The framework decomposes the complexity of entrepreneurial behaviour into three dimensions namely; venture creation (Kirkley, 2016a), innovative financing (Cardone & Fonseca, 2006; Prelipcean et al., 2014) and venture growth (Rwigema & Venter, 2004; Mamabolo et al., 2017a). Galanakis and Giourka (2017) support this notion by exploring the nature of skills, depicting factors promoting entrepreneurial activity and those that contribute to entrepreneurial venture success. These skills affect an entrepreneur's ability to execute actions to benefit from ideas and opportunities (Lamine et al., 2014; Galanakis & Giourka, 2017) as well as to facilitate successful venture creation.

1.2.5 The dimensions of the entrepreneurial process

Extant research proposes sub-processes to analyse the entrepreneurial process (Vogel, 2017). According to Perrini et al. (2010), the entrepreneurial process has five phases, namely opportunity identification, opportunity evaluation, opportunity formalization, opportunity exploitation and opportunity scaling up. Mets et al. (2013) propose that the entrepreneurial process include actions such as generation of ideas, opportunity recognition, opportunity development, opportunity exploitation and venture launch. For this study, we preferred opportunity identification, opportunity evaluation, opportunity exploitation and resource mobilisation as they have been widely discussed in literature as critical to successful preparedness of successful launching of ventures (Dimov, 2011).

1.2.6 Rationale for examining entrepreneurial behaviours in 4IR contexts

Entrepreneurial knowledge is vital in creating individual awareness, resulting in the changing of attitudes, which in turn alters entrepreneurial behaviour (Martin et al., 2013; Nasution et al., 2020). Previous research focused on factors that influence entrepreneurial readiness to support new venture creation in terms of motivational factors, opportunity identification, resources and entrepreneurial ability (Olugbola, 2016). Pardiman and Khoirul (2020) indicate that entrepreneurial readiness

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behaviours include physical, mental, and spiritual personal preparation, personality preparation, skill development preparation, business and venture activity preparation, and product marketing ability preparation. Extant research has further acknowledged the social embeddedness of entrepreneurial behaviours (Welter & Smallbone, 2011) for example the motives of entrepreneurs for creating ventures in the context of the environment conditions. The influence of self-efficacy on entrepreneurial behaviour has also been covered extensively (Shaheen & AL-Haddad, 2018). Though this study acknowledges previous research on entrepreneurial behaviour, the evolving nature of 4IR requires a new approach to improving entrepreneurial behaviours through skill acquisition for effective engagement in the entrepreneurial process. Raza et al. (2019) express the strong correlation of entrepreneurial readiness with entrepreneurial behaviour as measured by opportunity-based entrepreneurship.

This research study builds on previous research of Kirkley (2016) and Mamabolo et al. (2017a) where venture creation, innovative financing and venture growth are classified as the three dimensions of entrepreneurial readiness behaviour. New venture creation is regarded as one of the most relevant topics to entrepreneurship on which theories of management and organisational behaviour are built. The topic has evolved extensively in 4IR and comprehensive research is long overdue (Shepherd et al., 2020).

Entrepreneurial readiness behaviour, which manifests in this research study in venture creation, innovative financing and venture growth, is promoted by developing soft skills and exposing entrepreneurs to new ideas, as required by shifting workplace trends (Youth Business International, 2019). Moreso, entrepreneurial readiness behaviour should also include technical skills (Deloitte Global & the Global Business Coalition for Education, 2018; Petrillo et al., 2018) to become more adaptive to transformation, improve creativity and strengthen decision making (Henry et al., 2005; Dongo, 2019). In the current 4IR environment, relevant entrepreneurial skills are needed to enhance entrepreneurial behaviour within a favourable social environment (Farooq & Radovic-Markovic, 2016).

The significant shifts caused by 4IR require a new approach to training and improving entrepreneurial behaviours, applying entrepreneurial capabilities and skills to create

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value within different environments and contexts (Cooney, 2012; Ratten & Usmanij, 2021).

1.3 STATEMENT OF THE PROBLEM

A growing body of literature on 4IR skills emphasises student preparedness for the world of work (World Economic Forum, 2016; Eberhard et al., 2017; Panah & Rusman, 2018; Arek-Bawa & Reddy, 2022). However, the same studies also paint a bleak picture of disruption of the job market by the 4IR, leading to the disappearance of multiple job opportunities (Prifti et al., 2018). Given this changing job environment and the erasure of certain job categories, it is crucial to understand the importance of entrepreneurial capabilities and skills in creating value within different environments and contexts (Cooney, 2012; Ratten & Usmanij, 2021). The possession of 4IR skills almost guarantees the creation of new career pathways, such as engagement in entrepreneurial behaviours.

However, the realisation of entrepreneurial readiness behaviours, which are contiguous with the possession of 4IR skills (Raza et al., 2019), does not happen in a vacuum. Previous research (Bruyat & Julien, 2001; Shane, 2012; Kuckertz et al., 2017) has indicated that the entrepreneurial process does not have a unified classification for describing the entrepreneurship approach. We interpreted this to mean that how the entrepreneurial process interacts with various antecedents in shaping specific entrepreneurial behaviours cannot be assumed to be uniform across all contexts. As such, one needs to consider a case-by-case approach to the mechanisms through which 4IR skills interacts with the entrepreneurial process in shaping entrepreneurial outcomes. Yet, how this set of 4IR skills interacts with the entrepreneurial process in shaping entrepreneurial readiness behaviour in the context of university students remains a grey area.

The entrepreneurial process must be understood in terms of its dimensions to fully understand its mediation potential rather than consider it as a unilinear concept. Shane and Venkataraman (2000) specify three dimensions to the entrepreneurial process such as opportunity identification, opportunity validation and opportunity exploitation. Clough et al. (2019) insisted that there is a close integration between resource

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mobilisation and opportunity identification in the entrepreneurial processes. As a result, opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation are targeted to represent the entrepreneurial process due to their potential to trigger germane entrepreneurial outcomes (Rambe, 2018; Clough et al., 2019).

The knowledge of the entrepreneurial process is fundamental to the conversion of 4IR skills into specific entrepreneurial behaviours (Martin et al., 2013; Youth Business International, 2019). Therefore, the missing link in entrepreneurial literature is the knowledge of what role the entrepreneurial process plays, and the significance thereof in the relationship between specific 4IR skills and promotion of entrepreneurial readiness behaviours. This is the crucial gap addressed by this study.

1.4 RESEARCH OBJECTIVES, HYPOTHESES AND AIM

1.4.1 Main and subsidiary objectives

1.4.1.1 Primary objective

1. The primary objective is to examine the effect of 4IR skills on the entrepreneurial readiness behaviours of students and the extent to which the entrepreneurial process mediates this relationship.

1.4.1.2 Secondary objectives

1. To investigate the effect of the selected 4IR skills on entrepreneurial readiness behaviours.
2. To investigate the effect of the selected 4IR skills on the entrepreneurial process.
3. To examine the effect of the entrepreneurial process on the entrepreneurial readiness behaviours
4. To determine the extent to which the entrepreneurial process mediate the process between 4IR skills and entrepreneurial readiness behaviours.

1.4.2 Research hypotheses

The research objectives were set to establish the following hypothesis:

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The main hypothesis

H_0: There is a positive and statistically strong relationship between selected 4IR skills and entrepreneurial readiness behaviours of students, and the entrepreneurial process fully mediates this relationship.

Secondary hypotheses

H_1: There is a positive and statistically significant relationship between soft skills and entrepreneurial readiness behaviours.

H_2: There is a positive and statistically significant relationship between technical skills and entrepreneurial readiness behaviours.

H_3: There is a positive and statistically significant relationship between entrepreneurial skills and entrepreneurial readiness behaviours.

H_4: The entrepreneurial process fully mediates the 4IR skills-entrepreneurial readiness behaviours relationship.

H_5: Opportunity identification fully mediates the relationship between soft skills and venture creation.

H_6: Opportunity validation fully mediates the relationship between technical skills and innovation financing.

H_7: Opportunity exploitation fully mediates the relationship between entrepreneurial skills and venture growth.

1.4.3 Aim

The study contributes to entrepreneurial research, specifically on the role of the entrepreneurial process in shaping entrepreneurial behaviours in a complex 4IR climate characterised by disruption of the current job market and disappearance of certain traditional careers. This study contributes to the integration of disparate literature that that currently addresses the three concepts independently. For instance, one body of literature considers the importance of 4IR skills in developing a better understanding of the entrepreneurial process (Mamabolo & Myers, 2020). There are also some studies that emphasise the potential of developing 4IR skills to support the growth of entrepreneurial readiness behaviours. Other sources connect the entrepreneurial process to the nurturing of entrepreneurial readiness behaviours

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(Markowska, 2018; Pathak & Goltz, 2021). This study, therefore, merges the three strands of literature by investigating the connection between the three concepts to determine the extent to which the entrepreneurial process mediates the interaction of 4IR skills with entrepreneurial readiness behaviours.

1.4.4 Novelty of the study

This research study is novel in the sense that, although the 4IR skills critical for the future of work are relatively known and sufficiently discussed in human development literature, the 4IR skills seminal to the realisation of entrepreneurship behaviours remain speculative (Raza et al., 2019). This study is innovative in that it extends literature on 4IR skills central to the ever-changing labour market by examining such skills with reference to improving entrepreneurial readiness behaviours of final year university students about to enter the job market.

The speculation on the contribution of 4IR skills needed to support entrepreneurial readiness behaviours (Raza et al., 2019) further complicates the knowledge of the actual contribution of the entrepreneurial process to the 4IR skills-entrepreneurial readiness behaviour relationship. The uniqueness of this study, therefore, lies in exploring how the entrepreneurial process mediates the 4IR skills-entrepreneurial readiness behaviour relationship. This study investigates the extent of mediation of different dimensions of the entrepreneurial process.

To the extent that the study draws its samples from diverse disciplines and different universities, it sheds light on whether disciplinary differences in terms of 4IR skills impact entrepreneurial readiness behaviours. The study is also novel as it compares the 4IR skills of students from similar disciplines from different universities to establish if contextual differences regarding possession of 4IR skills have a bearing on the knowledge of the entrepreneurial process and entrepreneurial outcomes, especially readiness behaviours. Overall, the knowledge of the necessary 4IR skill sets equips students in HEIs for the challenges inaugurated by 4IR and for their future entrepreneurial careers.

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1.5 METHODOLOGY

This section abridges the methodology adopted in this study. Research methodology is defined as the different methods utilised in structuring a study, as well as gathering and analysing data in the investigation (Quinlan et al., 2015). The study adopted a positivist epistemology as it employed a quantitative research approach to measure data numerically in exploring relationships between variables. The study is descriptive, exploratory and explanatory cross-sectional in nature. It is descriptive as it systematically describes the nature and character of the phenomenon of entrepreneurial readiness behaviours and its antecedents in two university contexts in a developing country. The study is exploratory as it strives to clarify the lacuna on the role of the entrepreneurial process in mediating the interaction between selected 4IR skills and entrepreneurial readiness behaviours. The study is explanatory to the extent that it employs inferential statistics to explore causal relationships between these three variables. Furthermore, a deductive approach to quantitative data was adopted in this research study.

Data was collected through an online questionnaire tool, Google Forms. This was sent to students via email and was added to the students' university portal that is used for online classes. These students were drawn from Economic and Management Sciences, Natural and Agricultural Sciences, Health and Environmental Sciences, Engineering and Information Technology, Education, as well as Management Sciences at two universities. The total population of final year students in CUT (three study fields) is approximately 2 973 and at UFS (three study fields) it is approximately 4 379. Therefore, the total population of students in various fields of study is 7 352. The sample generated from the total number of final year students at the two institutions was 348 as determined by an online sample size calculator. Statistical Package for the Social Science (SPSS) and Smart Partial Least Squares (PLS), together with Process macro were used for analysing the data collected.

Research reliability refers to the degree of consistency and stability of the research method. Measurement is considered as reliable when the same results are obtained after repetitive studies on the same object of measurement (Dudovskiy, 2018). To ensure reliability, the research instrument was pilot tested with 30 respondents. Data

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reliability was tested by using Cronbach's Alpha in SPSS. Measurement procedures were reliable, and even though it is not a necessary condition for a research study to be considered valid (Mohajan, 2017). Validity describes how logical, truthful, meaningful, reasonable and useful the research measurement is (Quinlan et al., 2015). The validity of constructs used for the measurement model was assured using face validity and content validity. Face validity comprised checking the research instrument for its completeness, precision in questions asked and eliminating cumbersome questions and arranging them in a way that eliminated confusion and vagueness. Moreover, during data analysis validity was determined using convergent and discriminant validity (Hair et al., 2011; Rambe & Khaola, 2021). Content validity was assured by drawing on mainstream literature covering concepts examined.

Ethical standards guiding research into human subjects guided this investigation. A conceptual framework was used while completing this research study. The principles of voluntary participation, informed consent, informed disclosure, privacy and anonymity informed this investigation. For instance, participants were informed of their rights to voluntarily participate in the study and their anonymity was guaranteed. They were informed of the purpose of the research and envisaged benefits of their participation. The researcher sought ethical clearance from the Ethical Clearance Committee before commencing with data collection.

1.6 CHAPTER SUMMARY

The initial chapter commenced with defining and explicating 4IR skills and entrepreneurial readiness behaviour. Secondly, the 4IR skills were assessed with reference to their effects on the realisation of entrepreneurial behaviours. Thirdly, the entrepreneurial process was discussed and arguments were presented on its potential to mediate the 4IR skills-entrepreneurial behaviour relationship. Fourthly, the research objectives, hypotheses and aim of the research study were presented, where-after the methodology was outlined. Finally, the ethical considerations were discussed.

The next chapter renders a discussion on 4IR skills, the dimensions of 4IR skills, the importance of entrepreneurial education, theories of 4IR skills acquisition and the importance of 4IR skills.

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CHAPTER 2 4IR SKILLS

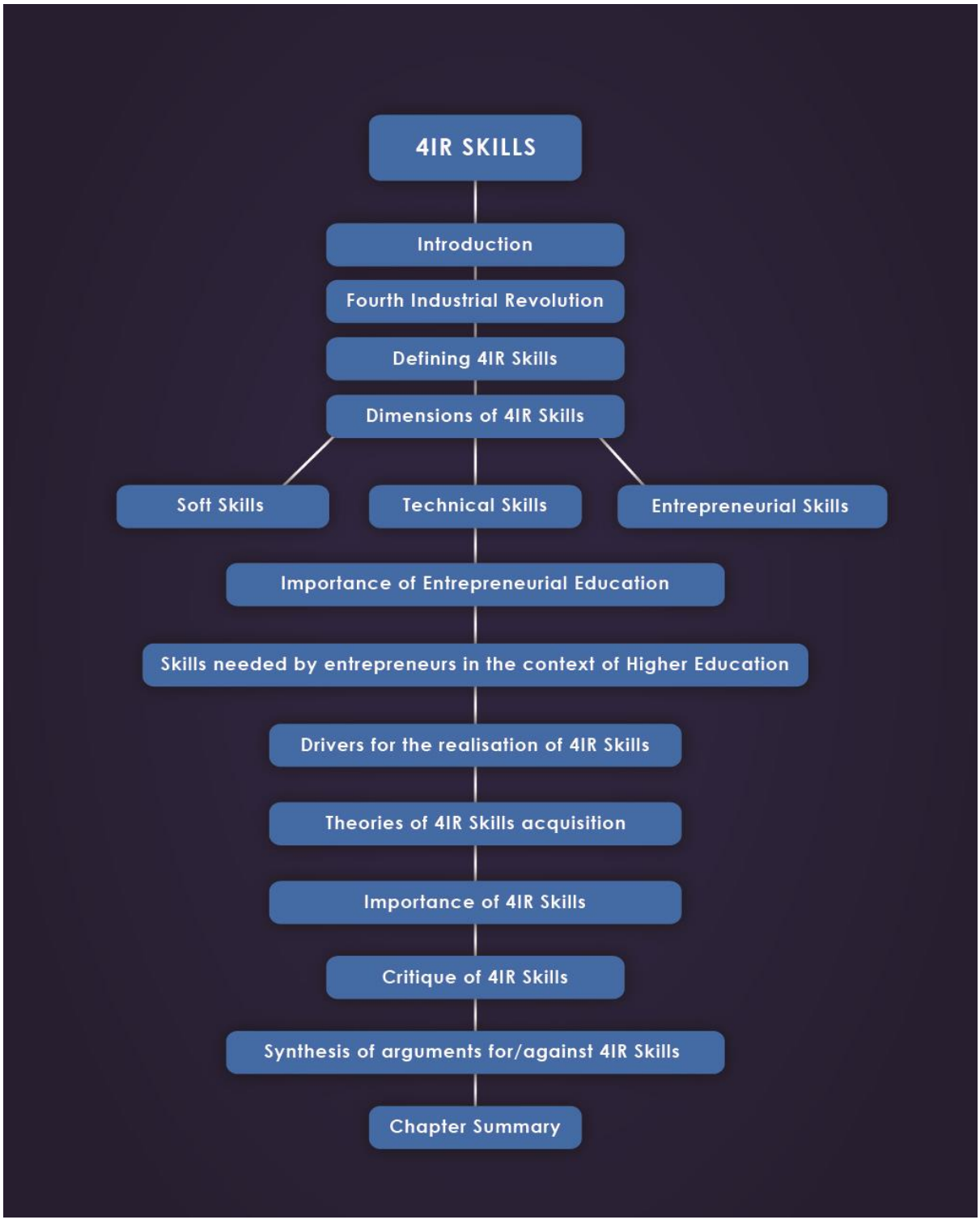

Figure 2. 1: Flow diagram indicating the structure of Chapter 2

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2.1 INTRODUCTION

The initial chapter provided an orientation to the study, focusing on entrepreneurial readiness behaviour and the main drivers of the Fourth Industrial Revolution (4IR) skills. The chapter also provided a cursory perspective on how the entrepreneurial process mediates in the relationship between 4IR skills and entrepreneurial readiness behaviour. The second chapter builds on this narrative by examining in comprehensive detail the concept of 4IR skills with specific emphasis on its constituents, the theoretical underpinning, the drivers of the concept and its importance. The chapter concludes with a synthesis of the arguments in support of, and those against, the application of the concept.

2.2 THE FOURTH INDUSTRIAL REVOLUTION

For one to fully appreciate the Fourth Industrial Revolution, it is critical to define the "industrial revolution." The "Industrial revolution" comprises the transformation of the technological, economic and social components in industry, with emphasis on changes in economic wealth, living conditions and circumstances of labour (Dombrowski & Wagner, 2014). Despite the complexity of precisely characterising each revolution, there is general consensus among researchers that there have been four revolutions namely, the First Industrial Revolution (1IR), the Second Industrial Revolution (2IR), the Third Industrial Revolution (3IR) and the Fourth Industrial Revolution (4IR). 1IR involved steam mechanisation (knowledge formulation), while 2IR targeted electrification and mass production (knowledge evolution). The Third Revolution comprised computerisation and knowledge distribution, while 4IR consists of cyber-physical systems and artificial intelligence robots (knowledge mutation) (Xing et al., 2018). Even though these revolutions are much more complex than this simple narrative, the fact that there are common characteristics that coalesce around each revolution, make every one of these revolutions much more distinct from the other.

In view of the reality that many organisations such as South African universities, are striving to realise entrepreneurship, while operating in the wave of the Fourth Industrial Revolution (4IR), necessitates defining this concept. Although the 4IR builds on previous revolutions emphasising knowledge formulation, knowledge evolution and knowledge distribution, respectively (Xing et al., 2018), the 4IR is fundamentally

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different from the previous revolutions. A part of 4IR consists of emerging technologies built on the digital revolution and is embedded within societies, as well as the human body (Davis, 2016). This is based on its strong emphasis on digital connectivity and advances in communication enabled digital technologies and the merging of the physical, biological and cyber worlds (Schwab, 2017). Such blurring of the boundaries between physical, biological and digital aspects of human life has enabled critical changes in the nature of skills. Similarly, society, industry and the economy are significantly impacted by these rapidly mutating technologies (Xing & Marwala, 2018).

To build on - and benefit - from these technological changes, South African universities need to actively contribute to entrepreneurship education, specifically focusing on selected 4IR skills. Bainbridge and Roco (2016) agree that universities need to focus on the changes as brought about by 4IR, necessitates new skills, such as advanced specialised skills that are in significant demand in the workforce to contribute to new knowledge and technology requirements. This argument positions skills required by 4IR as integral to the realisation of entrepreneurial behaviours of university students, as obtaining cross-functional skills should be a focus point in the context of education to establish a thriving work environment in the context of the 4IR (Xu et al., 2018).

Having defined the Fourth Industrial Revolution, the next section renders a comprehensive account of 4IR skills. A solid grasp of the 4IR skills broadens an understanding of the drivers of entrepreneurial behaviours, following which universities can equip students with the required skills to improve their entrepreneurial readiness behaviours.

2.3 DEFINING 4IR SKILLS

The knowledge of what composites 4IR skills becomes skewed without recourse to defining a skill. Therefore, this section provides a working definition of a skill before defining 4IR skills. A skill connotes the capacity and ability needed to perform a process or activity successfully (Pfrommer et al., 2013). Such a skill can be improved through understanding and judgment (Davies, 2008). Subsequently, abilities form part of the required core skill set, in supplement to basic skills and cross-functional skills

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(World Economic Forum, 2016). The skills described in Figure 2.2 are further elaborated.

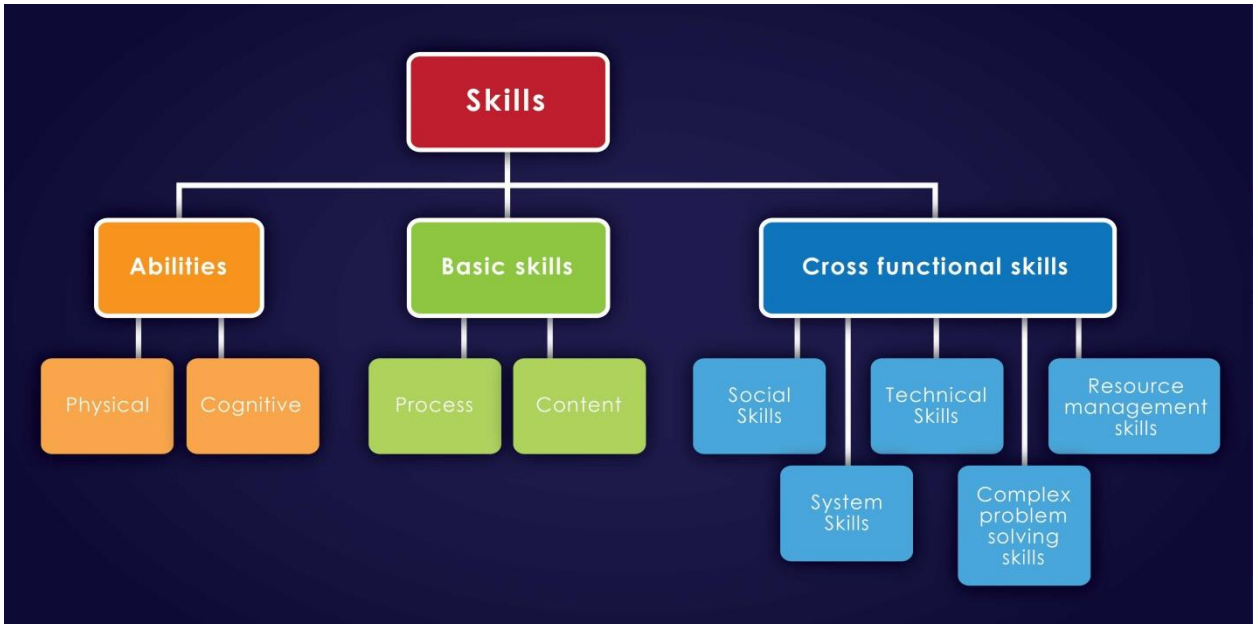

Figure 2. 2: Core skills required for 4IR
(Source: Adapted from World Economic Forum, 2016)

The educational environment must be improved by incorporating 4IR if it is to remain relevant within the exponentially developing technologies. Through adapting to the changes brought about by 4IR, educational institutions could ensure that graduates are equipped with the required skills and knowledge to enhance entrepreneurial behaviours. There is growing literature (Collins & Halverson, 2009; Naidu, 2018) that emphasise the possession of 4IR skills as critical to engagement in entrepreneurial careers in the context of 4IR. For instance, the development of 4IR skills is deemed fundamental to venture creation (Kirkley, 2016a), innovative financing (Cardone & Fonseca, 2006; Prelipcean et al., 2014) and the growth of ventures (Rwigema & Venter, 2004; Mamabolo et al., 2017a). Thus, a clear appreciation of 4IR skills is necessary to understanding the drivers of entrepreneurial behaviours demanded by this revolution. The World Economic Forum (2016) provides a comprehensive account of the core skills of 4IR (see Figure 2.2 above) comprising abilities, basic skills and cross functional skills. These skills are elaborated hereunder:

- *Abilities*: This entails the capacity to act physically and mentally. Physical ability entails physical alertness, mental alertness, precision and manual dexterity.

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Cognitive abilities comprise creativity, problem sensitivity, logical reasoning, mathematical reasoning and a flexible mind-set.

- *Basic skills*: These skills are divided into process skills and content skills. Process skills require critical thinking, active listening, self-awareness and monitoring others. Content skills require reading comprehension, Information and Communication Technology (ICT) literacy, active learning and written expression.
- *Cross-functional skills*: Cross-functional skills include technical skills, system skills, social skills, resource management skills and complex problem solving skills.

In the context of this study, these core skills act as building blocks for selected 4IR skills where abilities such as logical reasoning and creativity enhance entrepreneurial behaviour which sustains competitive advantage and venture growth (Friedrich et al., 2003; Bayon et al., 2015). Similarly, critical thinking and self-awareness facilitate the identification of opportunities (COEFS, 2017), which is pivotal to the development of entrepreneurial behaviours such as venture creation and innovative financing. Core skills is a comprehensive term, which encompasses technical skills such as problem solving skills (Darroch & Clover, 2005, Kim et al., 2018), job-specific skills (Tustin, 2003; Rwigema & Venter, 2004) decision-making skills (Glancey et al, 1998; Hogarth & Kareila, 2012; Bayon et al., 2015) and soft skills such as motivation (Kirkley, 2016b), communication (Nieman, 2006; Lefebvre, 2015), networking (Drakopoulou, 2002; Jansen, 2003; Doblinger, et al., 2015) and building long-term relationships (Rwigema & Venter, 2004; Nieman, 2006; Neneh, 2011). These skills facilitate the growth of new ventures through the entrepreneurial process that mediates this relationship.

While the classification of 4IR skills is comprehensive, it is in no way an exhaustive differentiation of the dimensions of these skills. The core skills articulated by the World Economic Forum (2016) could be conceived as general skills rather than 4IR skills as they lack that specificity to promote entrepreneurial behaviours. Although the abovementioned abilities, basic skills and cross-functional skills may not cover all skills, the WEF cluster provides a useful point of departure for understanding selected 4IR skills required to improve entrepreneurial readiness behaviours.

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2.4 DIMENSIONS OF 4IR SKILLS

This study identifies selected 4IR skills that students must acquire to survive and/or thrive in this evolving technological landscape caused by 4IR. The skills as discussed by Deloitte (2018b) qualify as 4IR skills, as they provide unique entrepreneurial opportunities to assist students to adapt to changes and enhance their skill set for future job opportunities (Deloitte, 2018a). Contemporary universities increasingly emphasise the importance of the future of work through encouraging the acquisition of cognitive skills (Frey & Osborne, 2015), however the dimensions of the selected 4IR skills fundamental in this study are soft skills, technical skills and entrepreneurial skills (Deloitte, 2018b).

2.4.1 Soft skills

There are different perspectives on the concept of soft skills, as noted in previous studies. According to Moin and Biswal (2012), soft skills are connected to personal habits, personality traits, social relationships, language, and communication. Thus, soft skills can be grouped into organisational skills, leadership skills, self-development skills, interaction skills and communication skills.

Alternatively, soft skills comprise the complete constellation of our communication, self-management and social behaviours that are crucial for professional success (Müller et al., 2015). Soft skills are perceived as interpersonal skills and behavioural skills, as they impact an individual's ability to communicate and relate to other people. People skills promote success, whilst interaction skills are critical for making presentations and building relationships. Therefore, one must be capable of communicating efficiently with different personalities in diverse circumstances. Furthermore, communication skills are essential when receiving information from different clients to determine their needs (Andrews & Higson, 2008; Dean & East, 2019).

Other studies conclude that a variety of soft skills are required to succeed, including conflict resolution, motivation and leadership (Halfhill & Nielsen, 2007; Lyons, 2007; Kirkley, 2016b). Reaves (2019) argues that soft skills exclude specific technical experience or knowledge, but comprises problem solving, creativity, critical thinking,

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leadership, empathy and teamwork. Although all these definitions explain the concept of soft skills, the relationship between soft skills and student entrepreneurs, as well as their entrepreneurial behaviour is not evident.

Soft skills training is insufficient in HEIs and this challenge is compounded by the fact that employers typically do not expose employees to soft skill training either (Bertolini & Giglio, 2017). To cope with the ever-changing environment, a proactive approach in training and educating students in a variety of soft skills to improve their entrepreneurial behaviours becomes imperative. Soft skills are difficult to acquire; they are the most important for success of an entrepreneur in terms of (for example), accessing venture capital from investors and accessing contracts from government agencies. Moreover, soft skills such as productivity, leadership, team management, communication and sales skills influence behaviours and habits of entrepreneurs when undertaking a project.

Although difficult to acquire, soft skills can be taught to students to develop their entrepreneurial behaviours (UPV, 2019). For instance, the Human Capital Theory recognises the assessment of soft skills (a dimension of 4IR skills) and comprises knowledge, skills and abilities integral to the development of human capabilities (Deloitte, 2018b). The assessment of soft skills is encouraged to arrive at a selected skill set to improve entrepreneurial behaviour. Soft skills such as critical thinking, creative thinking and problem solving, moral and professional ethics, teamwork, leadership, emotional intelligence, communication and entrepreneurship (Ibrahim et al., 2017) are encouraged in the development of a comprehensive skill set that ultimately complements entrepreneurial behaviour.

After developing soft skills, it is vital to apply the necessary soft skills in an entrepreneurial environment. The challenge of applying soft skills is evident, as Sousa (2018) suggests that entrepreneurs and universities should rethink their strategies towards skills development in a more integrated approach to respond to the challenges of the labour market. The challenges that arise from not improving soft skills impact employment, thus more engagement in training and education is required (Andrews & Higson, 2008; Mamabolo et al., 2017b; McCracken et al., 2017).

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2.4.2 Technical skills

There are different viewpoints on the significance of technical skills in literature. According to Jain and Anjuman (2013), technical skills are more tangible and easier to identify than soft skills. These are more concrete and job specific. Moreover, Gonçalves et al. (2017) regard technical skills as a requirement for an entrepreneur to execute job specific activities that ensure a successful venture. However, other research contradicts this position. For instance, Watts and Watts (2008) and Kačamakovic (2021) state that technical skills contribute as little as 15% and soft skills add up to 85% to an entrepreneur's success. These mixed reviews complicate the desiderata of aligning technical skills to the development of student entrepreneurs.

To evaluate the importance of technical skills, relative to entrepreneurial behaviour, the concept of technical skills must be understood. Technical skills consist of the capabilities essential for specific jobs associated with professional knowledge, techniques and tools (Müller et al., 2015). Furthermore, Parente et al. (2012) argues that technical skills such as planning and decision-making are integral to engagement in entrepreneurial behaviours. Students should be motivated to develop conceptual knowledge and business-related technical skills to complete actions vital to performing the entrepreneurial profession (Andrews & Higson, 2008). To fully benefit from the opportunities availed by 4IR, Deloitte (2018a) recommends the development of technical skills and targeted training among student entrepreneurs.

The studies discussed previously are based on Katz's theory where technical skills form part of the triplet managerial skills, namely technical skills, human skills and conceptual skills (Katz, 1991; Hassell et al., 1998; Ahmadi, 2011). According to Katz's theory, technical skills are relevant in lower management level (Katz, 1974; Robbins & Decenzo, 1998; Laud et al., 2016), however, since technical skills are relevant to the development of entrepreneurial behaviour, especially in the context of the 4IR, this set of skills is yet to be fully understood. Specific technical skills are required to overcome challenges in an ever-changing technological environment to enhance entrepreneurial readiness behaviours. More so, since technological transformation demands improved technical knowledge (Gundry & Welsch, 2001; Man et al., 2002;

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Rwigema & Venter, 2004; Trivedi, 2019), students that develop their technical skills during 4IR are expected to reflect higher levels of entrepreneurial behaviour.

2.4.3 Entrepreneurial skills

The possession of specific skills is vital for students considering a career in entrepreneurship (Lackéus, 2015). Chell (2013) argues that previous studies on entrepreneurial skills focus mainly on the theoretical aspect and inadequate research has been done on empirical evidence on the actual possession of these entrepreneurial skills. Mamabolo and Myers (2020) further state that extant research focus primarily on entrepreneurial skills, without distinguishing which skills are needed at each stage of the entrepreneurial process.

Perhaps the lack of clarity on entrepreneurial skills set could be attributed to tan elastic definition of entrepreneurial skills. One reason for the elasticity in the definition could be attributed to differences in skill requirements in developing and developed countries (Morales & Maquina, 2013). Many authors (COEFS, 2017; Deloitte, 2018a; Prifti et al., 2018) have not provided a precise definition of entrepreneurial skills. However, Nwafor (2009) and Umunadi (2014) define entrepreneurial skills as skills acquired by an entrepreneur to function effectively in a venture. Furthermore, entrepreneurial skills comprise knowledge and skills that enable an entrepreneur to identify, and develop, opportunities into successful ventures (Jardim, 2019).

Although studies on entrepreneurial skills are increasing worldwide (Loué & Baronet, 2012; Deakins et al., 2016; Shabbir et al., 2016; Jardim, 2021), the shortcoming lies in the insufficient research conducted on entrepreneurial skills specifically required by student entrepreneurs. Existing research focuses on entrepreneurial skills without exploring the intentional development of entrepreneurial skills of student entrepreneurs. Jardim et al. (2020) argue that students exhibit deficiencies in entrepreneurial skills such as resilience (Lee & Wang, 2017), initiative (McCallum et al., 2018), problem solving (Grecu & Denes, 2017), ability to work in a team (Amorim Neto et al., 2020), ability to create valuable products (Blumberg & Pfann, 2016) and self-efficacy (Fellnhofer, 2017). Low levels of entrepreneurial skills therefore lead to challenges regarding entrepreneurship and consequently economic development. As

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such, the lack of entrepreneurial skills and low percentage of potential entrepreneurs with the relevant skill set contributes to entrepreneurial inactivity, as well as the low number of entrepreneurs who can identify opportunities to create new ventures (Adendorff et al., 2013; Meyer & Synodinos, 2019).

Although entrepreneurs require different skills at each stage of the entrepreneurial process (Pretorius, 2001, Marvel, 2013, Mamabolo, et al., 2017a), two theories, namely Schumpeter's theory and Kirzner's theory, provide perspective on the aforementioned stages. Schumpeter's (1934) theory of entrepreneurship, founded on innovation, differs substantially from Kirzner's (1973) theory, which is grounded on opportunity recognition (Mamabolo et al., 2017a). However, Maritz and Amarsadi (2015) agree that opportunity identification and opportunity exploitation are fundamental constructs of the entrepreneurial process. Thus, the ability to identify and exploit opportunities are essential skills needed in the entrepreneurial process. Letaifa and Goglio-Primard (2016) indicate that students who possess entrepreneurial skills, such as to identifying and exploiting opportunities, are better positioned to establish new ventures thereby triggering entrepreneurial behaviours. According to Unger et al. (2011), entrepreneurial skills are an important contributor in the performance and success of ventures. An improved understanding of what the entrepreneurial process entails thus mediates the linkage of entrepreneurial skills and entrepreneurial behaviours, such as new venture creation.

Entrepreneurial skills adopt the perspective of Human Capital Theory, which indicates that skills are the result of investment in work experience and education (Becker, 1964; Chell, 2013; Unger et al., 2011). Human capital assists entrepreneurs to benefit from entrepreneurial skills as well as training according to their stages of development and their activity in each stage of the entrepreneurial process (Mamabolo et al., 2017a).

Entrepreneurial skills assist entrepreneurs in adapting to changes and enhancing their skill set for future opportunities, which is vital in the 4IR (Deloitte, 2018a). Emphasis on skills required for entrepreneurship such as critical thinking, social, creative, management, leadership and communication skills is vital for transformation in education institutions (Naudé, 2017). Previous research (Lackeus, 2015, Kuckertz, 2021) has established that entrepreneurship can be taught and that there is a positive

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relationship between high levels of entrepreneurial activity and education. Entrepreneurial skills acquired through education and training are therefore considered key attributes for students in improving entrepreneurship activity (Mamabolo et al., 2017a).

2.4.4 Selected 4IR skills

The concept of selected 4IR skills has undergone extensive research, but has not been unanimously defined. In the field of entrepreneurship, specifying and defining selected skills is both complex and ambiguous (Chell, 2013; Morales & Marquina, 2013). Many of the previous studies on the skills required by entrepreneurs have focused on abilities and knowledge (Stowe et al., 2010; Purzer et al., 2016; Schleicher, 2018a), without confirming the influence on entrepreneurial readiness behaviours of students.

Despite the importance of entrepreneurial readiness behaviour as a theoretical construct in understanding how skills are affected, the impact on selected 4IR skills of students must be investigated. Identifying opportunities and realising viable ideas is the core of entrepreneurial readiness behaviour (McAdam & Cunningham, 2019).

The purpose of this study is to explicate how selected 4IR skills affect students' entrepreneurial behaviour, including how specific programmes at HEIs could cultivate such behaviours. Knowledge of selected 4IR skills prepare students to participate in entrepreneurship and become entrepreneurs and these skills are critical in improving the entrepreneurial behaviours of students.

The selected 4IR skills pertinent to this study have been categorised into soft skills, technical skills and entrepreneurial skills. An elaborate presentation of these skills is provided in Table 2.1.

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Table 2. 1: Selected 4IR skills

Skill categories	Definition	Purpose	Examples	Teaching and training methodology
Soft skills	Communication abilities, social skills and personal attributes that support interactions and interpersonal relationships.	Supporting students to integrate and collaborate with external and internal workplace stakeholders, namely management, co-workers and customers.	Leadership, creative thinking, critical thinking, social emotional learning, communication, teamwork, collaboration, initiative, adaptability, growth mind-set, self-confidence, cultural awareness and empathy.	Mentorship, project-based, team-based, case simulation, experimental, coaching, job shadowing, business exposure and practical application.
Technical skills	Capabilities and knowledge to complete specialised tasks.	Equipping students with technical expertise to complete job-specific tasks.	Technology-based skills, coding, computer programming, financial management, project management, scientific tasks, mechanical functions and other job-specific skills.	
Entrepreneurial skills	Abilities and knowledge that support success in creating an entrepreneurial idea and opportunity.	Supporting students in creating a business, work, contract and consider freelancing.	Creativity, innovation, resourcefulness, business execution, business acumen, courage, risk-taking, initiative, industriousness, ingenuity, optimism, resilience and curiosity.	

(Source: Adapted from Deloitte, 2018b)

Although Deloitte (2018b) verifies that soft skills will support interactions and interpersonal relationships, the importance of soft skills in relation to entrepreneurial behaviours (in the context in 4IR) is not evident. Entrepreneurs therefore need to acquire new skills to become more adaptive, resilient and agile, and student

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entrepreneurs must strengthen soft skills to enhance entrepreneurial behaviours. Although soft skills are essential human skills that are increasingly required as a result of 4IR (Gray, 2016; Chandy, 2017), there has not been extensive research in relation to entrepreneurship. In this study, the application of soft skills in entrepreneurship is considered as essential for the development of entrepreneurs in creating new opportunities.

2.5 IMPORTANCE OF ENTREPRENEURIAL EDUCATION

Since the study focuses on different 4IR skills as they manifest in the context of HEIs, it is critical to understand the positive relationship between the desire to be entrepreneurial and the importance of entrepreneurial education. HEIs must provide students with practical entrepreneurial exposure and focus on self-confidence, problem solving skills and baseline skills to encourage successful new ventures (Herrington et al., 2014). Students with higher education are more intentional and are expected to create more ventures (Amorós & Bosma, 2014, Yu & Zhang, 2021). Furthermore, Turton and Herrington (2012), as well as Wu and Wu (2019) state that an effective education system is required to increase potential entrepreneurs, early-stage entrepreneurs and individuals with entrepreneurial intentions. Moreover, when skills required for successful ventures are identified and training is provided to develop these identified skills, entrepreneurs can still increase from any level in the educational system. Collaboration among HEIs is critical in enabling prospective entrepreneurs to acquire various skills through training to nurture entrepreneurial behaviour.

2.6 SKILLS NEEDED BY ENTREPRENEURS IN THE CONTEXT OF HIGHER EDUCATION

According to Mamabolo and Myres, (2020) recent research on the implications of 4IR on HEIs, specifically in Africa regarding skills and learning, is insufficient. To identify the required 4IR skills for student entrepreneurs, the teaching methodology for developing these skills in HEIs must be investigated first.

Research shows that blended and experiential learning are proposed teaching methodologies for acquiring skills (Hu, 2019; Mamabolo & Myres, 2020). Experiential learning (learning by doing) motivates students to develop flexibility and creativity in

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real life situations, while experiential learning entails participation in collaborative projects, internships and work-study programmes (Hu, 2019). These methodologies can be in the form of design thinking and virtual reality in teaching. The skills needed by an entrepreneur must thus be combined with education and practical knowledge to generate success in identifying and appropriating new opportunities. While practical knowledge is considered as contextual, students must understand the link between practice and theory in order to apply theoretical knowledge in the practice of entrepreneurship (Katajavouri et al., 2006).

The arrival of 4IR has brought significant changes into education, employment and skills development (Kamaruzaman et al., 2019). New skills are required from entrepreneurs and these are not provided by the current curriculum specifications (Walls, 2018). Brière et al. (2014) states that inadequate training leads to inadequate skills necessary for an entrepreneur. Poor educational systems, especially in South Africa, that has one of the worst educational systems of the developing countries, fail to successfully equip entrepreneurs with the required skills (Turton & Herrington, 2012). HEIs must adapt to equip students with the skills needed to nurture successful entrepreneurs, anticipating the dynamic technical changes (Hu, 2019). Kyrö (2005) postulates an occupationally orientated approach by HEIs, that should aim to provide student entrepreneurs with knowledge and skills. HEIs need to develop students to become entrepreneurial by honing specific skills.

Xing & Marwala (2018) identifies emotional intelligence, judgment, critical thinking, cognitive flexibility, negotiation and people management as critical skills in line with the technological innovations of 4IR. It is clear that HEIs should redesign curricula to equip students to learn and prosper in the digital era.

2.7 DRIVERS FOR REALISATION OF 4IR SKILLS

A review of existing literature suggests that 4IR is an era of rapid transformation, shaped by complex, powerful and interconnected forces. Three fundamental technological drivers of 4IR, namely developments of digital, physical and biological technologies, have a lasting influence on human activities, processes and skills (Guoping et al., 2017; ILO & OECD, 2018). These drivers, specifically technological

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advancements, have a significant impact on the skills relevant to this study. It is thus important to understand what these drivers entail, as such perception contributes to 4IR and goad students to improve their 4IR skills to adapt to and meet the demands of technological advancement.

4IR is built on technological advancement causing significant change at a fast pace in the digital world resulting in new skill requirements. Literature suggests that the relevance of existing skills is diminishing and therefore encourages the development of 4IR skills (World Economic Forum, 2016). The effect of technological advancements on the acquisition of skills of student entrepreneurs is examined in this study.

4IR is powered by three technological drivers. Marwala (2017) suggests that it is important to understand how these drivers will change the work environment from "task-based" to human-centred skills development.

Table 2. 2: Technological drivers of 4IR

Technological drivers	**Fields**
Digital technologies	Internet of Things (IoT), Artificial Intelligence (AI), Big Data, machine learning, cloud computing and digital platforms.
Physical technologies	3D printing and automatic cars.
Biological technologies	Generic engineering and Neurotechnology.

(Source: Adapted from Guoping et al., 2017)

To thrive in 4IR, entrepreneurs must be equipped with the relevant skill sets to survive these disruptive technologies. This study demonstrates how these 4IR technologies could promote the relationship between 4IR skills and entrepreneurial activities.

2.7.1 Digital technologies

The observation is made that digital technologies are considered as the fundamental driver for 4IR. Most of the advances and innovations in 4IR are enhanced through digital technologies, within their respective areas, but also holistically. Digital technologies are manifested on four constructs, namely IoT, AI, Big Data and digital platforms (see Table 2.2 above).

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The aim is to develop an informed understanding of IoT as a concept in order to determine the drive thereof for the realisation of 4IR skills of students. The basic concept of IoT is the integration of identification and tracking technologies. The main characteristics of IoT are reliability, scalability, sensing, self-adaptation, interconnectivity, intelligence, unique identity, heterogeneity and dynamic changes (Licite-Kurbe & Chandramohan, 2020). For the purpose of this study, it is important to understand the capability IoT has in developing 4IR skills where student entrepreneurs use their intuition and technical knowledge to create new ventures. IoT further presents entrepreneurs with new opportunities for innovation (Krotov & Junglas, 2008).

On the other hand, the impact that AI technology-based entrepreneurial ventures has on 4IR skills cannot be underestimated. AI simulates the thinking and behavioural patterns of humans (Guoping et al. 2017), but Baruffaldi et.al. (2020) go a step further and show that machines perform human-like cognitive functions such as reasoning, interacting, learning and understanding. Requisite skills continuously change as human decision-making is replaced by AI. Ransbotham et al. (2017) assert that entrepreneurs need to display 4IR skills, such as leadership, vision, managerial knowledge and willingness to adapt by making reliable, replicable decisions in new situations. AI applications can therefore make predictions, decisions and recommendations about the next stage, based on data gathered from student entrepreneurs (Ally & Wark, 2020). Alsaaty et al. (2019) concur that advancements in AI technologies enhance 4IR skills that facilitate the entrepreneurial process stages of opportunity identification and opportunity exploitation. AI therefore drives 4IR skills of student entrepreneurs and opens infinite opportunities for students to gain new skills.

Student entrepreneurs need skills to competently use digital technologies such as Big Data and cloud computing. Big Data and cloud computing entail enhanced storage capacity of big volumes of data. Student entrepreneurs require technical skills, such as using software applications (Buyya & Sukumar, 2011) and accessing information in the cloud, to promote entrepreneurship.

The fourth aspect of digital technologies is digital platforms. These platforms convene data, people and assets by acting as a network platform (Guoping et al., 2017). Digital

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technologies have a definitive impact on the development of selected 4IR skills required from student entrepreneurs, especially computer literacy skills such as coding, programming and using algorithms to pick up modified patterns and predict new results. By using these digital platforms, student entrepreneurs who possess these 4IR skills can make informed decisions.

2.7.2 Physical technologies

Autonomous vehicles and 3D printing are two primary manifestations of physical technology, but for the purpose of this study only the impact of physical technology on skills of student entrepreneurs is investigated. Although the realisation of a 3D model into a three-dimensional object and the invention of autonomous vehicles has the potential to alter the fields of transportation and industry production (Fagnant & Kockelman, 2015), the focus is on physical technologies as a driver for the realisation of 4IR skills. These visible achievements and rapid physical applications have a direct effect on the development of soft skills, entrepreneurial skills, especially technical skills of student entrepreneurs.

2.7.3 Biological technologies

Biotechnical advancement drives the 4IR and is centred on genetic engineering and neurotechnologies, but it is important to determine how these biotechnical technologies affect 4IR skills acquisition of student entrepreneurs. These biotechnical advancements generate a range of entrepreneurial opportunities in the fields of medical treatment behaviour, which in turn requires selected 4IR skills to realise these entrepreneurial opportunities.

2.7.4 Impact of drivers of 4IR

Naude (2017) contends that radical and fast changes need to take place in industry and education to create a dynamic environment for skilful entrepreneurs to adsorb new digital technologies. Innovations in 4IR technologies thus have an impact on the development of an entrepreneur's skill set. However, the change of the skills landscape required under 4IR is difficult to predict as digital technologies develop and transform quite rapidly. The rapid transformation caused by automation and intelligent

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machines generates an increase in job dislocations and, simultaneously, a slump in entrepreneurial skills. Following this, 4IR has introduced new challenges and demands by initiating changes in entrepreneurial behaviour patterns. The current set of skills of entrepreneurs is inefficient and leads to extensive challenges. In the light of this, critical steps must be taken to improve the level of entrepreneurial skills required for success in 4IR (Yusuf et al, 2020).

Technological drivers of 4IR will change the nature of work and new occupations in 4IR will concentrate on non-routine tasks which require higher order cognitive and soft skills. Required 4IR skills must be less susceptible to automation and technological advancement (Ra, 2018) since routine manual and cognitive tasks are gradually displaced by automation. On the other hand, employment in occupations associated with non-routine cognitive tasks expand. Frey and Osborne (2017) concur that the risk of automation of low-skill occupations is high, therefore technological drivers place a premium on high level skills unlikely to be replaced by automation.

Technological drivers have a direct impact on academic competency. Accumulating new knowledge will develop learnability (Ra et al., 2019). Learnability, where soft skills and higher order cognitive skills are required, has implications for HEIs (Heckman & Kautz, 2012). Students with learnability skills will be able to transcend successfully to meet the needs of 4IR. Education must therefore respond by providing different types of skills to benefit automation and capitalisation (Canidio, 2013).

The impact of technology on learning outcomes enables skills development. Digital technologies use AI to model students' cognitive processes and enable personalised learning. Technology-driven learning has proliferated in higher education. Shifting the focus of education from what students learn to the way how they learn is productive for improving learnability (Ra, 2018). Grand-Clement (2017) concurs that the digital world has infiltrated the skills and education domain, where technology is increasingly applied to deliver skills and education in an innovative manner. Panah and Rusman (2018) posit that skills inherent to humans such as creativity, strategic problem solving, judgment, ethics, communication, cultural agility, collaboration, creative problem solving and teamwork should complement AI to strengthen the effect of machine automation. More so, there are three features that distinguish humans from machines,

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namely social interactions, physical mobility and dexterity, as well as creativity. However, these features may become less effective in the face of the rapid progress in AI (Schwab, 2017).

2.7.5 Labour market changes

OECD (2016) posits that the composition of the labour market has changed in terms of required skills, therefore skills development has to be congruent with changes in skills demands. Manual and routine tasks are easing due to digitalisation, while high skilled tasks are increasing, demanding problem solving and interpersonal skills. More so, technological advancement requires design and innovative skills to perform technological tasks, while a set of meta-skills (for example flexibility and agility, including technical skills) and core skills (such as teamwork, leadership, initiative and problem solving) are imperative to complement the changes in the nature of entrepreneurial behaviour in 4IR. OECD (2017) puts a premium on skill mixes, including cognitive skills such as numeracy, literacy and basic Information and Communication Technology (ICT) skills. Complementary skills, for example critical thinking, creativity, problem solving and communication, interpersonal and emotional skills such as self-awareness are becoming more and more important.

2.8 THEORIES ON 4IR SKILLS ACQUISITION

Research on 4IR skills generally follows the Human Capital Theory perspective, which argues that skills contribute directly to the outcomes of investment in work experience and education (Becker, 1964; Chell, 2013; Unger et al., 2011; Mamabolo & Myres, 2020). This study explores the effects of 4IR skills on entrepreneurial behaviours (e.g. venture creation, innovation financing and venture growth). Furthermore, it presents the Human Capital (HC) Theory as relevant to the research niche because investment in training and education leads to the acquisition of selected skills. A synthesis of the HC Theory is provided below to make specific connections to the transformations brought about by 4IR.

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2.8.1 Human Capital Theory

The Human Capital Theory, originally developed by Schultz (1961), postulates that humans are capable of increasing productivity through skills training and education (Marvel et al., 2016). McCracken et al. (2017) argues that the Human Capital Theory propounds that people who invest in training and education improve their set of skills and are more productive and successful than individuals with fewer skills. This implies that students, who invest in the development of their 4IR skills have the potential to significantly improve specific entrepreneurial behaviours. Human capital investments can be found in formal and informal education, practical learning and work experience (Unger et al., 2011) and manifest in work integrated learning. The human capital approach is premised on the understanding that access to work integrated learning is critical in the development of 4IR skills that affect entrepreneurial behaviours. Knowledge and skills are human capital outcomes acquired through human capital investments in work experience, industry experience and formal education (Becker, 1964; Souleh, 2013; Mamabolo et al., 2017b). Through training and education, HEIs contribute to the acquisition of 4IR skills, especially those relevant to entrepreneurship. Human capital includes investment in entrepreneurs through higher education (HE) to stimulate entrepreneurial behaviours. According to the Human Capital Theory, entrepreneurs benefit from entrepreneurship education and training to acquire 4IR skills that culminate in the improvement of entrepreneurial behaviours.

The Human Capital Theory supports the value of entrepreneurship education and training (EET), therefore the formation of effective HC through the utilisation of EET is rapidly growing globally (Martin et al., 2013). Davidsson and Honig (2003) and Games et al. (2019) provide empirical evidence that formal education assisted nascent entrepreneurs to discover entrepreneurial opportunities, but failed to empower them to exploit these opportunities. Contrary to these findings, Florin et al. (2003) and Unger et al. (2011) argue that humans possess human capital attributes such as knowledge, experience, education and skills required in opportunity exploitation. The lack of clarity on the exact effect of entrepreneurship education on specific human capital outcomes (skills), and the entrepreneurial process is therefore relevant for this study.

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The majority of the research that applied the Human Capital Theory concentrated on either opportunity recognition or opportunity exploitation (Brixy et al., 2012; Singer et al., 2015). Opportunity recognition and opportunity exploitation are both grounded in the Human Capital Theory where human capital is integral to the process of entrepreneurship (Haber & Reichel, 2007). This encompasses that: i) human capital is vital to discovering and exploiting entrepreneurial opportunity (Alvarez & Barney, 2007; Marvel, 2013); ii) HC assists in generating opportunities by gaining financial resources and launching ventures (Bruns et al., 2008; Dimov, 2010); iii) that human capital also aids in the generation of new knowledge and creates advantages for new ventures (Corbett et al., 2007; Bradley et al., 2012).

The Human Capital Theory has been increasingly applied within the area of entrepreneurship, consistently connecting human capital attributes to entrepreneurial success (Unger et al., 2011). Human capital develops 4IR skills of student entrepreneurs that lead to enhanced chances at successful ventures. There is compelling evidence that human capital plays a vital role in promoting aspects of entrepreneurship (Unger et al., 2011; Martin et al., 2013).

2.8.1.1 Human capital, its outcomes and the entrepreneurial process

To anchor this study, the complexity of HC is deconstructed and a typology of HC is generated. The typology of HC and the entrepreneurial process described in Figure 2.3 below is subsequently elaborated on.

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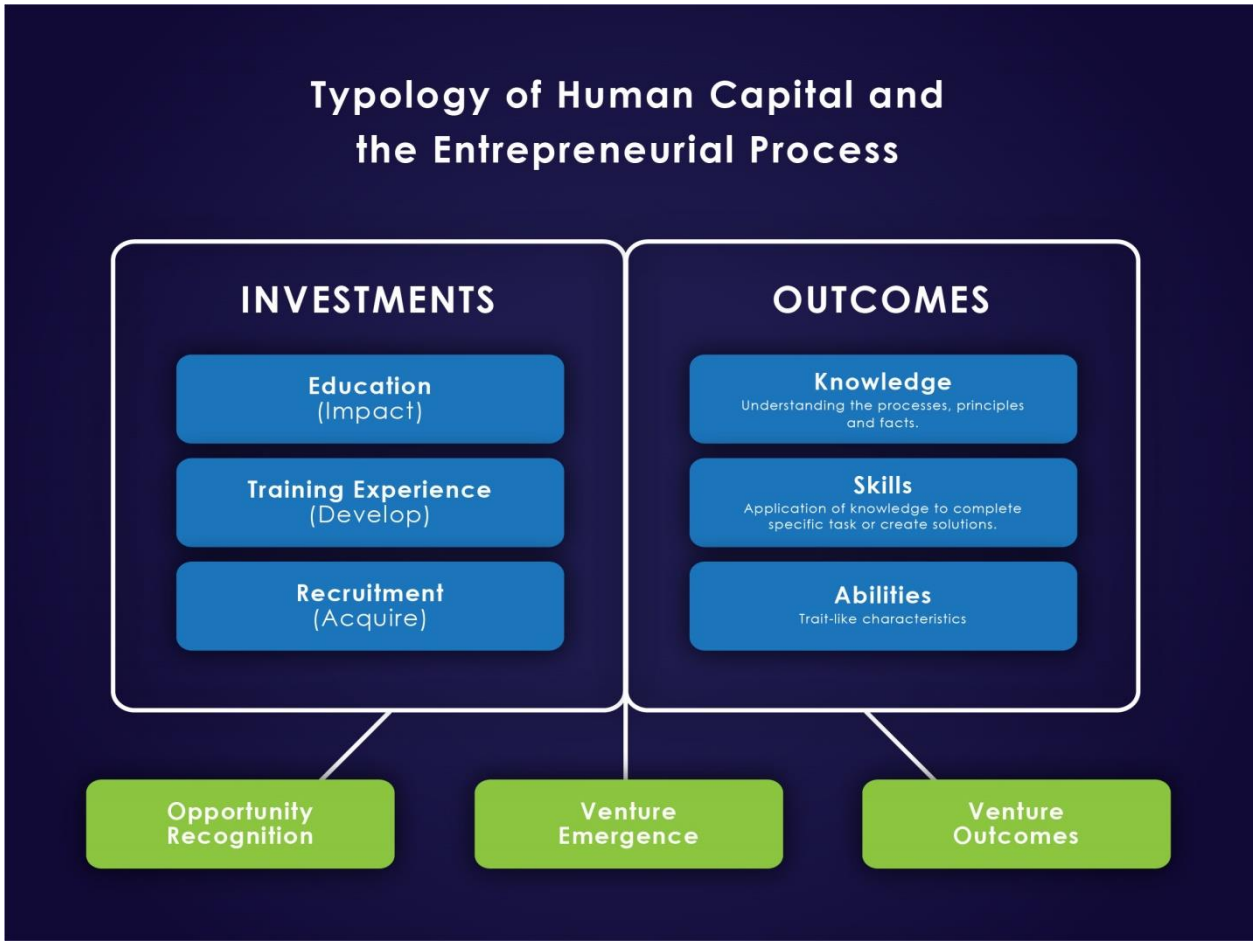

Figure 2. 3: Typology of Human Capital and the Entrepreneurial Process
(Source: Adapted from Marvel et al., 2014)

Although this research focuses on skills as a dimension of HC outcomes, the interrelations among the investments in human capital, outcomes and their impact on entrepreneurship cannot be underestimated.

Since the literature suggests that prior knowledge and skills are key determinants of HC, such knowledge and skills can serve as critical in the development of entrepreneurship, itself a process explored from the perspective of opportunities (Baeta & Andreassi, 2021). This means an entrepreneur needs to have prior knowledge, particular personality traits and exploit their networks effectively if they are to turn opportunities identified into new business opportunities (Ardichvili et al., 2003; Jarvis, 2016). Kuckertz et al. (2017) regard the possession of human capital as vital to the identification of opportunities and their exploration in the entrepreneurial

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process. HC is, therefore, valuable in the first stage of opportunity identification where entrepreneurial opportunities are discovered and created (Marvel, 2013).

The next stage is opportunity validation where HC plays an important role in the accumulation of knowledge (Bradley et al., 2012). HC investments and outcomes are validated by prior learning of context-specific knowledge, abilities and skills (Fahrenbach, 2021). This means the possession of relevant knowledge is integral to the validation of entrepreneurial opportunities.

In the stage of opportunity exploitation HC assists by using external knowledge sources to realise opportunities (Clough et al., 2019). Training is a key HC investment that facilitates an entrepreneur's skill enhancement (Lasi et al., 2014) to explore opportunities for new venture creation. This means the external knowledge of mentors, role models and innovators can be vital to the exploitation of identified opportunities as they use their experiences and circumstances to prevent occasional pitfalls that nascent entrepreneurs might encounter.

Entrepreneurial resource mobilisation is the last stage where entrepreneurs accumulate resources to realise an opportunity (Marquis & Tilcsik, 2013). Resource mobilisation involves combining different resources to make strategic decisions and pursue market opportunities when allocating scarce resources (Kodithuwakhu & Rosa, 2002). The provision of training for employees (Densford et al., 2018) can assist in determining how entrepreneurs secure resources (Bradley, 2002).

The dimensions of HC outcomes, namely knowledge, skills and abilities (KSAs) are valuable in entrepreneurship. Knowledge is defined as the understanding of processes, principles and facts where the value of knowledge is higher when associated with specific entrepreneurial activities (Markman & Baron, 2003). Many arguments describe why prior knowledge, or human capital, is of distinct importance in entrepreneurship (Shane, 2000; Ardichvili et al., 2003; Shepherd, 2018). Prior knowledge facilitates the process of recognising entrepreneurial opportunities (Baeta & Andreassi, 2021).

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Amorós and Bosma (2014) indicate that educated entrepreneurs are likely to create new ventures. The acquisition of skills thus entail not only that graduates should obtain knowledge (Quellmalz, 2012), but also employ skills to create successful ventures. Unger et al. (2011) confirm that skills are indispensable in the creation of entrepreneurial ventures. Skills therefore have a direct impact on entrepreneurial behaviour when venture creation and venture growth are present.

Hayton and McEvoy (2006) agree with Becker (1964) who argues that a skill is an observable and direct application of knowledge as an outcome of practical experience and education. According to the Theory of Human Capital the acquisition of skills is the outcome of human capital investments that can improve through development and training. The Human Capital Theory indicates that a skill in the entrepreneurial context is generally described as the ability to perform tasks (Mamabolo et al., 2017a). Skills refer to an observable application of knowledge, but are usually task-specific and depend on practice or experience. Skills that are entrepreneurial task-specific, such as engaging with others (Chell, 2013), are useful within the entrepreneurial process. In this regard, skills can be developed through investments in education, practice, training and experience alternatively or in collaboration.

Abilities are defined as characteristic traits useful when performing tasks (Marvel et al., 2014). Chell (2013) refers to ability as an aptitude that effects an entrepreneurs' skill acquisition to perform a specific task. Abilities are opportunity and cognitive focused. The circumstances of the entrepreneurial process will determine which KSAs are required. Thus, knowledge, skills and abilities associated with education and experience support the concept of entrepreneurial human capital.

The importance of entrepreneurial human capital is increasing as ventures are becoming more competitive (Deros et al., 2012). Entrepreneurial human capital research emphasizes that educational investments lead to improved skills (Marvel et al., 2014). By improving education and skills of entrepreneurs, as well as the quality of entrepreneurial ability, the focus is directed on the innovative abilities of entrepreneurs (Naudé, 2012). Human capital is critical across all the stages of the entrepreneurial process. Elements of human capital influence the transition from one stage to another in the entrepreneurial process (Marvel et al., 2016). It is evident that

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specific human capital investments are valuable to nascent entrepreneurs and venture creation (Davidsson & Honig, 2003).

2.9 IMPORTANCE OF 4IR SKILLS

Having established that 4IR is fundamentally different from previous industrial revolutions, it is critical to understand the importance of 4IR skills for students in realising entrepreneurial readiness behaviours required to establish a successful venture. Skills such as creative skills, problem solving skills and social skills, including leadership, change management, curiosity, critical thinking, collaboration and communication, risk-taking, management and sales are all 4IR skills required for entrepreneurship and are described as non-routine analytical and interpersonal skills (World Economic Forum, 2015). 4IR thus creates opportunities for selected skills, especially skills associated with entrepreneurship (Brynjolfsson & McAfee, 2012; Autor & Dorn, 2013).

A lack of financial sector knowledge and experience among new ventures, as well as a shortage of entrepreneurial skills (Global Entrepreneurship and Development Institute, 2017) influence the level of entrepreneurial readiness behaviour as these skills are necessary to facilitate the development of venture creation, innovative financing and venture growth. Some skills can be taught and refined through exposure and training. Entrepreneurs are therefore encouraged to train and develop soft skills and technical skills (Mamabolo et al., 2017a). This study thus proposes a positive relationship between the selected 4IR skills and entrepreneurial readiness behaviours of students.

Newly hired graduates do not exhibit higher-level knowledge and information-based skills at the desired level and this lack inhibits the development and growth of new entrepreneurial ventures. Consequently, educators at HEIs have been urged to recognise the opportunities and challenges in 4IR to ensure that graduates develop the necessary skills to become competitive (Boyles, 2012). The argument is that entrepreneurs equipped with the acquired 4IR skills are likely to display entrepreneurial behaviour through successfully identifying and exploiting opportunities. Grand-Clement (2017) anticipates that partnerships between ventures

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and education systems must be formed with emphasis on developing selected skills to enhance entrepreneurial readiness behaviour.

Furthermore, Deloitte (2018b) acknowledges the mediation of the entrepreneurial process where entrepreneurial skills such as industriousness, risk-taking and business execution lead to opportunity exploitation. A research gap still exists in determining the impact that opportunity exploitation has on the relationship between entrepreneurial skills and venture growth.

2.10 CRITIQUE OF 4IR SKILLS

In view of the reality that South African universities strive to realise entrepreneurship while operating in an era of rapid technological advancement, 4IR skills are scrutinised. The focus point in the context of education should be on students obtaining selected 4IR skills to establish entrepreneurial behaviours in students. Still, there is no consensus on which 4IR skills qualify as the most crucial.

There is mere speculation about the contribution of 4IR skills needed to support entrepreneurial readiness behaviours (Raza et al., 2019). This further complicates the knowledge of the impact of selected 4IR skills on entrepreneurial readiness behaviours.

Although research focuses on required skills by entrepreneurs without acknowledging the importance and complexity of skills across the stages of the entrepreneurial process, some recent research has investigated skills across different stages of the entrepreneurial process (Mamabolo & Myers, 2020). However, there is still no unified set of skills identified as required by entrepreneurs to transition through all stages of the entrepreneurial process. This study thus investigates the different stages of the entrepreneurial process in relation to soft skills (Darroch & Clover, 2005), technical skills (Perks & Struwig, 2005) and entrepreneurial skills (Venter et al., 2015).

2.11 SYNTHESIS OF ARGUMENTS FOR AND AGAINST 4IR SKILLS

Schultz (1961), Becker (1964), Davidsson and Honig (2003), as well as Mamabolo and Myers (2020) postulate that investments in human capital, especially work

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experience and education, contribute directly to human capital outcomes, which relates to the acquisition of knowledge and skills. Morales and Marquina (2013) however posit that there is no clarity on specific skills required by entrepreneurs in the light of 4IR. In the same vein, Chell (2013) argues that research on entrepreneurial skills is mainly theoretical, lacking support from any empirical evidence.

Research on the Human Capital Theory demonstrates skills have a direct impact on entrepreneurial readiness behaviours, especially concerning venture creation activities (Becker, 1964; Unger et al., 2011). However, literature also indicates that human capital does not necessarily exhibit positive relations regarding performance of ventures (Chawla et al., 2010).

Studies in Human Capital Theory furthermore verify conflicting conclusions regarding relationships between HC, skills and the entrepreneurial process. Human capital is considered as integral to the entrepreneurial process (Haber & Reichel, 2007) and researchers have widely applied the Human Capital Theory in entrepreneurship studies, focusing on identification and creation of entrepreneurship opportunities (Alvarez & Barney, 2007; Davidsson & Honig, 2003; Ucbasaran et al., 2008; Unger et al., 2011). Mamabolo et al. (2017a) agree that opportunity recognition and opportunity exploitation are fundamental constructs. Research also confirms variations and contradictory conclusions regarding the entrepreneurial process (Moroz & Hindle, 2012; Shane, 2012).

There is a positive relationship between human capital assets, entrepreneurship training and education and entrepreneurial outcomes in a meta-analytical study by Martin et al. (2013). Entrepreneurship training and education is significant in the development of skill sets related to entrepreneurship (Mamabolo et al., 2017b).

Considering the theoretical underpinning of 4IR skills and the drivers of these concepts, it is important to assess the impact of the entrepreneurial process on the relationship between 4IR skills and entrepreneurial readiness behaviour.

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2.12 CHAPTER SUMMARY

South African universities need to actively engage in entrepreneurship education, specially focusing on selected 4IR skills to counteract the disruptions caused by technological advancements. These selected 4IR skills are integral to the realisation of entrepreneurial readiness behaviours of university students, as obtaining these cross-functional skills should be a focus point in establishing a work environment that could successfully navigate the dynamics embedded in 4IR (Xu et al., 2018).

This chapter examined literature related to 4IR skills and the complexities associated with defining 4IR skills and the dimensions thereof. Supporting research evidence from across literature reviewed in this chapter verified the influence technological advancements as drivers have on 4IR skills development. Finally, the chapter singled out the relevance of adopting the HC Theory to underwrite the contribution of 4IR skills in light of the outcomes of work experience and education. The next chapter focuses on the entrepreneurial process.

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CHAPTER 3 ENTREPRENEURIAL PROCESS

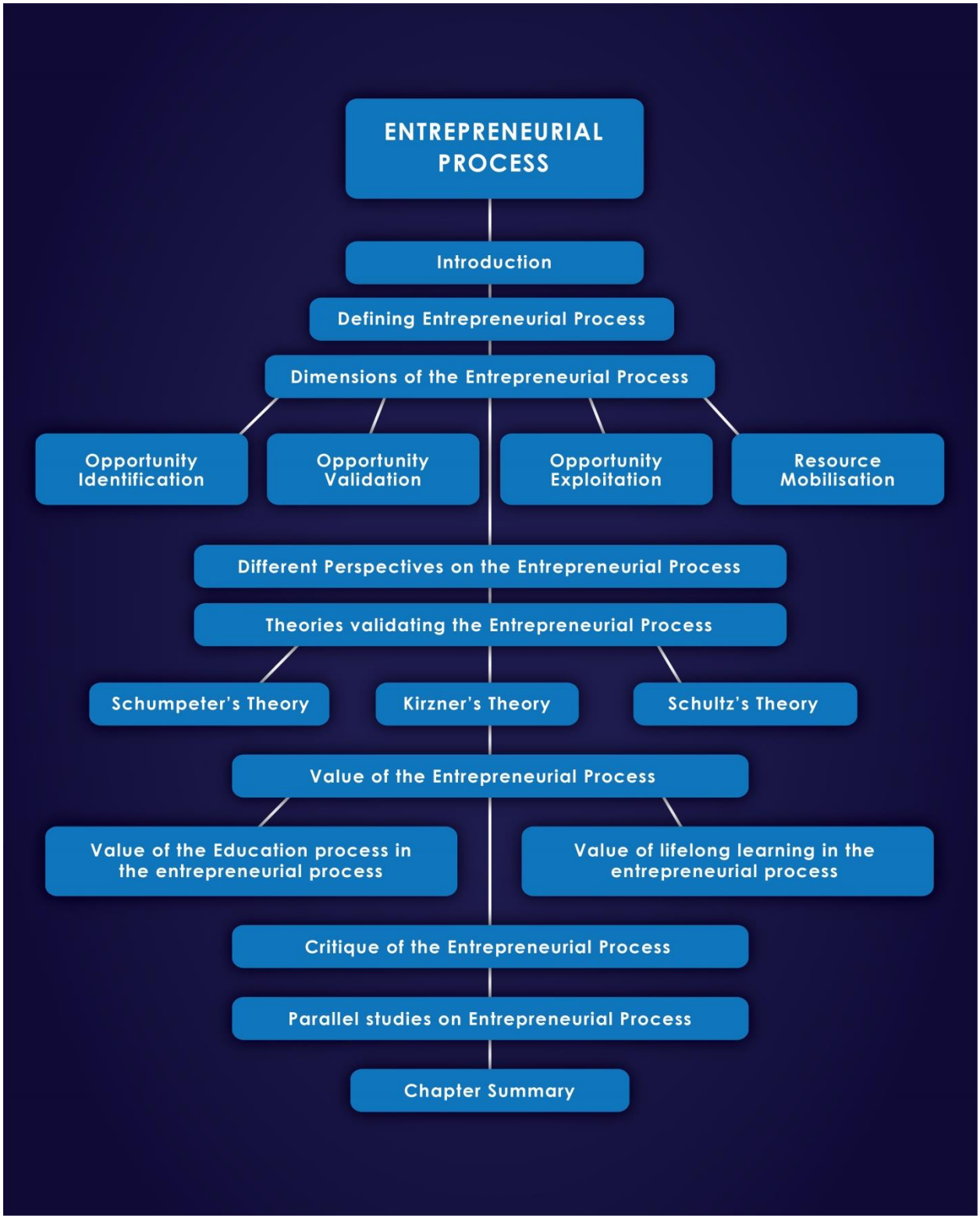

Figure 3.1: Flow diagram indicating the structure of Chapter 3

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3.1 INTRODUCTION

The extensive discussion of the previous chapter cannot be devoid of context and as such a brief articulation of the South Africa context is critical to appreciating the layout and flow of this chapter. The importance of emphasising 4IR skills in Chapter 2 can be seen in the South African president's promulgation of the Presidential Commission on the Fourth Industrial Revolution (4IR) and the convening of the Free State Provision Summit on 4IR in the Central region. More so, the strong emphasis on student entrepreneurship and preparing university students for the 4IR is highlighted by both the Central University of Technology (CUT) and the University of the Free State (UFS) highlighting critical graduate attributes fostering social entrepreneurial action through entrepreneurial projects (e.g. through Enactus (CUT) and Commercio (UFS). Thus, the extensive discussion of 4IR skills in Chapter 2, served as a springboard for a better appreciation of the entrepreneurial process discussed in Chapter 3.

Having laid a solid foundation on 4IR skills in the previous chapter, the current chapter builds on this entrepreneurial process. A process-based view of entrepreneurship is adopted in this chapter grounded on the ever-changing nature of nascent technology-based entrepreneurship (Hamid et al., 2017). The chapter, therefore, concentrates on defining the entrepreneurial process, articulating its dimensions and presenting different perspectives on the process. The study then presents theories that validate the entrepreneurial process and discusses the value embedded in the process. In tandem, a critique of the entrepreneurial process is presented, followed by parallel studies on entrepreneurship and then the relationship between entrepreneurship process and 4IR is discussed extensively. The chapter then concludes with a deliberation of the entrepreneurial process as a whole. The next section grapples with the definitions of the entrepreneurial process.

3.2 DEFINING ENTREPRENEURIAL PROCESS

Since the entrepreneurial process can be conceived as an amalgamation of "entrepreneurship" and "process", the full appreciation of this compound concept demands recourse to who is an entrepreneur and defining entrepreneurship to fully comprehend what the term entails. Therefore, this section is first devoted to defining

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the term “entrepreneur” before it turns to appreciating what constitutes the entrepreneurial process.

An entrepreneur is an individual that identifies opportunities, takes risks and creates ventures (Othman et al., 2006; Rusu et al., 2012). This definition suggests that entrepreneurs recognise more opportunities than other non-entrepreneurs, as they pursue opportunities more intentionally than non-entrepreneurs. Successful entrepreneurs use a familiar environment to identify opportunities that are processed through different mechanisms, namely knowledge representation and learning, perception (consciousness, attention and biases), decision making (creativity, discovery, problem solving skills and intelligence) and cognitive development (Acs & Audretsch, 2005; Dongo, 2019). Becoming an entrepreneur is a result of developing intentions towards entrepreneurship with positive approaches to independence and risk (Douglas & Shepherd, 2002; Antoncic et al., 2018). Furthermore, entrepreneurs display a significant need for achievement (Okhomina, 2010), high autonomy and locus of control, taking initiative and risks, as well as being self-confident and creative (Mbuqe, 2017). Entrepreneurs are set apart from non-entrepreneurs by traits such as assessing, perceiving and utilising opportunities, as well as taking risks to direct resources towards innovation (Allen, 2015). Entrepreneurs need to demonstrate behaviours that support entrepreneurship by initiating skills that support opportunity identification and opportunity exploitation. An understanding of opportunities is critical to business development as venture creation is essentially about complex problem solving based on fulfilling a need or acting on an opportunity that presents itself to the entrepreneur.

Ahmad and Seymour (2008) posit that entrepreneurship involves entrepreneurial activity where human action adds value, through identifying new markets, products and processes that support economic development. Entrepreneurship is also described as a combination of three elements namely, the context in which an opportunity is created, personal abilities of the entrepreneur to identify opportunities and the capacity to exploit the opportunity (Martin & Osberg, 2007). Entrepreneurship is thus considered as multiple actions of creating new ventures, by recognising opportunities that are commonly ignored due to the environment (Hall et al., 2012). The obliviousness towards opportunities can be multi-faceted – it can arise from

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individuals' lack of perfect information about the opportunity at hand, the growing uncertainty and complexity in the environment and high cognitive load on the individual arising from competing cues and signals from the external environment. Therefore, entrepreneurship is a mobiliser of opportunities which has the potential to be an economic equaliser. This view resonates with the Schumpetarian assessment of an entrepreneur as a disturbance handler in the economy. This is the kind of an entrepreneur who seeks to establish a state of equilibrium in the economy by initiating the process of innovation to destabilise economic markets (Schumpeter, 1934).

The basis of entrepreneurship research rests on the theories of Schumpeter and Kirzner who both define entrepreneurship as a concrete foundational concept to economic reconfiguration (Berman & Kariv, 2016). Both Kirzner's and Schumpeter's theories have been used in recent entrepreneurial opportunity research, namely opportunity discovery and opportunity creation (Alvarez & Barney, 2007; Alvarez et al., 2013; Zivdar, 2020). Schumpeter describes entrepreneurship as a process of innovation through human creativity that leads to value-creating opportunities (Ndofirepi, 2016), whilst Kirzner defines entrepreneurship as a vital part of opportunity recognition (Kirzner, 1973; Lim & Xavier, 2015; Shrader & Hills, 2015). The two concepts of innovation and opportunity recognition are not isolated, but interconnected. The pro-active process of entrepreneurship is creating innovation, new ventures, value and transformation through technology by risk-taking people that exploits opportunities to increase competitive advantage (Stevenson & Jarillo, 2007; Kuratko et al., 2011; Venter et al., 2015). Therefore, entrepreneurship is defined as a process where recognising business opportunities are encouraged to tackle new ideas and methods in an ever-changing market environment (Baum et al., 2007). Innovation that ultimately leads to entrepreneurship suggests a definite relationship between innovation and opportunity recognition. The entrepreneurial process includes enterprising individuals who seize opportunities (Venkataraman, 1997; Odongo, 2021) to create new ventures. This stance entails innovation and creativity (Venter et al., 2015).

The HC theory within entrepreneurship literature links HC attributes to entrepreneurial success (Unger et al., 2011). HC is essential to discover and create entrepreneurial opportunity (Marvel, 2013), while exploiting opportunities is considered equally

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important when acquiring financial resources (Dimov, 2010). HC further contributes to the accumulation of new information and knowledge (Bradley et al., 2012).

Given the emphasis of the HC approach in entrepreneurship literature, students need to acquire skills throughout the entrepreneurial process to enhance their entrepreneurial readiness behaviours. Ramraj and Marimuthu (2021) demonstrate the importance of 4IR skills to survive this transformative work environment, while Olaitan et al. (2021) recognise the importance of investigating the readiness of individuals during 4IR, by developing their skills to become more equipped entrepreneurs. This study, therefore, provides broad knowledge on the contribution of 4IR skills to entrepreneurial readiness behaviours and entrepreneurial process discourses.

In simple terms, the entrepreneurial process is when new ventures are created by an entrepreneur through the identification, validation and exploitation of an opportunity. Here, opportunity is a value-creating innovation that exhibits market potential, which in turn leads to the entrepreneur creating value for customers (Longenecker et al., 2006). Opportunity identification and opportunity exploitation have a significant impact on the entrepreneurial process (Hisrich & Peters, 1998; Kuckertz et al., 2017), because they are instrumental to the success of a new venture creation. The entrepreneurial process is distinguished as a manner in which alert entrepreneurs realise that opportunities exist. Opportunities are then evaluated and further developed through innovation by the entrepreneur, to create new ventures (Shane, 2003; Stevenson & Jarillo, 2007; Rwigema et al., 2008; Kuratko et al., 2011; Venter et al., 2015). The entrepreneurial process requires an assessment of appropriate and sufficient resources to create new ventures, products or services (Barringer & Ireland, 2010).

There are several driving forces of the entrepreneurial process, namely it is opportunity driven, utilises resources creatively, is driven by an entrepreneurial leader and team, is dependent on a balanced organisation and has a holistic, integrated and sustainable business (Timmons & Spinelli, 2007; Mishra & Zachary, 2015). According to Odongo (2021), the identification and pursuit of opportunities is the core of entrepreneurial success and set entrepreneurs apart from non-entrepreneurs. Having defined the

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entrepreneurial process, the constitution of this process is discussed in the next section.

3.3 DIMENSIONS OF THE ENTREPRENEURIAL PROCESS

A unified approach towards the entrepreneurial process does not exist in the entrepreneurship field (Gartner, 1990; Brazeal & Herbert, 1999; Bruyat & Julien, 2001; Shane, 2012; Kuckertz et al., 2017). Moroz and Hindle (2012) and Shane (2012) support this notion that entrepreneurship research lacks empirical evidence on the entrepreneurial process. Nevertheless, across a considerate amount of entrepreneurship research, the entrepreneurial process encompasses different stages or phases.

Haber and Reichel (2007) identify four stages, namely the discovery of an idea, the development of an idea, the acquisition of human capital and financial resources and finally, the operationalisation of the idea. Shane and Venkataraman (2000) suggest a definition of the entrepreneurial process that entails three main stages, namely identification, validation and exploitation of opportunities.

As human capital (HC) emerges in this study as a theoretical lens through which the entrepreneurial process is studied, four stages are identified where education as an investment result in outcomes (skills). The first stage is opportunity identification, where HC is important to discover and create entrepreneurial opportunities (Alvarez & Barney, 2007; Marvel, 2013). The second stage is opportunity validation where HC is vital in the accumulation of knowledge (Bradley et al., 2012). The next stages are opportunity exploitation and resource mobilisation, where HC assists by acquiring resources and launching new ventures (Bruns et al., 2008; Dimov, 2010). For this research, the entrepreneurial process thus consists of four stages, where each stage is added to the former (summarised in Figure 3.2 below). Skills in each stage differ and change in importance and complexity across stages (Mamabolo & Myres, 2020). Figure 3.2 illustrates the different phases of the entrepreneurial process.

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Figure 3. 2: Dimensions of the Entrepreneurial Process

Consistent with previous literature (Shane & Venkataraman, 2000; Clough et al., 2019), this research study identified the dimensions of the entrepreneurial process as opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation. Building on this classification, the entrepreneurial process is observable and action-orientated which contributes to an environment where students can interact within an entrepreneurial context. Having identified the entrepreneurial process dimensions (which can also be viewed as stages), the next section is devoted to an extensive discussion of each of these dimensions to contextualise the debate.

3.3.1 Opportunity identification

The initial stage of the entrepreneurial process involves activities associated with identifying perceived opportunities and the accumulation of resources necessary for

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the successful formation of a new venture (Kunene & Van Vuuren, 2008). Alvarez et al. (2013) posit that entrepreneurial opportunities can be identified and exploited according to the diversity of the entrepreneurs' resources. The first stage of the entrepreneurial process is thus the identification of a viable opportunity that is present in the market (Bhave, 1994; Timmons, 1999; Kuratko, 2001; Baron 2004b; Amorós & Bosma, 2014). Opportunity identification can be divided into the following steps: scanning the environment, identifying opportunities, developing opportunities, evaluating opportunities and evaluating teams (Gartner et al., 1999; Ardichvili et al., 2003). Furthermore, steps within opportunity identification involve scanning the environment for information and utilising the changing information effectively from the transformed external environments (Markman & Baron, 2003; Du Toit, 2016). Thus, through opportunity recognition, the entrepreneurial process has potential to succeed (McCline et al., 2000; Kodithuwakhu & Rosa, 2002). Opportunity identification seeks improvement in a competitive environment (Man et al., 2002). Opportunity identification is therefore defined as a favourable environment that produces new products, services or ventures (Barringer & Ireland, 2010). More so, an entrepreneur can identify an opportunity where a gap exists. For instance, the provision of an increased number of automatic teller machines (ATMs) was designed precisely as a solution to reduce the length of queues in the bank. The environment and an individual's experience play a vital role in identifying and recognising entrepreneurial opportunities (Baron & Ensley, 2006).

Opportunity identification is an essential part in entrepreneurship education. According to Gruber et al. (2015) entrepreneurs use skills to examine the environment and identify technological changes. Skills such as problem solving, creativity, critical thinking, risk-taking and innovation are vital for this stage (Badawi et al., 2018). The ability to identify opportunities can thus lead to the improvement of the quantity of ideas generated and the innovativeness of these ideas (DeTienne & Chandler, 2004).

Drawing from the above discussion, opportunity identification includes sensing and recognition of market needs and resources to create a link between separate needs and resources by introducing a business concept (Ardichvili et al., 2003). In human capital development, four opportunity identification processes indicate that variations in human capital are associated with the selection and application of various

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opportunity identification processes. These processes are replication, innovation, acquirement and education (Chandler et al., 2005). This study argues that entrepreneurial skills are relevant in each specific entrepreneurial stage.

3.3.2 Opportunity validation

There exists a considerable amount of empirical and theoretical research on the processes of opportunity identification and exploitation, but the process of opportunity validation has received less focus (Wood & McKelvie, 2015). These processes are non-linear and interrelated, therefore opportunity validation is important to a holistic approach. Existing research focuses on the assessment of an opportunity and the economic impact thereof (Smith et al., 2010). Opportunity validation may involve comparing and testing innovative ideas in the market to determine their uptake and value. Activities such as testing through market research and learning are employed in the opportunity validation process (Musteen et al., 2018).

A solid evaluation validates opportunities to achieve specified results and thus it is a vital component to determine an entrepreneurs' actions. The ability to evaluate an opportunity is considered as a distinctive and fundamental characteristic of an entrepreneur (Hindle, 2007). The skill of evaluation is primarily an entrepreneurial skill, as entrepreneurs need to examine different opportunities and validate which opportunity is the best option to pursue. Being knowledgeable of what opportunity could be of significant value will determine when and where to take action.

3.3.3 Opportunity exploitation

Opportunity exploitation includes the utilisation of external knowledge sources to realise identified opportunities by means of investments, actions and the deployment of resources (Foss & Klein, 2012; Clough et al., 2019). Opportunity exploitation is dependent on the level of problem solving and the capacity to explore diverse knowledge sources (Foss et al., 2013).

Entrepreneurs exploit identified opportunities (Parente & Feola, 2013), but the act of exploitation can also be performed by non-entrepreneurs (Hindle, 2007; Ramoglou et

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al., 2020). Although opportunity identification can be experienced by entrepreneurs or non-entrepreneurs, opportunity exploitation differentiates entrepreneurial behaviour through the validation of opportunities (Maritz & Amarsadi, 2015). An entrepreneur's ability to discover and exploit an opportunity that other individuals do not notice signals the importance of entrepreneurial alertness (Kirzner, 1973; Park et al., 2017). Opportunities that are pursued by entrepreneurs result from an awareness of possibilities (Hisrich & Peters, 2002). Entrepreneurs who exploit opportunities are often calculated risk-takers that do not only see the potential gap in the market but take action to fulfil the need. Haynie et al. (2009); Li et al., (2015); Nieto & Gonzalez-Alvarez, (2016) concur that not only knowledge of an opportunity is essential, but the availability of resources to act on the opportunity also influences opportunity exploitation.

3.3.4 Resource mobilisation

The process where entrepreneurs accumulate resources to execute an opportunity is referred to as entrepreneurial resource mobilisation (Marquis & Tilcsik, 2013). Resource mobilisation consists of acts of resource management that enable entrepreneurs to manage resource-related limitations (Armstrong, 2015). Resource mobilisation includes activities such as identification, collection and utilisation of resources (Fiet et al., 2013). Collecting resources is important, but utilising the accumulated resources is vital to obtain results in the entrepreneurial process.

There is a close integration between opportunity identification and resource mobilisation where these two entrepreneurial processes interact (Clough et al., 2019). Identifying opportunities will determine which resources are of significant value to advance the outcome of the entrepreneurial process. O'Sullivan et al. (2014) determined that resources are becoming scarce, while human needs are increasing excessively. Therefore, three types of resources were formerly utilised for production, namely natural resources (water, natural gas, oil and minerals), human resources (entrepreneurship, leadership, skills, and knowledge) and capital resources (buildings, machines, infrastructure and equipment).

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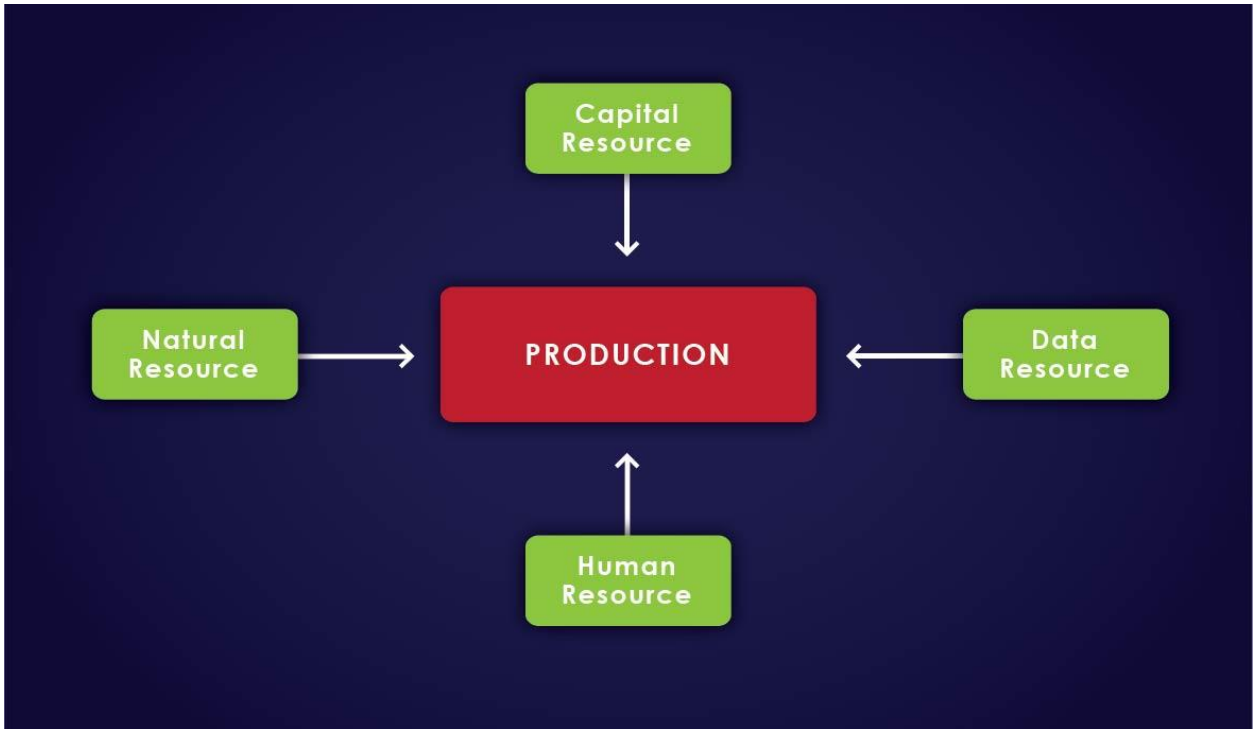

Figure 3. 3: New production resources
(Source: Adapted from O'Sullivan et al., 2014)

While these three types of resources are regarded as important for production, an additional resource is necessary for improving the entrepreneurial process. Laney (2017) states that 4IR demands a new resource, namely data resources, for macro-economic developments. This resource, also referred to as big data, is defined as high velocity, volume and variety information assets that necessitates new forms of processing to enhance decision making, process optimisation and insight discovery. Barton and Court (2012) and Javaid et al. (2021) argue that access to big data is critical in this innovative era as data is considered as the main driver of transformation and growth. Big data can assist entrepreneurs in resource mobilisation since human behaviour is captured and patterns are verified. This can distinguish which resources are necessary for successful results in the entrepreneurial process.

Student entrepreneurs use big data to engage in resource mobilisation. Student entrepreneurs who display technical skills such as abilities to use software applications, coding and computer programming assemble the resources to exploit entrepreneurial opportunities.

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3.4 DIFFERENT PERSPECTIVES ON THE ENTREPRENEURIAL PROCESS

The integration of the iterative approach in the entrepreneurial processes of opportunity identification and opportunity validation promote venture creation (Dimov, 2007a; Dimov, 2007b). Patil et al., (2019) posit that in this iterative approach, the entrepreneurial process is cut into a series of repetitive loops, or cycles. Within each iteration features are revised or new features are introduced. Volatile changes take place in 4IR and requirements often vary. By converting opportunities to assist the entrepreneurial process, the iterative approach complements the period of transformation in 4IR. Entrepreneurs apply this approach in four action steps in the opportunity exploitation stage. As entrepreneurs enter new stages in the entrepreneurial process, problems can be encountered, whereby they must revert to earlier stages. The iterative approach includes two types of actions, namely micro-iterations and macro-iterations. Micro-iterations take place within a stage to improve the outcome of each stage. Macro-iterations move back from one stage to a previous stage to resolve issues (Goldsby et al., 2017).

Another approach is the sequential approach, where all phases are carried out in linear fashion. The process is broken into clear phases and is characterised by a rigid structure. There is no progression to a next stage before the previous one concludes. Output of the previous stage is therefore input to the next stage; however, this approach does not complement the entrepreneurial process, especially in this era of transformation in 4IR. The difference between the iterative and sequential approaches is clarified in Table 3.1.

Table 3. 1: Difference between the iterative approach and the sequential approach

Iterative approach	**Sequential approach**
Scope and requirement are defined for next iteration.	Scope and requirements are specified upfront at conception of entire process.
Flexible structure. Changes are accepted and applied in impending iterations.	Clear and rigid structure. Excess time spent on planning.

(Source: Adapted from Patil et al., 2019)

Baron (2008) identifies vital aspects of the entrepreneurial process, such as opportunity recognition, acquiring needed resources successfully and responding

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sufficiently in a highly dynamic environment. These aspects could be affected by behaviour and cognition, as well as unstable environments in which entrepreneurs operate that influence their performance in creating new ventures. Therefore, stages in the entrepreneurial process have to be adaptable and adjustable, and cannot be considered as fixed and complete.

3.5 THEORIES VALIDATING THE ENTREPRENEURSHIP PROCESS

3.5.1 Schumpeter's Theory

Schumpeter contributed to the progress in understanding entrepreneurship through underlining the importance of innovation (Toma et al., 2014). Schumpeter (1934) suggested that through innovation, entrepreneurs destabilise economic markets. The entrepreneur functions as a creator of new processes and products when introducing them to the market, causing destabilisation of the market in the process. Schumpeter introduced the modern growth theory that is centred on the byproduct of the process of innovation and development. The description of the innovation process by Schumpeter is still applicable in the contemporary technologically and knowledge driven global economy (Carayannis, 2007). Economies benefit from optimising existing resources in a stable environment and treats disruptions such as new venture creation as important for the entrepreneurial process. Schumpeter established the connection between entrepreneurship, growth and innovation (Toma et al., 2014).

Schumpeter adopted the view that the entrepreneurial process is one of the vital factors in economic development (Toma et al., 2014). Entrepreneurial activity is a critical factor for economic development through innovation and creativity manifest in markets (Jones & Jayawarna, 2011; Gemmell et al., 2012; Brizek, 2014). Furthermore, Schumpeter's theory focuses on how innovation may lead to improved opportunity identification since this ability could impact the entrepreneurial process.

Schumpeter's major contribution to entrepreneurship research is evident in his theory of economic development. Schumpeter contributed to the progress in understanding entrepreneurship through underlining the importance of innovation (Toma et al., 2014) Schumpeter (1934) suggested that through innovation, entrepreneurs destabilise economic markets. Entrepreneurial activity, as a result of innovation and creativity, is

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a critical factor for economic development in markets (Jones & Jayawarna, 2011; Gemmell et al., 2012; Brizek, 2014). The entrepreneur functions as a creator of new processes and products when introducing them to the market, causing destabilisation of the market in the process. Economies benefit from optimising existing resources in a stable environment and treats disruptions, such as new venture creation, as important for the entrepreneurial process. Schumpeter adopted the view that the entrepreneurial process is one of the vital factors in economic development (Toma et al., 2014). Furthermore, Schumpeter's theory focuses on how innovation may lead to improved opportunity identification, as this ability could impact the entrepreneurial process.

Schumpeter therefore established the connection between entrepreneurship, growth and innovation (Toma et al., 2014). Schumpeter introduced the modern growth theory that is centred on the byproduct of the process of innovation and development. The description of the innovation process by Schumpeter is still applicable in the contemporary technologically and knowledge driven worldwide economy (Carayannis, 2007).

3.5.2 Kirzner's Theory

Kirzner (1973) considers entrepreneurship as alertness to profitable ventures. Due to this alertness, entrepreneurs possess different cognitive capabilities that benefit them in the opportunity recognition process (Gaglio & Katz, 2001). Two key components that entrepreneurs utilise for alertness to identify entrepreneurial opportunities are linking an entrepreneur's prior knowledge to existing knowledge and then benefiting from the cognitive capabilities possessed by the entrepreneur (Kirzner, 1973; Kirzner 1997). Entrepreneurs can identify unnoticed entrepreneurial opportunities (Kirzner, 1973; Kirzner 1979) that equip them to perceive not only the current market, but also its future prospects (Berman & Kariv, 2016). A vigilant entrepreneur will be more alert to identify feasible opportunities and may therefore lead to an improvement on the entrepreneurial process.

According to Kirzner (1973), human action leads to entrepreneurial action through innovating, predicting and discovering opportunities in a highly dynamic environment.

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Kirzner (1998) then states that an entrepreneur seeks opportunities and throughout their involvement, restores equilibrium in the market. After entrepreneurs have formed part in organising markets and entrepreneurial activities, they obtain information that contributes to the market environment (Eckhardt & Shane, 2003). Kirzner's Theory gives a platform for entrepreneurs to seek and identify opportunity that may lead to the exploitation and validation of opportunities.

3.5.3 Schultz's Theory

Schultz (1979) defines entrepreneurship, an aspect of human behaviour, as the ability to alter resources in reaction to changing circumstances. He further regards entrepreneurial ability as a part of human capital. He argues that education, experience and training, the outcomes of human capital, can increase entrepreneurial ability. Humans with specific entrepreneurial skills and experiences can increase entrepreneurial ability in an economy. Having the entrepreneurial ability to mobilise resources constitutes a part of the entrepreneurial process that mediates entrepreneurial readiness behaviour.

Schultz also emphasised the vital role of creativity in economies (Audretsch, 2006), where creativity has a stabilising effect (Schultz, 1975). Supporting this argument, Hébert and Link (1989) established that entrepreneurship is a process where economies are restored to equilibrium by means of innovation and creativity. Creativity comprises the generation and implementation of new ideas characteristic of new venture creation (Fillis & Rentschler, 2010). It is critical that economic systems based on knowledge and technology focus on relevant technological creativity adjusted to the contemporary macro-environment (UNCTAD, 2010; Krauss & Sternberg, 2013). Obtaining more knowledge will create new ideas that will improve the identification of more opportunities. Improving the entrepreneurial process will systematically restore the economy.

3.6 VALUE OF THE ENTREPRENEURIAL PROCESS

Baron (2008) captures the dimensions of the entrepreneurial process and sees successful venture creation as the ultimate goal. Bernoste et al. (2019) posit that the

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first key aspect is an entrepreneur's capacity to identify opportunities that will potentially lead to venture creation and growth.

Haber and Reichel (2007) also identify four main stages of the entrepreneurial process but emphasise that performance of the entrepreneurial process is conditioned on the entrepreneur's possession of certain capabilities or skills. Therefore, the purpose of this study is to underline the value of the entrepreneurial process through acquiring selected skills in an educational environment for university students.

3.6.1 Value of the education process in the entrepreneurial process

Entrepreneurship education is defined as the specific context of education with focus on creating a venture and becoming self-employed. This definition encapsulates opportunity identification, self-employment, business development, venture creation and venture growth in becoming an entrepreneur (Mahieu, 2006; QAA, 2012). In support of this definition, Maritz and Donovan (2015) state that the entrepreneurial process and innovative entrepreneurship education are focused on opportunities and the creation of value. Fayolle (2010) argues further that innovation and entrepreneurship education develop entrepreneurial qualities, skills and attitudes, which equip individuals with the necessary tools. This supports the notion that the education process is valuable in the acquisition of the selected skills necessary in the entrepreneurial process.

The argument regarding the entrepreneurial process is that the teaching method of the education process is significant in promoting entrepreneurship. The lack of knowledge of different teaching methodologies could be one of the main reasons why university students often struggle to understand the entrepreneurial process. It is therefore relevant to explore different approaches to entrepreneurship education in universities. Heinonen and Poikkijoki (2006) concur that the learning objectives of the education process should focus on growing understanding and knowledge of entrepreneurship among university students and therefore combining relevant entrepreneurial skills and behaviour as a requirement for the entrepreneurial process.

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Research shows that entrepreneurial skills can be developed through education (Alakaleek, 2019). Education can develop skills and attributes that generate an entrepreneurial mindset to prepare students as entrepreneurs, capable of solving fast-changing and complex problems (Davey et al., 2016; Boldureanu et al., 2020). Traditional business education fails to equip students with knowledge and skills required in the entrepreneurial process, therefore it has to change, essentially meaning that entrepreneurial education must be expanded. Traditional education must shift towards an experiential learning methodology by implementing a more action-oriented strategy and a mentoring and group-work approach resulting in greater learning effectiveness. Valuable skills that need to be developed are innovation, creativity, risk-taking and collaboration, while problem solving and critical thinking are also considered as key skills in this approach. A more hands-on approach tapping into simulations, case studies, internships and projects to encourage interactive entrepreneurial skills is advised (Cooney, 2012). Shah et al. (2020) conclude that entrepreneurial education can provide university students with knowledge, skills and motivation required for successful venture creation.

Practical teaching should be a vital aspect of the teaching structure of HEIs and is undeniably an essential expansion of theoretical teaching. Furthermore, the practicum contributes significantly to the understanding, development and improvement of the entrepreneurial process of university students. Practical teaching is the cultivation of different applied aptitudes conducted through numerous systematic professional skill training and practical activities. Practical teaching with experimental teaching demonstration centres and internship training provides students and teachers with guidance on exploring new ideas, discovering new problems, and acquiring new results in the procedure of investigating, training, practicing and experimenting (Shen, 2019). Practical teaching should improve the content of entrepreneurship education and innovation of university students. HEIs are required to establish a rigorous innovation and entrepreneurship system to add value to entrepreneurial practice (General Office of the State Council, 2015). Practical teaching should simulate the entrepreneurial process by encouraging the cultivation of university students' skills and awareness toward innovation and entrepreneurship. The skills cultivated by HEIs should encourage lifelong learning, therefore practical teaching should mirror the characteristics of teaching content, organisational forms of teaching processes and

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methods (Shen, 2019). Kaijage and Wheeler (2013) argue that even if entrepreneurship education encourages entrepreneurial action, the emphasis should be on different teaching methodologies promoting the entrepreneurial process. Entrepreneurship education thus requires a fundamental metamorphosis of educational systems.

3.6.2 Value of lifelong learning in the entrepreneurial process

Entrepreneurial education can equip students with lifelong skills needed for self-employment and venture creation (Amire et al., 2016). Lifelong learning will become the norm as automation expands exponentially, which implies that the individuals will need to improve skills on a regular basis (Gwata, 2019). Lifelong learning is described as the act of constantly acquiring knowledge, technological abilities and conceptual attitudes in order to survive by adapting to the environment (Guay et al., 2014). Students of all ages must take part in the process of reskilling in line with lifelong learning (Schwab, 2017). Lifelong learning is encouraged by the entrepreneurial process, where students aim to acquire selected skills and knowledge (Newman, 2015).

Innovation is a tool of the entrepreneur (Drucker, 1993) and creates value for whoever adopts it (Baldwin & Curley, 2007). Innovation relates to the adoption, exploitation and development of value-added activities and is vital for competitiveness (Crossan & Apaydin, 2010; Lewrick et al., 2010). Embracing innovation education and entrepreneurship develops more innovators and entrepreneurs (Donovan et al., 2013; Maritz & Brown, 2013). Innovation and transformation in the world require humans to constantly evolve, resulting in the urgency for lifelong learning. Therefore, lifelong learning is necessary to ensure that the entrepreneurial process is kept up to date. HEIs should focus on learning outcomes, student-centred learning and most importantly, lifelong learning (Panah & Rusman, 2018) to stimulate the entrepreneurial process.

3.7 CRITIQUE OF THE ENTREPRENEURIAL PROCESS

Although it is recognised that 4IR skills are essential in the creation of new ventures, the focus of extant research is on required skills of entrepreneurs without

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differentiating the required 4IR skills in each stage of the entrepreneurial process. The entrepreneurial process may therefore appear to be sequential and linear, but in fact it is iterative and dynamic. Within each iterative approach, skills are introduced or revised. Whenever an entrepreneur enters a new stage in the entrepreneurial process, a previous stage may have to be revisited to address problems. It is possible that a stage in the entrepreneurial process can be omitted or later implemented in combination with another stage. Van der Veen and Wakkee (2006) postulate that some stages in the entrepreneurial process can even overlap. This demonstrates the iterative nature of the entrepreneurial process.

Although there are 4 identifiable constructs of the entrepreneurial process, i.e. opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation, boundaries are fluid and constantly changing. Mets (2015) agrees and describes the entrepreneurial process as holistic, but unique with outcomes influenced by antecedent variables. The core components of the entrepreneurial process are thus partly overlapping each other, and partly interchangeable.

3.8 PARALLEL STUDIES ON ENTREPRENEURIAL PROCESS

There exist a lot of opportunities in South Africa for new venture growth. This growth can be powered by the development and implementation of the entrepreneurial processes and by investing in the education system to produce and support student entrepreneurs.

Each country faces challenges regarding the skill level of their workforce when adopting 4IR (Aulbur et al., 2016). To thrive in the turbulent period of 4IR, current and future generations must adapt to a transformed education system. The education system needs to transform from one based on facts to a system based on the active application of knowledge in a collective, problem-solving manner (World Economic Forum, 2015). Students should acquire cross-functional skills to promote the entrepreneurial process in 4IR and this should be a vital focus point in the context of education (Xu et al., 2018).

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Entrepreneurs should be aware of the technological transformation process currently taking place. The digital aspect of the world is continuously growing and developing. Therefore, automation will affect skills in the future in different work environments. It is important to know which skills should be focused on and which skills will have the biggest impact in the future (McKinsey & Company, 2018).

Three components necessary in the measurement of the ecosystem for entrepreneurs are the quality of education systems, the years of education adjusted for skills and the creation of new entrepreneurial ventures. African countries with a healthy entrepreneurial ecosystem will be able to make use of the opportunities provided by 4IR (Naudé, 2017). Where South Africa is behind world automation leaders, such as Germany and China, it is necessary to collaborate to ensure that skills meet the requirements (Mkansi, 2019) of the entrepreneurial process. If South Africa works towards incorporating 4IR in the society, their economy will grow and the country will be more sustainable and stable, as well as an increase in innovation, education and skills development will arise (Knott-Craig, 2018).

3.9 CHAPTER SUMMARY

The literature review of this chapter provided the definition and concept of the entrepreneurship process. Furthermore, the different dimensions and perspectives were discussed. The entrepreneurship process which consists of opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation involves entrepreneurial activity through human interaction.

The theories used in this thesis include Schumpeter's Theory, Kirzner's Theory and Schultz's Theory. However, the main underlying framework for the study is Schultz's model, where entrepreneurship is considered as an aspect of human behaviour and entrepreneurial ability is regarded as part of human capital.

The integration of the iterative approach in the entrepreneurial process stimulates venture creation and growth. Venture growth can be powered by the implementation of the entrepreneurial process by investing in the education system to produce student entrepreneurs. Entrepreneurial education focuses on the development of

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entrepreneurial qualities and skills to improve the entrepreneurial process of student entrepreneurs. Effective entrepreneurship education, by stimulating the entrepreneurial process, is likely to reduce the numbers of job dislocation and promotes venture creation.

Therefore, a study of the entrepreneurial process will add value to the adoption of strategies and influence students to develop selected 4IR skills to improve their entrepreneurial ability. Since changes brought about by 4IR requires entrepreneurs to adopt the entrepreneurial process, entrepreneurial readiness behaviour will also be influenced. The next chapter provides an extensive review of entrepreneurial readiness behaviour.

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CHAPTER 4 ENTREPRENEURIAL READINESS BEHAVIOURS

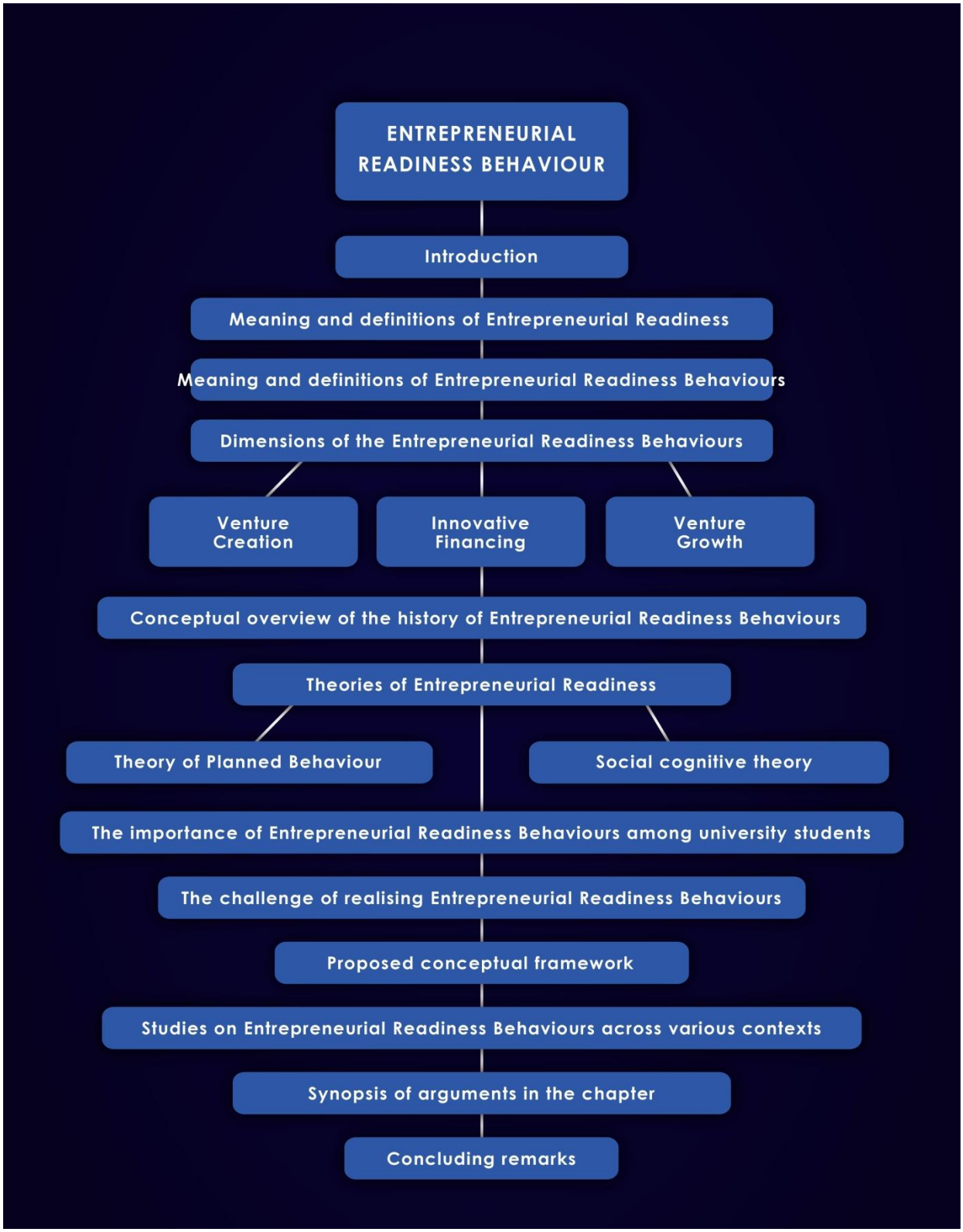

Figure 4. 1: Flow diagram indicating the structure of Chapter 4

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4.1 INTRODUCTION

This chapter follows on the previous chapters on the need to undertake entrepreneurial studies to evaluate the significance of the selected 4IR skills in transforming technological environment in terms of entrepreneurship of graduate students and the subsequent entrepreneurial process. Past studies identified skills needed due to 4IR and the entrepreneurial process per se, but not in context of the mediation of the entrepreneurial process.

The argument for the requirement of selected 4IR skills appears to be not only relevant in the entrepreneurial process, but also in the entrepreneurial readiness behaviour of student entrepreneurs. Where 4IR requires educational institutions to update skills to meet the needs of transforming technologies and industries (Bainbridge & Roco, 2016), entrepreneurial readiness behaviour is sidelined. The minimal input in entrepreneurial activities is of great concern if effective entrepreneurial training is not introduced (Olugbola, 2016). No study to the researcher's knowledge has probed the effects of selected 4IR skills on entrepreneurial readiness behaviour in relation to the mediation of entrepreneurial readiness behaviours among university students. Therefore, this chapter outlines the context in which entrepreneurial readiness behaviours are investigated.

This chapter opens with various definitions of entrepreneurial readiness and entrepreneurial readiness behaviours. This is followed by the dimensions and history of entrepreneurial behaviours. The importance of this behaviour among university students is discussed following an investigation of different theories. Keeping the challenges of realising entrepreneurial readiness behaviour in mind, a conceptual framework is proposed.

4.2 DEFINITIONS OF ENTREPRENEURIAL READINESS

According to Hempel and Fiala (2012) and Olugbola (2017), research on youth entrepreneurial activities is scarce. From a behavioural perspective, entrepreneurial readiness of student entrepreneurs in terms of opportunity identification and exploitation is investigated. Volatile changes caused by transformation have raised the need to develop the required skills among students enabling them to identify and

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exploit opportunities. Shane et al. (2012) suggest that a successful venture depends on entrepreneurs' readiness to turn viable ideas into a new venture. Opportunity identification has a significant and positive effect on entrepreneurial readiness towards the creation of new ventures (Seun & Kalsom, 2015). To identify and exploit opportunities depends largely on readiness of students to actively participate in entrepreneurial activities. Barringer and Ireland (2015) posit that the low level of opportunity exploitation among students is the result of lack of required skills to engage in entrepreneurial activities.

Entrepreneurial readiness is defined as the convergence of a group of personal characteristics that distinguish individuals with readiness for entrepreneurial activity. It further entails competent entrepreneurs who analyse and observe their environment in such a manner that they channel their productive and creative potentials. In addition, they exhibit the capability to fulfil the need for self-achievement and challenges that may transpire (Coduras et al., 2016; Ruiz et al., 2016). Entrepreneurial readiness of students thus depends on the ability to identify and explore viable opportunities to realise self-achievement.

Lau et al. (2012) define entrepreneurial readiness as the cognitive attributes of willingness and capability of an individual when directing behaviour in an entrepreneurial environment. An individual's willingness to be self-employed (Mitchell et al., 2002; Ayalew & Zeleke, 2018) and social resources (Estrin & Mickiewicz, 2011) are considered as indispensable elements in starting a new venture. Carsrud and Brännback (2009) agree that entrepreneurial readiness depends on the positive mindset of students towards entrepreneurial activities. Mitchell et al. (2002) and Olugbola (2017) suggest further that prior knowledge, social networks and cognitive abilities enable students to identify opportunities that influence readiness to create a new venture.

Entrepreneurial readiness consists of four elements relating to an individual's social connectedness, fear of failure, opportunity perception and skills. This entrepreneurial readiness concept represents interlinked characteristics. Entrepreneurial readiness also plays a substantial role in an individual's entrepreneurial intention. Entrepreneurial readiness is further based on an individual's self-efficacy, risk

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aversion, social capital and opportunity perception (Schillo et al., 2016). The relation to entrepreneurial behaviour is evident when entrepreneurial readiness is defined. These characteristics and entrepreneurial intentions reinforce entrepreneurial readiness behaviour.

4.3 DEFINITIONS OF ENTREPRENEURIAL READINESS BEHAVIOURS

In a time of volatile change caused by 4IR, the domain of entrepreneurship has expanded. In the pursuit of entrepreneurial opportunities, entrepreneurial behaviour has received increased attention. Entrepreneurial behaviour is a subdivision of entrepreneurial activities dealing with predicting, understanding and influencing an entrepreneur's behaviour in an entrepreneurial environment. Entrepreneurial behaviour implies the prediction, understanding and control of human behaviour in ventures. The focus is on the impact of entrepreneurial behaviour on the creation and growth of ventures. Entrepreneurial behaviour increases the margin of success and survival of ventures during transformation (McAdam & Cunningham, 2019).

Despite the growing interest in entrepreneurial behaviour as a construct of entrepreneurship, extant research on entrepreneurial readiness behaviour of student entrepreneurs is insufficient. According to Bird et al. (2012) the focus should shift to human action in venture creation and growth in order to fully comprehend entrepreneurial behaviour. McAdam and Cunningham (2019) posit that behaviour is the result or outcome of experience, motivation, personality, knowledge and skills of entrepreneurs externalised through action.

The definition of entrepreneurial behaviour emphasises the actions of entrepreneurs engaged in the entrepreneurial process. Entrepreneurs' actions differ and set them apart from non-entrepreneurs (Ndofirepi, 2016). Actions that create value to ventures are directed by an entrepreneur's prior knowledge, experience, education and attributes (Harmeling, 2011; McAdam & Cunningham, 2019). This statement is supported by Basu (2004) and Coduras et al. (2016), who confirm that an entrepreneur has attributes, namely readiness to pursue opportunities and generate results. Timmons (1989) and Sobel (2008) define behaviour-based entrepreneurship as the ability to build or create a venture from minimum resources. Furthermore, Timmons

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(1999) contends that successful entrepreneurs exhibit similar behaviours and attitudes, such as perseverance, determination, optimism, integrity, effectiveness, motivation, diligence and always search for opportunities. Ozdemir et al. (2014) agree that entrepreneurs utilise skills to assist them in making informed decisions which lead to successful venture creation. Successful entrepreneurs attribute venture success to behaviour and attitudes. Entrepreneurship is therefore in essence a succession of activities, performed by entrepreneurs to fulfil specific objectives, such as venture creation.

According to Kirkley (2016a), the most pervasive factor influencing new venture creation and growth is technological advancement. This factor prominently features in entrepreneurial decision-making (Gerschewski & Xiao, 2015) and entrepreneurial behaviour, leading ultimately to new venture creation.

Entrepreneurial readiness has a strong correlation with entrepreneurial behaviour as measured by means of opportunity-based entrepreneurship and entrepreneurial entry (Raza et al., 2019). Entrepreneurship is also associated with change-oriented behaviour and innovation (Drucker, 1985), as well as opportunity-driven behaviour (Morris et al., 2001). Drucker's definition supports Schumpeter's definitions, as entrepreneurship behavioural aspects align with the entrepreneurial process associated with innovation and transformation (Ndofirepi, 2016).

4.4 DIMENSIONS OF THE ENTREPRENEURIAL READINESS BEHAVIOURS

Prior research conducted on entrepreneurship illustrates that entrepreneurial behaviour is planned and deliberated (Kazmi & Nabradi, 2017). Planned behaviour is best predicted by intentions. Intentions play an important part in venture creation (Linan & Chen, 2009). Desirability and self-efficacy impact the entrepreneurial intentions of students at universities (Kazmi & Nabradi, 2017) which in turn determine the entrepreneurial readiness behaviours of students. For this study, entrepreneurial readiness behaviour consists of the following elements: venture creation, innovative financing and venture growth.

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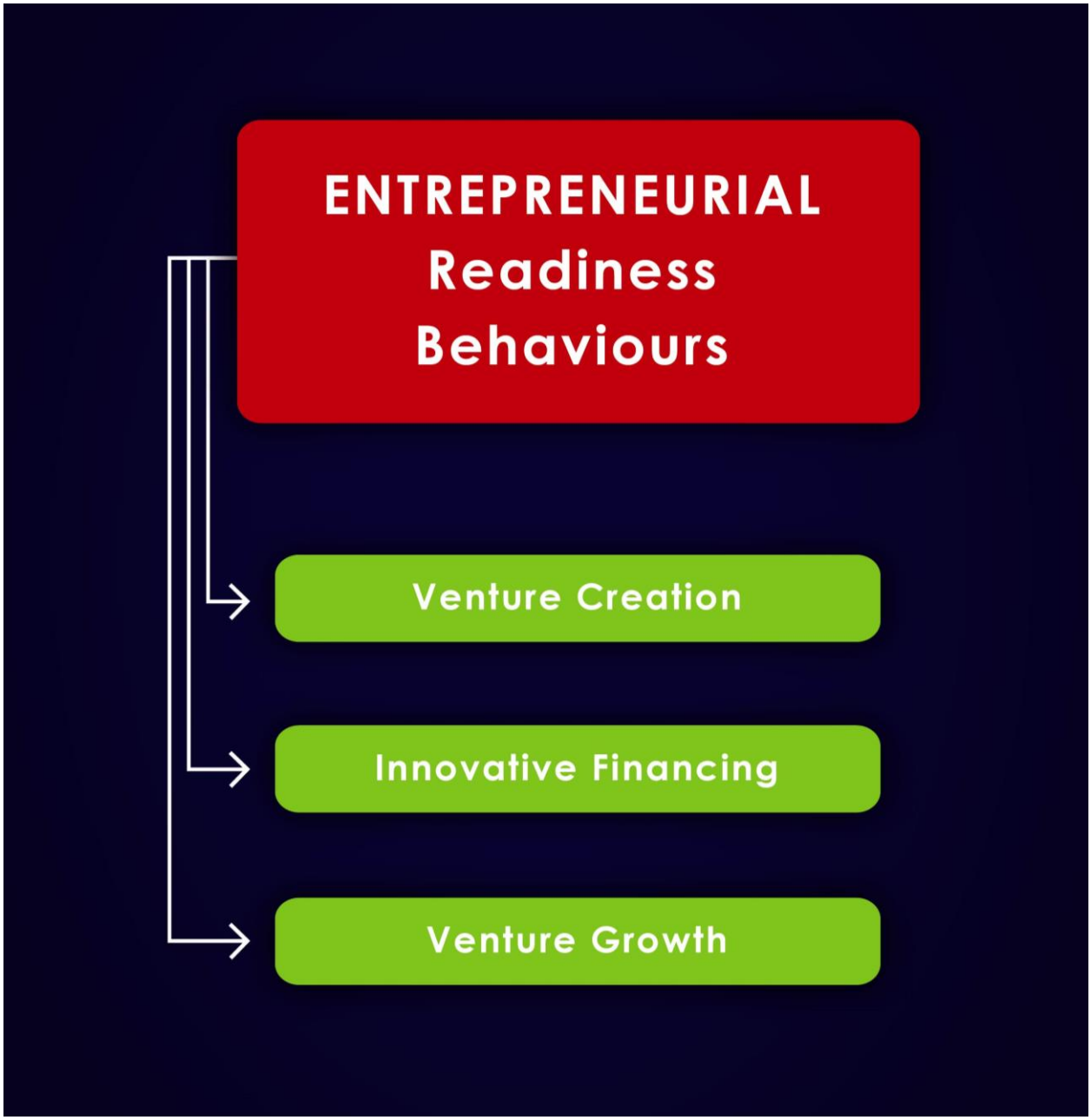

Figure 4. 2: Dimensions of Entrepreneurial Readiness Behaviours

Previous research (Rwigema & Venter, 2004; Cardone & Fonseca, 2006; Prelipcean et al., 2014; Kirkley, 2016; Mamabolo et al., 2017a) considered venture creation, innovative financing and venture growth as the three dimensions of entrepreneurial readiness behaviour. Wulandari et al. (2021) also suggest that entrepreneurial readiness involves the identification of opportunities and mobilisation of resources for entrepreneurial performance. This research study builds on this classification by using the different dimensions of entrepreneurial readiness and considering them as key contributors to entrepreneurial venture success.

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New venture creation is a process where an entrepreneur engages in entrepreneurial activities to turn an opportunity into a viable venture. These dimensions of entrepreneurial readiness behaviours are further elaborated on.

4.4.1 Venture creation

Shane and Venkataraman (2000) and Kuratko et al. (2015) identify different facets of new venture creation such as new venture ideas, evaluation and exploitation of opportunities. Entrepreneurs utilise specific capabilities and skills to assist them in the rational decision-making process necessary to achieving success through the creation of a new venture (Ozdemir et al., 2014). Although there are many factors that can influence new venture creation, such as trends, market demands, social environment and economic conditions, the most pervasive factor appears to be technological change. This factor involves innovation and specifically entrepreneurial decision-making, resulting in new venture creation (Gerschewski & Xiao, 2015).

Although innovation and creativity are prerequisites in the cognitive perspective, entrepreneurs should also possess sufficient skills and knowledge in the new venture creation process (Kirkley, 2016s). Experience, skills and prior knowledge are essential in new venture creation (Shane, 2003). This cognitive perspective forms the basis of cognitive characteristics of entrepreneurs in the design and establishment of new ventures (Mehdivand et al., 2012). An entrepreneur's cognitive ability is a resource that can be utilised to predict venture creation. The entrepreneurial preparedness and capability of an individual are cognitive resources positively associated with decisions regarding venture creation (Mitchell et al., 2000).

Cognitive structures, specifically business skills and education, will influence the degree of capability when creating a new venture (Verheul et al. 2002; Levie & Autio 2008). An entrepreneur's inclination to create a new venture will be reduced by low levels of business skills and knowledge, whereas developing business skills and knowledge will encourage entrepreneurs in the process of new venture creation (Arenius & Minniti, 2005). Therefore, a developed educational system will assist

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entrepreneurs with the required skills and knowledge to participate in entrepreneurial ventures (Mitchell et al., 2000; Bosma & Levie, 2010).

Resources and capabilities, such as operating capital, human resources, technology and financial investment, are vital in the planning of creating a new venture (Kanchana et al., 2013). Vital elements of new venture creation are personal preparedness to be self-employed (Mitchell et al., 2000) and social resources managed by individuals (Maula et al., 2005; Driga et al., 2009; Estrin & Mickiewicz, 2011).

4.4.2 Innovative financing

New innovative ventures play a vital role in knowledge-based economies as they are an essential source of jobs, productivity growth, radical innovations and function as disciplining the behaviour of new ventures (Block et al., 2016). Regrettably, these ventures frequently suffer from financial constraints, which restricts venture growth (Carpenter & Petersen, 2002; Cosh et al., 2009; Brown & Earle, 2015). These financial constraints for new innovative ventures are the lack of funding, collateral, cash flow and asymmetric information (Hall & Lerner, 2010).

Entrepreneurial ventures are drivers of employment and economic development. New innovative ventures are connected to the essential creation, development and growth of industries, markets, technologies and create entrepreneurial jobs (Megginson, 2004). Ventures usually need a significant amount of financial capital to sustain venture growth. Therefore, venture capital should be emphasised (Bellavitis et al., 2017). Despite the significance of venture capital, a new set of financing sources have emerged (Bruton et al., 2015). Entrepreneurial ventures are supported by these various sources of financing, which include angel finance, lease finance, bank finance, supplier finance, crowdfunding and private equity (Hanssens et al., 2015).

4.4.3 Venture growth

Venture growth has become vital for success within entrepreneurial behaviour (Venkataraman, 1997; Carton & Hofer, 2006). Identifying and pursuing opportunities are important to venture growth and crucial traits will be influenced. Tolerance of risk-

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taking and need for achievement of entrepreneurs will impact the way the opportunity is explored and will determine the venture's growth (Beattie, 2016).

The last dimension of the entrepreneurial process leads to the survival of a venture, which may result in the expansion of the optimum size influenced by the market demand (Glancey, 1998; Larsson et al., 2003). Venture growth is vital to entrepreneurial success and determines entrepreneurial ventures from small businesses (Wickham, 2001; Rwigema & Venter, 2004; Nieman, 2006).

The growth of new ventures is dependent on financial and human resources (Cooper et al., 1994). Knowledge and capacity are associated with human capital and include the education level, as well as management and industry experience. Human capital contributes to venture growth and plays an important part in the success of entrepreneurs. Human capital elements of entrepreneurs include education, work history, family-environment, age, support networks and role models (Hisrich, 1990; Krueger, 1993). Higher human capital increases the chances of a new venture's success and survival (Dyke et al., 1992; Bruederl & Preisendoerfer, 1998). Furthermore, human capital of an individual entrepreneur plays an essential part in the success of such an entrepreneur. An entrepreneur with managerial and industrial experience, higher education level and business exposure has a far greater chance of success than entrepreneurs with minimal managerial and industrial experience, lower level of education and little business exposure (Lussier & Pfeifer, 2001). Important drivers of venture growth include ambition and motivation (Baum et al., 2001). An entrepreneur with higher growth aspirations is thus more likely to create a successful venture with massive potential for further growth (Župič & Giudici, 2017).

There are five distinct indicators for venture growth. Financial growth involves increases in turnover, business assets and profits. Strategic growth includes transformation through acquisitions and mergers, exploiting new products, opportunities and markets. Structural growth relates to transformation through organising a venture's internal systems that involves managerial roles, communication links, controlling resource usage, reporting relationships and increasing employees' responsibilities. Organisational growth relates to the transformation of the processes

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used, management attitudes towards employees, culture of organisation and the role entrepreneurs play as the venture grows from small to large. Lastly, image growth involves the transformation of small ventures into more professional, newly built premises and redecorating the premises (Gundry & Welsh, 2001; Wickham, 2001; Rwigema, 2004; Nieman, 2006). The activities embedded in the venture growth process are connected to five strategic growth intentions, known as technological change, market expansion, gathering resources, organisational development and operations (Gundry & Welsch, 2001; Man et al., 2002; Rwigema & Venter, 2004).

4.5 CONCEPTUAL OVERVIEW OF THE HISTORY OF ENTREPRENEURIAL READINESS BEHAVIOURS

To understand entrepreneurial behaviour, this research relied on studies of the psychological traits of entrepreneurs. These traits of entrepreneurs, such as risk-taking, innovativeness, autonomy and need for achievement distinguish entrepreneurs from non-entrepreneurs (McClelland, 1961; Begley & Boyed, 1987). However, a consistent and widely accepted profile of an entrepreneur could not be established. The use of this approach is limited in explaining the development of entrepreneurial behaviour (Palma et al., 2009).

In the 1990s, the research focus shifted to an examination of entrepreneurial behaviour and Ajzen's (1988) Theory of Planned Behaviour emerged. This behavioural approach is centred on the activities of the entrepreneur, instead of focusing on the entrepreneur. In comparison to the trait approach, the behavioural approach is advantageous to entrepreneurs and ventures. Entrepreneurial behaviours are observable, overt and demonstrable; therefore, it can be measured in an objective fashion. The different levels on entrepreneurial behaviour are observable. Entrepreneurial behaviour is measurable and manageable. Furthermore, entrepreneurial behaviour is more flexible and susceptible to change in comparison to the trait approach. Under the entrepreneurial behavioural approach, entrepreneurs develop along with venture growth (Palma et al., 2009; McAdam & Cunningham, 2019).

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The concept of entrepreneurial readiness can be determined at the initial phases of entrepreneurial contemplation, instead of assessment of entrepreneurial entry or outcomes (Schillo et al., 2016). When entrepreneurial lifestyles are socially accepted, it boosts beliefs of entrepreneurial self-efficacy and increases the readiness of adopting entrepreneurial behaviour. Moreover, entrepreneurs in a familiar environment provide opportunities to identify and learn about tasks involving entrepreneurship (Minniti, 2005; Nanda & Sørenson, 2010; Bosma et al., 2012a). This conception is derived from the theoretical model of Minniti (2005), which illustrates that regions with originally similar characteristics may result in different outcomes of entrepreneurial activity. In historical terms, specific natural conditions and unpredictable institutional actions impact the exposure to entrepreneurship (Sørenson, 2017).

Social environment plays a role in entrepreneurship by reducing ambiguity for potential entrepreneurs and assists them to acquire entrepreneurial skills and necessary information. The entrepreneurial self-reinforcing effect depends significantly on the ability of entrepreneurs to observe individuals' behaviours (Minniti, 2005). Another mechanism that contributes to the self-perpetuation of new venture formation and self-employment is the connection to entrepreneurial values (Niittykangas & Tervo, 2005; Laspita et al., 2012; Fritsch et al., 2019). Supporting this concept, past entrepreneurship adopts entrepreneurial self-perpetuation by promoting attitudes which influence entrepreneurship. These attitudes can be an alternative for entrepreneurship-facilitating conditions (Fritsch et al., 2019).

Historic entrepreneurial motivations focused on tolerance for ambiguity, risk tolerance and self-confidence (Summers, 2000). More recent studies have concentrated on beliefs and attitudes, as these can predict behaviours and intentions. These notions are grounded on human cognitive processes that distinguish possible results and make decisions on feasible actions to achieve these results (Segal et al., 2005). The conceptualisation of the past is that the historical self-employment rate does not measure entrepreneurial attitudes. It is argued that the persistence of entrepreneurship is motivated by continuous structural determinants of entrepreneurship. Therefore, the exposure of entrepreneurship-facilitating attitudes will remain a plausible explanatory factor of persistent behaviour (Fritsch & Wyrwich,

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2017). Higher levels of historic self-employment produce more entrepreneurial personality, which leads to innovation activity that is a vital for future growth. Innovative activities and new venture formations have historical entrepreneurial roots that originate from entrepreneurial personality. Current and historical entrepreneurship is linked to the prevalence of positive attitudes towards entrepreneurship (Fritsch et al., 2019).

4.6 THEORIES OF ENTREPRENEURIAL READINESS BEHAVIOUR

A basic building block of entrepreneurship is that an entrepreneur's action is guided by intentions (Aloulou, 2018). Understanding the link between intentions and actions is critical when investigating entrepreneurial readiness behaviour of students.

Intentional models propose a thorough framework for comprehending the entrepreneurial process (Krueger, 1993). Intentions provide essential insights into behaviour processes, such as the understanding of experiences, consequences and correlations of behaviours (Ajzen, 1987). Intentions successfully predict behaviours, which are influenced by attitudes. The possession of entrepreneurial intentions exerts an impact on formulating businesses and often, the behaviour leads to creating new ventures (Murugesan & Jayavelu, 2015).

Entrepreneurial intentions imply possessing conscious awareness and conviction on the intention of creating new ventures (Liñán, & Fayolle, 2015). Entrepreneurial intentions are cognitive actions implemented by individuals to create new ventures and establish new value within existing businesses (Fini et al., 2009). Kruger et al. (2000) identifies that ventures are created intentionally and not by mistake, thus emphasising opportunity identification which leads towards entrepreneurship. It is vital to understand factors which influence entrepreneurial intentions, as these could be motivation for future entrepreneurship (Rambe et al., 2015).

4.6.1 The Theory of Reasoned Action

The Theory of Reasoned Action explains the relationship between attitudes, beliefs and behaviour. Behavioural intentions are conceptualised as a function of beliefs in this theory. Attitudes toward behaviours and subjective norms determine behavioural

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intentions. Behavioural intentions thus result from attitudes but are the determinant of behaviour. This theory is only applicable when the individual has control over the performance of the target behaviour (Aloulou, 2018).

4.6.2 Theory of Planned Behaviour

Ajzen's Theory of Planned Behaviour (1988) suggests that entrepreneurial behaviour is predicted by entrepreneurial intentions formed by attitudes, subjective norms and perceived behaviour control (Fellnhofer, 2017). Intentions form an integral part of entrepreneurship as these lead to a planned action (Kreuger & Carsrud, 1993). Intentions predict an individual's readiness to act, therefore they forecast planned behaviour (Kibler, 2012). Intentions are thus a form of commitment towards action, behaviour or a future plan (Ngugi et al., 2012). The Theory of Planned Behaviour proposes therefore that an individual's intention depends on the attitude towards behaviour (Kibler, 2012; Ngugi et al., 2012; Giagtzi et al., 2013; Rusteberg, 2013).

Attitudes predict intentions, whilst intentions predict behaviour. Intentions furthermore provide insight into behaviour processes (Shapero, 1975; Ajzen, 1987). Attitude towards behaviour translates to the amount of unfavourable and favourable predisposition that leads to specific behaviour of an individual (Schwarz et al., 2009; Packham et al., 2010; Teixeira, 2010).

Arjen, (1991) further posits that behaviour contains three determinants: attitude based on social norms, attitude based on entrepreneurial expectations and perceived behavioural control. In the Theory of Planned Behaviour, attitude is thus based on perceived behavioural control, whereas both perceived behavioural control and intention explain actual behaviours before intention precedes the start of a new venture (Aloulou, 2018). In the Theory of Planned Behaviour, attitude is thus based on perceived behavioural control as intention precedes the start of a new venture (Arjen, 1991). The Theory of Planned Behaviour increases predictive ability of behavioural intention by combining the perceived behavioural control to the original two components (Liñán et al., 2005; Schwarz et al., 2009; Liñán & Chen, 2009; Liñán et al., 2011; Fayolle & Gailly, 2013; Fretschner & Weber, 2013). The three determinants

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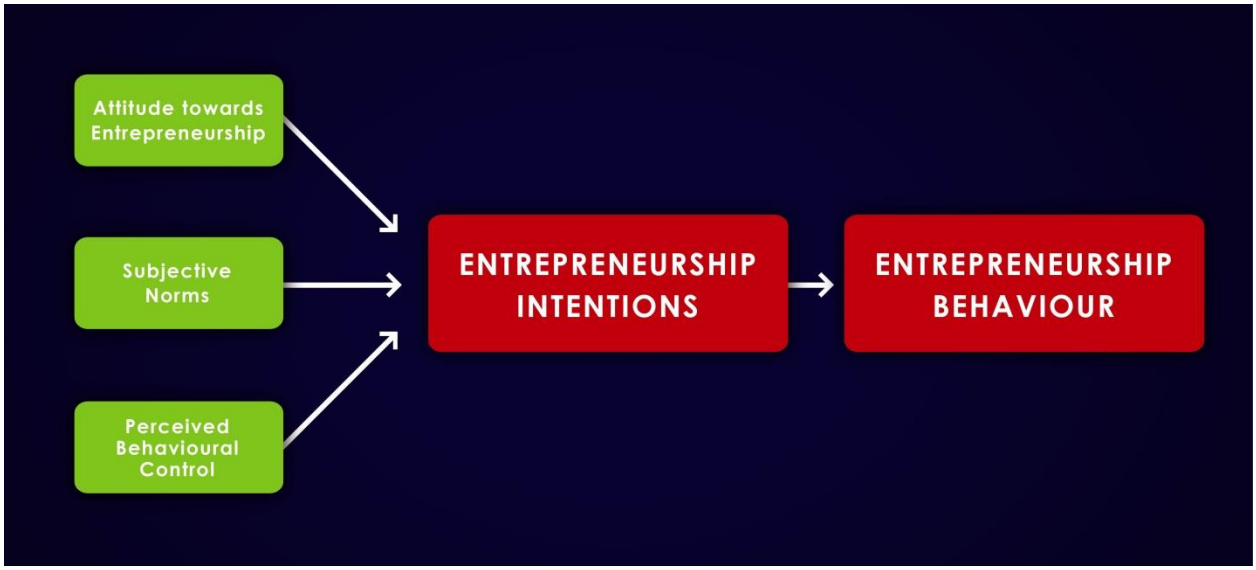
of behavioural intention are subject to the effect of normative, behavioural and control beliefs (Ajzen, 1991).



(Source: Adapted from Ajzen, 1991)

Figure 4. 3: Model of The Theory of Planned Behaviour

The three determinants that derive from the Theory of Planned Behaviour do not equally contribute in measure to the impact of behavioural intention (Krueger et al., 2000; Krueger, 2006; Fayolle & Gailly, 2013; Malebana & Swanepoel, 2015). Instead, the extent of impact on each component is subject to circumstantial and individual factors (Franke & Luthje, 2003). Two domains can be added to influence behaviour, namely the environmental and the individual domain. The environmental domain includes environmental influences and support, whilst the individual domain exhibits factors such as knowledge, skills, personal traits, demographics, networks and individual psychology (Fini et al., 2009). The Theory of Planned Behaviour provides an explanation of an individual's intentions towards entrepreneurship (Rehan et al., 2019) and adheres to the research of Bosnjak et al. (2020) where intention is an antecedent of entrepreneurial behaviour. Drawing on the Theory of Planned Behaviour, as a framework, students' attitude toward skill acquisition can be instrumental in reinforcing certain behaviours such as those relating engagement in entrepreneurship. In this research study, the Theory of Planned provides a useful framework for understanding how the integration of 4IR skills influence students' engagement in entrepreneurial behaviour.

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4.6.3 Social cognitive theory

The cognitive approach provides insight into the complexity of the entrepreneurial process (Krueger et al., 2000) and focuses on the role of entrepreneurial socialisation. The social cognitive theory focuses primarily on entrepreneurial cognitions (Busenitz & Lau, 1996; Mitchell et al., 2000). The social cognitive theory suggests that entrepreneurs possess knowledge structures that represent sequences of predictable behaviours (Abbott & Black, 1986). Knowledge structures exert an impact on entrepreneurial performance and an entrepreneur's venture creation decisions (Lau et al., 2012). The social cognitive theory proposes that entrepreneurs' structures are affected by the social context and their own personal characteristics. Commitment and ability form the basis of entrepreneurs' characteristics and these personal values represent their knowledge structure.

Entrepreneurial readiness is conceptualised by the social cognitive theory in terms of two elements of the cognition structure, namely entrepreneurial willingness and capability (Lau et al., 2012). Entrepreneurial willingness and capability are comparable (Mitchell et al., 2000) to venture arrangements and venture abilities. Entrepreneurial willingness supports motivation toward entrepreneurial behaviours and entrepreneurial careers in particular. Therefore, the cognition structure motivates and shapes entrepreneurial behaviour and is an outcome of knowledge, skills, abilities, perceived attitudes and intentions (Aloulou, 2018).

4.6.4 Entrepreneurial career model

Dyer's (1994) model of entrepreneurial careers explains that entrepreneurial career choices can be influenced by role models. These role models can facilitate entrepreneurial self-efficacy, which affects an individual's expectations of a successful entrepreneurial career (Fellnhofer, 2017). In this study, the entrepreneurial career model is of value for the qualitative research available on the relationship between education and career selection linked to entrepreneurship (Dickson et al., 2008; Solomon & Matlay, 2008; Stokes & Wilson, 2010).

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4.7 THE IMPORTANCE OF ENTREPRENEURIAL READINESS BEHAVIOURS AMONG UNIVERSITY STUDENTS

Research on the need for selected skills over the entrepreneurial intention of university students is insufficient (Pinto et al., 2020). The selected skills improve university students' intention to create new ventures. For this study, the role of HEIs is considered as important to increase the entrepreneurial readiness behaviour of students.

4.7.1 Education in 4IR

HEIs are perceived as proactive contributors to technological development, innovation and economic growth. Heinonen and Hytti (2010) posit that the objectives of entrepreneurship education include improving students' entrepreneurial behaviour and providing them with the required skills for venture creation. Understanding and applying these objectives of entrepreneurship education in the design of entrepreneurship studies at HEIs is important to develop effective curriculums (Blenker et al., 2006; Adetunji & Kayode, 2016).

Before young entrepreneurs join the global market, their entrepreneurial capacity and set of skills must be assessed to adjust the training programmes. This will be advantageous to assist an entrepreneur by creating a venture that will result in venture growth. Together with entrepreneurship training and education attained from universities, government should assist in continuous training after graduation for entrepreneurs to be knowledgeable of entrepreneurial activity (Olugbola, 2016).

Entrepreneurial readiness behaviour as an outcome of entrepreneurship education, justifies more intensive research (Bird et al., 2012). This study investigates the impact of entrepreneurial education in HEIs on entrepreneurial readiness behaviour of students. Entrepreneurial education includes teaching and learning activities that enforce student entrepreneurial behaviour and mind-set with knowledge, skills and abilities (KSAs) (Ekpoh & Edet, 2011; Ooi et al., 2011).

Entrepreneurship education is a fast-growing field, although the effectiveness and outcomes of entrepreneurial education programmes are somewhat questionable.

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Research on the role of HEIs on entrepreneurship is scarce (Autio & Fu, 2015; Goltz et al., 2015) and requires investigation on effects of entrepreneurship education influencing entrepreneurial behaviours. There is a positive relationship between entrepreneurial readiness and opportunity-based entrepreneurship and entrepreneurial entry which in turn influences entrepreneurial behaviour (Raza et al., 2019). Students who actively participate in entrepreneurial education will improve their individual entrepreneurial behaviour (Wu et al., 2021).

The Theory of Planned Behaviour, social cognitive theory and entrepreneurial career model are interlinked theoretical concepts observing that role models can facilitate entrepreneurial self-efficacy through perceived behaviour control in entrepreneurship education (Fellnhofer, 2017). Entrepreneurial self-efficacy is a predictor of entrepreneurial intentions (McGee et al., 2009). The Theory of Planned Behaviour (Ajzen, 1988) suggests a positive effect of entrepreneurial self-efficacy on entrepreneurial intentions. Entrepreneurial intentions are a strong predictor of entrepreneurial behaviour and are considered as planned intentional behaviours (Lorz & Volery, 2011; Rengiah & Sentosa, 2014). Entrepreneurial intentions have a definite impact on entrepreneurs creating new ventures (Fatoki, 2010; Agbim et al., 2013).

Entrepreneurship education is closely related to entrepreneurial intentions and compliments knowledge and entrepreneurial skill development (Bae et al., 2014). There is recent research on entrepreneurial skills and their positive impact on developing entrepreneurial intentions (Chell, 2013; Morales & Marquina, 2013). Entrepreneurial skills are critical for entrepreneurs to create successful ventures (Shabbir et al., 2014). According to Chell (2013) skills can be improved through practice and repetition. Students can therefore acquire skills through entrepreneurship education and improve their entrepreneurial intentions (Fekri et al., 2012) and their perceived behaviour control (Liñán, 2008).

4.7.2 Practical versus theoretical education

4IR requires HEIs to update entrepreneurial skills such that proficiencies and knowledge meet the needs of transforming technologies and ventures (Bainbridge & Roco, 2016). Darwish et al. (2018) agree that HEIs play a role in forming

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entrepreneurial behaviour where knowledge is unlimitable, valuable and dynamic. Entrepreneurial education provides knowledge that entrepreneurs can use to develop new entrepreneurial opportunities. Students need to develop entrepreneurial behaviour to think and act in unpredictable situations. HEIs must involve students in the entrepreneurial activities by promoting programmes and activities that stimulate students to practice and learn (Pinto et al., 2020).

Practical teaching should be an integral aspect of the teaching structure of HEIs and is undeniably an essential expansion of theoretical teaching. Furthermore, it contributes significantly to the understanding, development and improvement of entrepreneurial behaviour of university students. Practical teaching is the cultivation of different applied aptitudes by numerous systematic professional skills training and practical activities. Practical teaching with experimental teaching demonstration centres and internship training foundation provides students and teachers a guidance to explore new ideas, discover new problems, and acquire new skills when investigating, training, practicing and experimenting. The skills cultivated by HEIs require lifelong learning, therefore practical teaching should be implemented based on teaching content, organisational forms teaching processes and methods (Shen, 2019).

Theoretical teaching is different from practical teaching as it requires teachers to systematically follow the principle, content and concept of a specific subject. Students need to actively implement, complete and participate in different practical teaching activities, while being supervised by teachers so that students of HEIs can increase their knowledge and behaviour, improve their skills, advance their methods and develop what they learned into action. Therefore, practical teaching is based on the aspects of numerous disciplines and actively enables various interactive teaching methods (Yong & Shuhua, 2014).

4.8 THE CHALLENGES OF REALISING ENTREPRENEURIAL READINESS BEHAVIOURS

This study uses the Theory of Planned Behaviour to demonstrate the relationship between barriers, entrepreneurial intention and the constructs of entrepreneurial intention, namely the attitude of students towards becoming entrepreneurs and

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perceived behavioural control. Entrepreneurial intentions precede entrepreneurial activity and affect the new venture creation (Douglas, 2013; Rauch & Hulsink, 2015).

Entrepreneurial intentions are good predictors of actual entrepreneurial behaviour (Liñán & Chen, 2009). Entrepreneurial intention is the willingness to participate in entrepreneurial activity and is a predictor of entrepreneurial venture creation. It is evident from the findings of extant research, that perceived barriers to entrepreneurial behaviour, such as financial and market constraints, have an extremely negative effect on entrepreneurial intentions and personal motivation of students (Sitaridis & Kitsios, 2016). Previous research has found that motivation, experience, knowledge and skills can counteract these barriers (Singh Sandhu et al., 2011; Sesen & Pruett, 2014). Entrepreneurial inexperience is partly the cause of lack of knowledge and skills of students. Giacomin et al. (2011) and Sing Sandu et al. (2011) further state, that students are greatly influenced by internal personal attributes such as motivation, knowledge and skills. Sitiridis and Kitsios (2016) postulate that there is a positive correlation between barriers and entrepreneurial intentions, which present a higher correlation of internal challenges such as motivation, knowledge and skills in comparison to external barriers, such as financial and market constraints.

4.9 PROPOSED CONCEPTUAL FRAMEWORK

Rapid change brought about by 4IR increases the need for entrepreneurial readiness of students. Entrepreneurship training impacts the development of entrepreneurial ability. Motivation, opportunity identification, resources and entrepreneurial ability determine entrepreneurial readiness (Olugbola, 2017).

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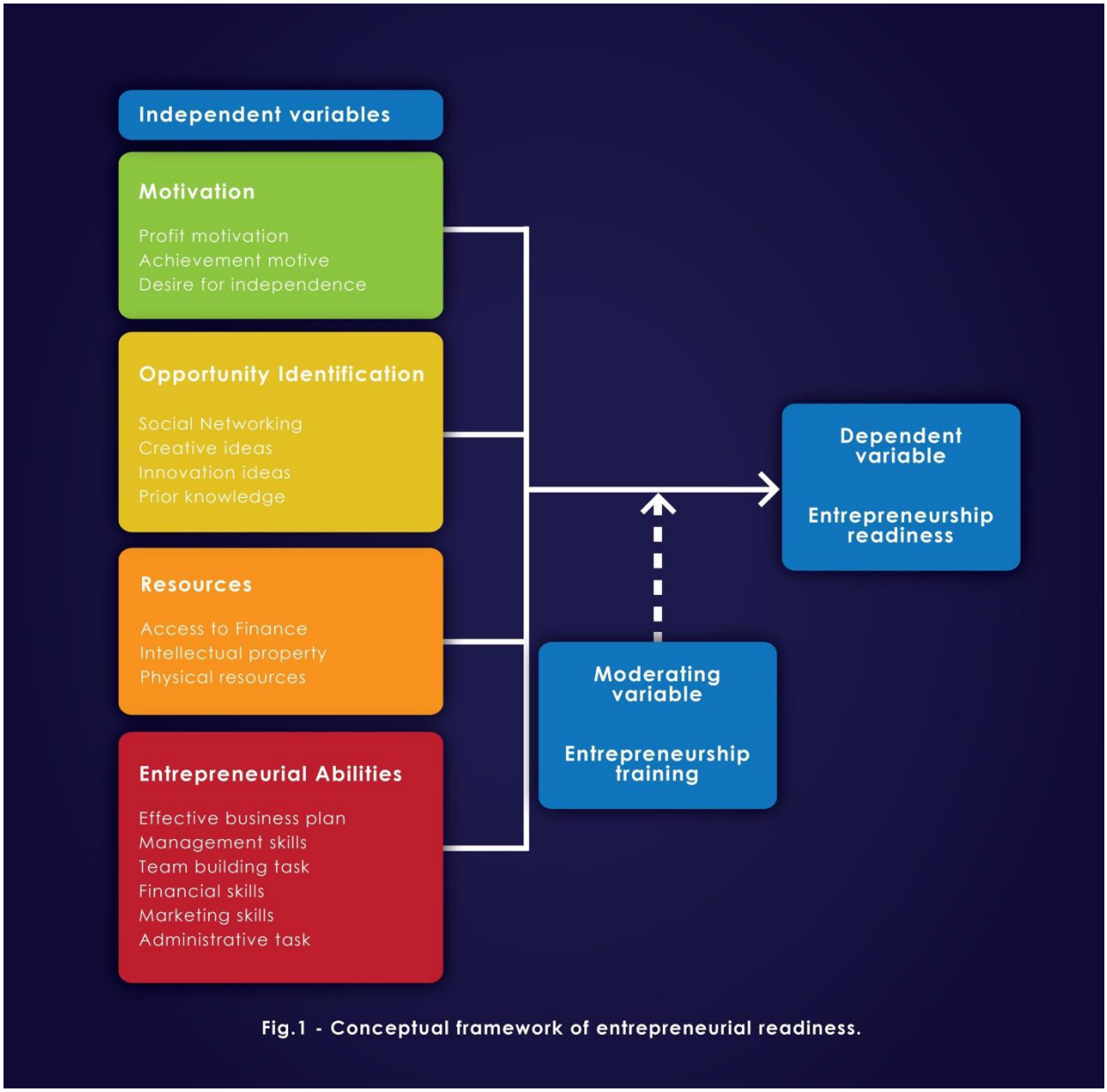

(Source: Adapted from Olugbola, 2017)

Figure 4. 4: Conceptual framework of entrepreneurial readiness

Figure 4.4 is divided into four success components namely motivation, opportunity identification, resources and entrepreneurial ability. Although these variables share some similarities with those identified in this current study, there are also some subtle differences. For instance, motivation is not part our conceptualisation of the entrepreneurial process and training is not considered a mediator in our study as it has been widely studied in entrepreneurial readiness literature. Since this study explores skills in the light of 4IR, the framework of entrepreneurial readiness behaviour only considers those skills and different dimensions of the entrepreneurial process that

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could trigger entrepreneurship readiness. Entrepreneurship is seen as a social process, as an opportunity or idea is frequently formulated through a social situation. Risk-taking behaviour, innovation and strategic pursuits of ventures are more accessible for youth (Olugbola, 2017). Knowledge is vital to create individual awareness, resulting in the changing of attitudes, which then in turn alters entrepreneurial behaviour (Martin et al., 2013). Factors such as entrepreneurial behaviours and creativity among technology-oriented ventures rise as the age of entrepreneurs increase (Agbim et al., 2013; Singh, 2014).

4.10 STUDIES ON ENTREPRENEURIAL READINESS BEHAVIOURS ACROSS VARIOUS CONTEXTS

In countries with widespread entrepreneurship skills and knowledge, higher levels of entrepreneurial behaviours are expected (Urbano & Alvarez, 2014), as entrepreneurs are poised to identify and exploit opportunities (Kirzner, 1973), to persuade people to support new ventures and to overcome challenges of starting and managing new ventures (Begley et al., 2005; De Clercq et al., 2010).

Students equipped with the necessary skills and knowledge to initialise entrepreneurial ventures are the result of a well-developed training and educational system (Mitchell et al. 2000; Bosma & Levie, 2010). This also affects entrepreneurial intentions when resources and attention to entrepreneurship are privileged by an education system (Bowen & De Clercq, 2008). This system also increases the number of knowledgeable entrepreneurs who can assign resources on an individual level toward new venture creation (De Clercq & Arenius, 2006). An educational system with the focus on entrepreneurship training, encourages awareness of entrepreneurship as a possible occupation, specifically concerning the risks and opportunities involved (Peterman & Kennedy, 2003). Environmental contexts influence individuals' behaviours towards entrepreneurship (Raza et al., 2019). Interaction between environmental contexts and individual characteristics influence entrepreneurial behaviours in HEIs (De Clercq et al., 2013; Stenholm et al., 2013).

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4.11 SYNOPSIS OF ARGUMENTS IN THE CHAPTER

The chapter contributes to the argument that selected 4IR skills effect entrepreneurial readiness behaviour. Entrepreneurial readiness behaviour could be developed through entrepreneurial training and education. Focusing on selected 4IR skills in entrepreneurial training and education could equip entrepreneurs by improving their entrepreneurial readiness behaviour. This could motivate entrepreneurs to create innovative ventures and contribute to the economy. Entrepreneurs should be adaptable to the ever-changing technological environment as it contributes to entrepreneurial readiness behaviour.

4.12 CONCLUDING REMARKS

A study of the entrepreneurial readiness behaviour of students will add value to entrepreneurship education by investing in skills development to improve entrepreneurial readiness behaviour. The changing landscape of 4IR requires student entrepreneurs to enhance entrepreneurial behaviour and ultimately result in venture creation and venture growth. South African universities need to engage in the development of entrepreneurial readiness behaviour in students.

This chapter reviewed research related to the entrepreneurial readiness behaviour of students. The definition and concept of entrepreneurial readiness behaviour were discussed. The dimensions of entrepreneurial readiness behaviour were elaborated on, explaining the inter-correlation among the concepts. Various theories were investigated in this chapter, including the main underlining theory, Theory of Planned Behaviour. Extant research reviewed in this chapter teased the influence entrepreneurial readiness behaviour has on 4IR skills development. The next chapter focuses on the relationship among 4IR skills, the entrepreneurial process and the entrepreneurial readiness behaviour.

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CHAPTER 5 THE THEORETICAL FRAMEWORK AND THE CONCEPTUAL FRAMEWORK

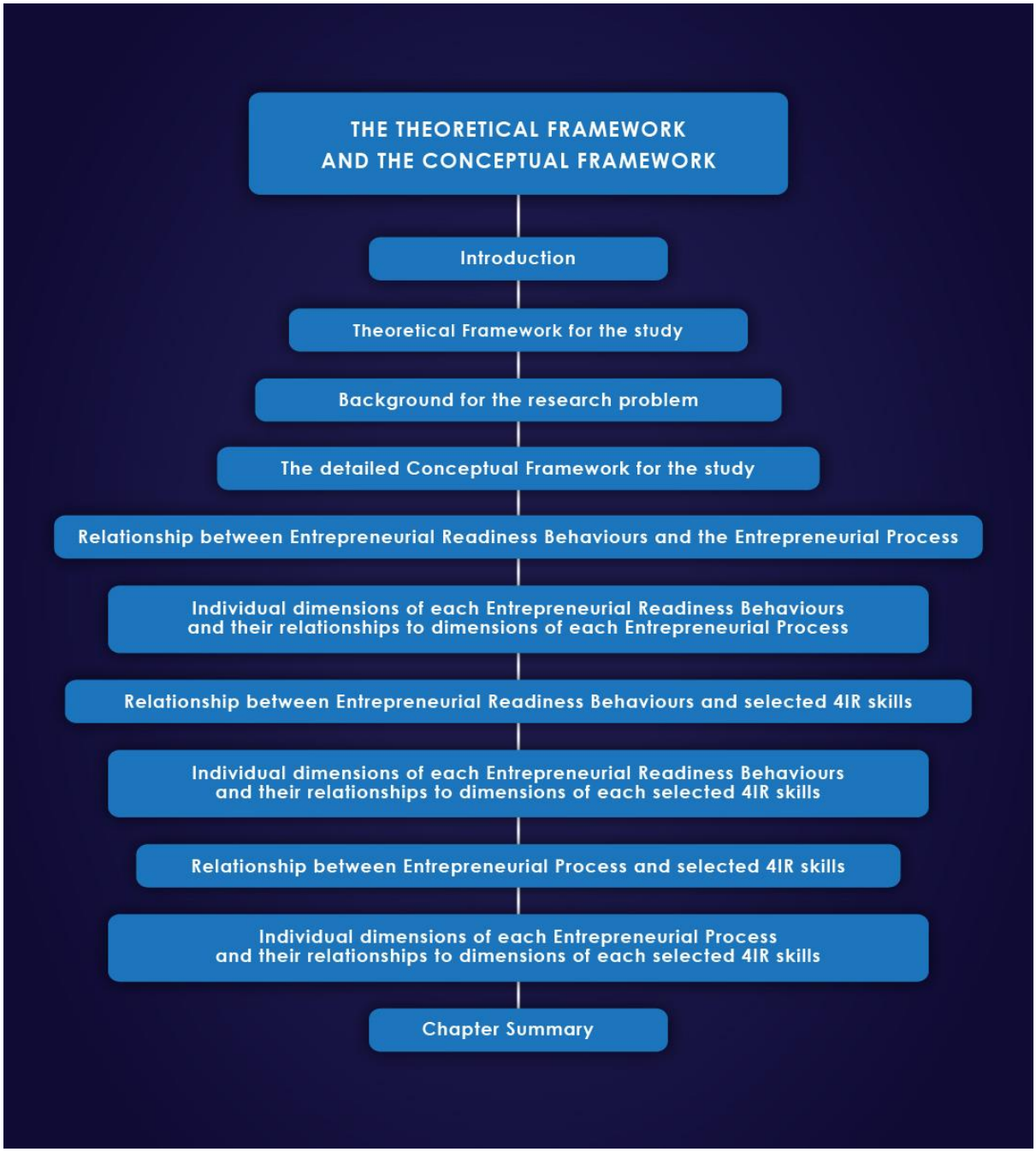

Figure 5. 1: Flow diagram indicating the structure of Chapter 5

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5.1 INTRODUCTION

This chapter provides a theoretical framework of key concepts in this research study and proposes the interrelationships among them concepts, supported by a discussion on the relevant theory. Human Capital Theory serves as the principal theoretical lens to the understanding of skills in the research. The central argument presented in the research literature is that human capital investments require selected skills in different stages of the entrepreneurial process and consequently influence students' entrepreneurial readiness behaviour. Selected 4IR skills relevant to this discourse are determined to promote students' entrepreneurial readiness behaviour and to clarify the mediation of the entrepreneurial process. This study is restricted to South African HEIs only.

5.2 THEORETICAL FRAMEWORK FOR THE STUDY

This research, focusing on selected 4IR skills, adopts the Human Capital Theory, which posits that knowledge and skills are outcomes of investing in human capital (HC) training and education investments (Mamabolo et al., 2017b). In addition to acquiring selected 4IR skills from human capital investments, these skills stimulate entrepreneurship. Mitchell (2011) defines entrepreneurship as a process where an individual with entrepreneurial characteristics is inclined to start a venture.

There is ample research available on human capital in relationship to opportunity identification (Shane, 2000; Chell, 2013), personal skills (Narkhede et al., 2014; Deakins et al., 2016) and technical skills (Chang & Rieple, 2013). The Human Capital Theory is therefore pertinent to the competence approach that requires an amalgamation of personal attributes inclusive of personality characteristics, knowledge and skills (Hayton & Kelley, 2006; Hayton & McEvoy, 2006; Ployhart & Moliterno, 2011), such as self-efficacy, resilience and creativity (Grimaldi et al., 2012; Grimaldi et al., 2013; Newman et., 2014; Tan, 2014; Madrid et al., 2018). The objective of this research study is to determine which selected 4IR skills are required by student entrepreneurs across different stages of the entrepreneurial process.

The entrepreneurial process is a key concept in this research. The proposition is that there is a relationship between selected 4IR skills and entrepreneurial readiness

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behaviour. Although human capital investments such as entrepreneurship education are not the only variable that affects students' entrepreneurial readiness behaviour, Pardiman and Khoirul (2020) propose that student entrepreneurs' tendency towards entrepreneurial activities increases when they feel equipped to become successful entrepreneurs. Entrepreneurial readiness behaviour therefore includes skill development preparation and venture activity preparation. Based on this explanation, students' entrepreneurial readiness behaviour includes human capital investments as outcomes.

5.3 BACKGROUND TO THE RESEARCH PROBLEM

HC is relevant to the transformation era of 4IR, since enhanced training is vital. With the introduction of 4IR, the danger of technologies outperforming humans in cognitive tasks becomes apparent (Xing et al., 2018). Routine cognitive tasks are being replaced by Artificial Intelligence-based algorithms for big data (Frey & Osborne, 2013). AI is defined as a computerised method that imitates human behaviour in problem solving (Xing & Gao, 2014; Marwala & Hurwitz, 2017). There still exists a gap between human and computerised problem solving due to the exclusive characteristic of human problem solving featuring the ability to conceptualise on different levels and mobilise across them globally (Xing & Marwala, 2018). The HC Theory supports the value of entrepreneurial education and training (EET), therefore the formation of effective HC through the utilisation of EET is growing globally (Martin et al., 2013).

Although technological development has led to the replacement of predictable tasks performed by low skilled workers by machines, investment in HC remains essential as humans are still indispensable even in a fully automated work environment. Although the boundaries between humans and machines are starting to dissolve, humans still have the capacity to improve their skills (Xing et al., 2018).

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(Source: Adapted from Xing et al., 2018)

Figure 5. 2: 4IR dissolving human and machine boundaries

In an uncertain future filled with challenges, entrepreneurial behaviour has become a prerequisite prompting improved entrepreneurial skills. Therefore, an innovative approach, including skills related to entrepreneurship such as creativity, problem solving, self-confidence and readiness for change, has to form the foundation for economic transformation in any environment. Thus, entrepreneurship education has become essential as opportunities have multiplied (Henry et al., 2003).

Despite the rapid evolution of the 4IR, Butler-Adam (2018) posits that the implications for education, specifically HEIs, have not received enough attention. Hu (2019) argues that most HEIs base their curricula on previous models that fail to adapt to the demand of 4IR skills and talent development. Educational institutions, especially universities, have to re-evaluate their role as initiators of entrepreneurial ventures and entrepreneurship. The entrepreneurial-directed approach focuses on entrepreneurship education at universities, with entrepreneurial behaviour and skills as a platform for the entrepreneurial process (Heinonen & Poikkijoki, 2006).

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5.3.1 The impact of 4IR skills on Africa

Although researchers have identified different skills required in 4IR, there is insufficient research on selected skills required in an African context. Selected 4IR skills ensure that university students are equipped to enhance entrepreneurial readiness behaviours. Reddy et al. (2016) support this notion and conclude that HEIs in Africa do not equip students with the required 4IR skills.

Although Africa is ill-prepared to overcome the disruptions associated with 4IR, the continent has the potential to accelerate its progress using 4IR technologies (de Klerk, 2016). Autor and Dorn (2013) acknowledge that 4IR creates opportunities for skills that stimulate entrepreneurship. While Africa should take advantage of these opportunities arising from 4IR, the business world has identified workers with a low level of skill as one of the major constraints for venture development. Africa has to address the huge problem of unemployment of the youth as venture growth is low and delays economic growth on this continent (AfDB et al., 2018).

5.3.2 4IR skills required in sub-Saharan African ventures

The wave of technological advancement on the African continent necessitates skill development (Olumuyiwa et al., 2023). In comparison with developed countries, Africa as a developing continent is confronted with new challenges for future workforce which are skills related. A focus on the development of the skills required for 4IR and relevant to entrepreneurial success will enhance entrepreneurial activity in Africa (Borrageiro & Mennega, 2023). The benefits of 4IR will bypass Africa if Information and Communication Technology (ICT) infrastructure and adequate skills are not incorporated to take advantage of these technologies. A high level of skills is required by industries to be able to identify and adopt and new technology (Naudé, 2019) and use it for entrepreneurial pursuits. Unfortunately, industries in Africa have serious skills shortages and specifically, digital skills shortages (Banga & te Velde, 2018). Africa will have to make institutional and skills changes to participate and benefit from 4IR by prioritising education and refining the type of skills to adapt to innovations brought about by automation (Naudé, 2017).

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South Africa presents a relevant and critical context for investigating 4IR skills with reference to entrepreneurial readiness of students. Cotec (2014) states that education is fundamental to an innovative society, even though Chigbu et al. (2023) reported that traditional teaching and learning methods prevalent at South African universities do not complement 4IR skills. In HEIs in SA, entrepreneurship delivery remains largely founded on the conduct of lectures to develop new ideas, and hence the need to shift toward modern pedagogical models to ensure greater entrepreneurial readiness. García-Morales et al. (2021) propose new methods of teaching, such as innovative and technology-based pedagogy, which could trigger entrepreneurial success. Alignment of new teaching and learning methods that are consistent with 4IR skills in South Africa, is underwhelmingly missing (Waghid, 2019). As such, Oke and Fernandes (2020) warn that the higher education sector in South Africa is not prepared for the rapid transformation of 4IR. Some scholars have called on universities to adopt innovative teaching and learning approaches especially those that hone the necessary 4IR skills (Omodan, 2019) to harness innovation and enhance students' entrepreneurial behaviour. Additional research is needed as the impact of transformative learning in HEIs in South Africa is still inconclusive and unclear with regard to the diversity of the skills imparted (Majanja, 2020). If South Africa works towards incorporating 4IR in the society, its economy will grow and the country will be more sustainable and stable, thus more occupations will be available, ensuring better security and safety, innovation, production, education and skills development (Knott-Craig, 2018).

The focus of this research study is South African graduates, even though these graduates must look into the sub-Saharan African continent when they launch their ventures as the SA market is too small to accommodate all of them. The key factor determining the extent of benefits and challenges that 4IR presents to economies in sub-Saharan Africa has not received enough research attention. Many sub-Sahara African countries are currently experiencing problems with skills shortages, as well as mass unemployment (Millington, 2017; Debrah et al., 2018). These shortcomings are characterised by low levels of skill and education and slow venture growth (World Economic Forum, 2017; Akanle & Adésìnà, 2018; Ogundari & Awokuse, 2018). Naude (2017) and Ogwo (2018) agree that numerous sub-Sahara African economies are

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exposed and vulnerable to disruptions in the labour market caused by a lack of education and skills mismatch.

Demographically sub-Saharan Africa has the youngest population where 60% of the population is under the age of 25 years (World Economic Forum Africa, 2016; Naudé, 2017; Rocca, 2020). It is predicted that 25% of the world's under-25 population will reside in this continent by 2030. Therefore, 4IR is a threat to humans in terms of the capabilities and skills required for certain occupations due to robotics and automation technologies (World Economic Forum, 2017). This can have a big impact on the economy in sub-Saharan Africa as skills disruptions and shortages, job dislocations and mass unemployment will influence venture growth and economic transformation (World Economic Forum Africa, 2016; Naudé, 2017). Furthermore, Rocca (2020) posits that the Covid-19 pandemic contributed to mass unemployment that increased economic instability in Africa. It is vital for sub-Sahara African economies that struggle with mass unemployment and skilled labour shortages to prepare ventures for skills disruptions and imminent job losses anticipated from 4IR. The threats arise from the new upsurge of technological revolution through service automation and manufacturing (Department of Economic & Social Affairs 2017; Naudé 2017).

Regardless of the educational and infrastructural challenges that Africa experiences, technological changes occurring worldwide due to 4IR will impact South Africa. South African universities need to actively contribute to entrepreneurship education by focusing on selected 4IR skills to adapt to these technological changes. Thus, careful preparation must take place in terms of understanding the 4IR skills that university students need to have to realise entrepreneurial readiness behaviour and create new ventures.

South Africa has the strongest infrastructure of production in the continent, but regretfully, the country has a low level of entrepreneurial readiness. Innovation is supported by the financial sector and entrepreneurial activity is encouraged. Human capital is a challenge as digital skills trail behind. The most pressing area for South Africa is to address its institutional framework to be responsive to change and innovation (World Economic Forum & A.T. Kearney Management Consulting

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Company, 2018). Thus, investing in human capital will lead to a higher level of entrepreneurial readiness by improving the required skills.

More so, the unemployment rate of South Africa (recorded in 2021) is noted as 34.9% (StatsSA, 2021), making it imperative that new ventures be successfully established and sustained. The critical thinking and digital skills of the current South African labour market are inadequate for the development of a successful economy in 4IR and are not as advanced on a global scale (Schwab, 2018). This in turn reinforces the importance of acquiring relevant 4IR skills, in order to increase success for entrepreneurs. It is in this regard that the importance of quality education systems, teaching relevant skills is underscored.

5.4 DETAILED CONCEPTUAL FRAMEWORK FOR THE STUDY

The conceptual framework of this research study is based on literature review and human capital theory. In order to test the causal relationship of selected 4IR skills on entrepreneurial readiness behaviour, the independent and dependent variables have to be identified.

The independent variable in this study is the selected 4IR skills which are the predictor of the dependent variable, presented as the students' entrepreneurial readiness behaviour. In this causal relationship, the entrepreneurial process is the mediating variable that links these variables to explain the relationship between selected 4IR skills and students' entrepreneurial readiness behaviour.

The mediating variable, the entrepreneurial process, is affected by the independent variable, selected 4IR skills, whist affecting the dependent variable, students' entrepreneurial readiness behaviour. The entrepreneurial process therefore links and explains the relationship between selected 4IR skills and students' entrepreneurial readiness behaviour. HEIs are the control variables in this research study.

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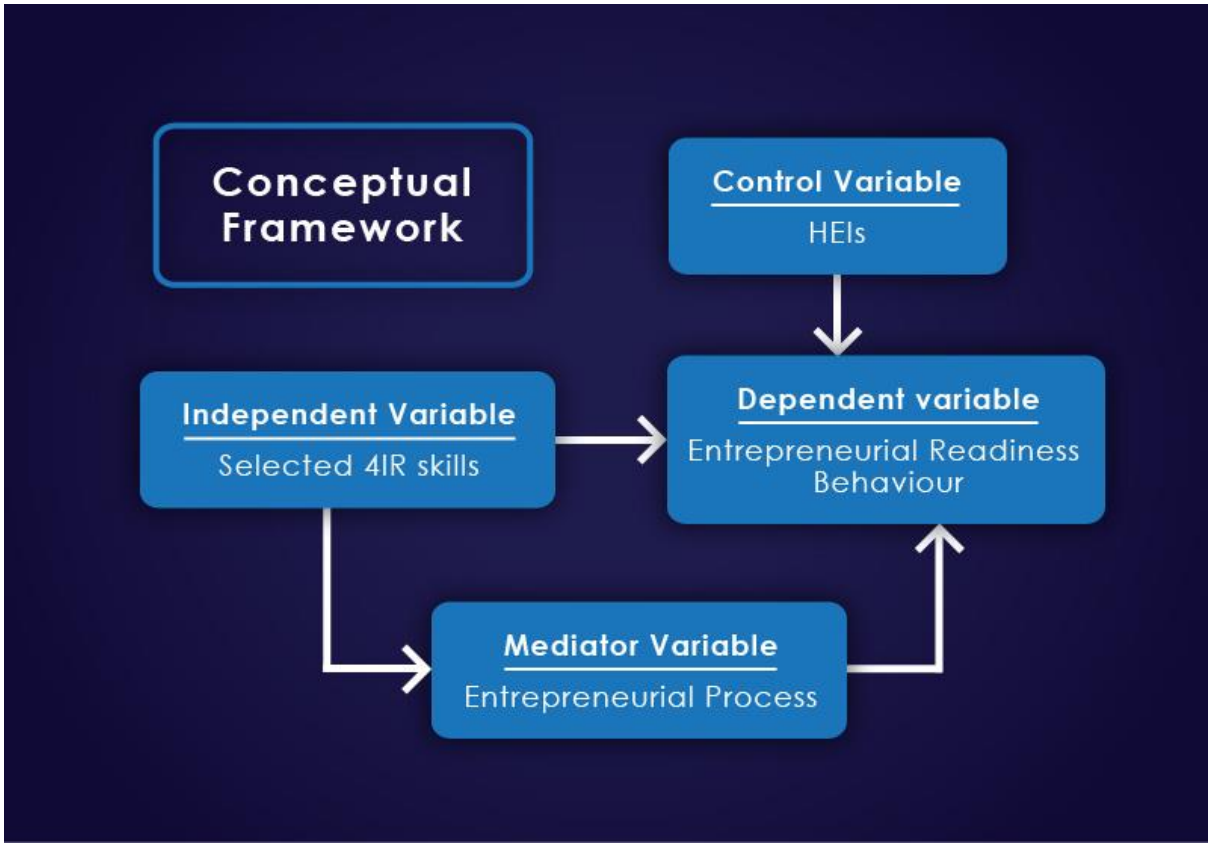

Figure 5. 3: Variables of the conceptual framework in this study

Entrepreneurship education faces challenges in supporting the entrepreneurial process. The typical university environment is unlikely to contain numerous entrepreneurial elements (Gibb, 2002; Sogunro, 2004). Current education concentrates on developing intellect and knowledge, whereas entrepreneurship education focuses on making critical decisions in humans (Kyrö, 2003). An entrepreneur needs new methods of thinking, knowledge, developing new behaviours and acquiring new skills. Entrepreneurial approaches should be incorporated in traditional teaching methods (Gibb, 2002), leading to opportunities for students to participate in their learning environment (Gorman et al., 1997; Fiet, 2000; Boldureanu et al., 2020).

The purpose of this study is to identify selected 4IR skills required to promote entrepreneurial behaviour of university students. It is critical that HEIs should enhance entrepreneurial behaviour. Infusing entrepreneurial behaviour and skills leads to increasing the understanding of entrepreneurship and learning to become more entrepreneurial (Rae, 2000). This kind of education will impact the process of

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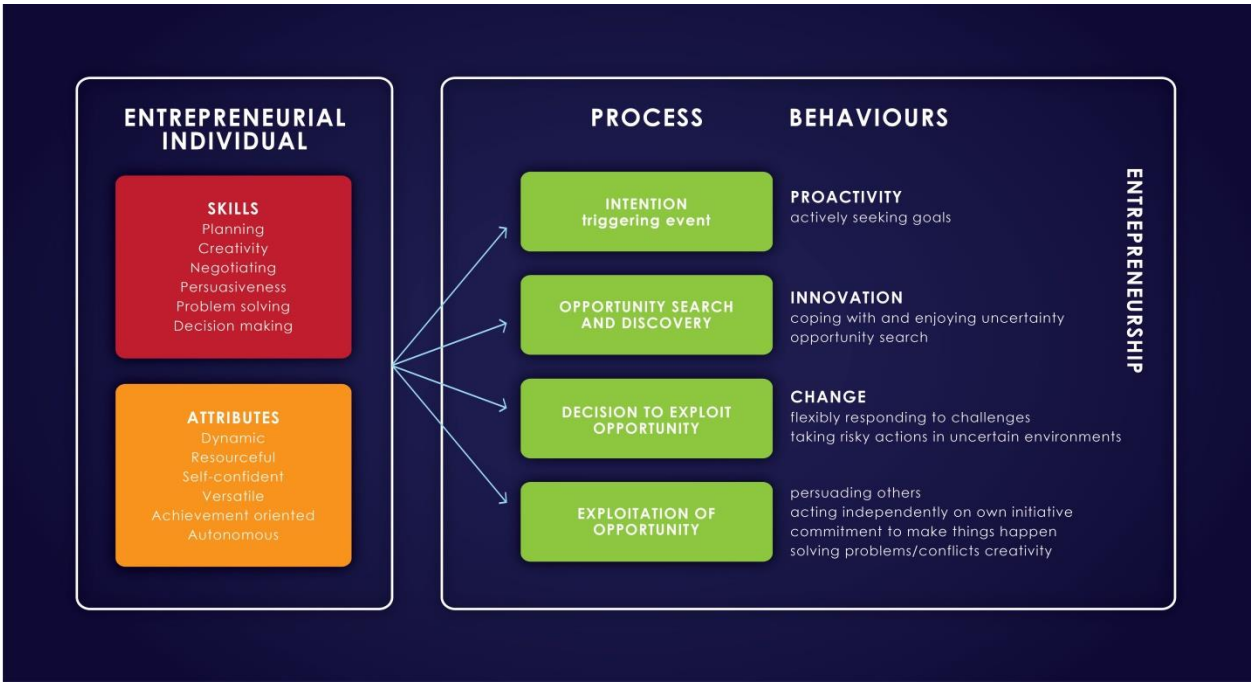
transforming into an entrepreneur for the long term (Heinonen & Poikkijoki, 2006). Entrepreneurship education aims to integrate attributes and skills of an identified entrepreneurial individual with the entrepreneurial behaviour and entrepreneurial process (Gibb, 1993; Shook et al., 2003).



(Source: Adapted from Gibb, 1993; Shook et al., 2003)

Figure 5. 4: The entrepreneurial individual's skills and attributes impact on the entrepreneurship process and entrepreneurship behaviour

Figure 5.4 is a short summary of the proposed conceptual framework. The 4IR skills especially soft skills, technical skills and entrepreneurial skills are postulated as antecedents of entrepreneurial readiness behaviour. Although entrepreneurial readiness behaviours can be direct consequences of these different skills sets, knowledge of the entrepreneurial process (i.e., opportunity identification, validation and exploitation, as well as resource mobilisation) is fundamental to the exhibition of such behaviours. Therefore, entrepreneurial readiness behaviours such as knowledge of and intention to create new ventures, knowledge of innovative venture financing and venture growth pre-supposes student possession of diverse 4IR skills.

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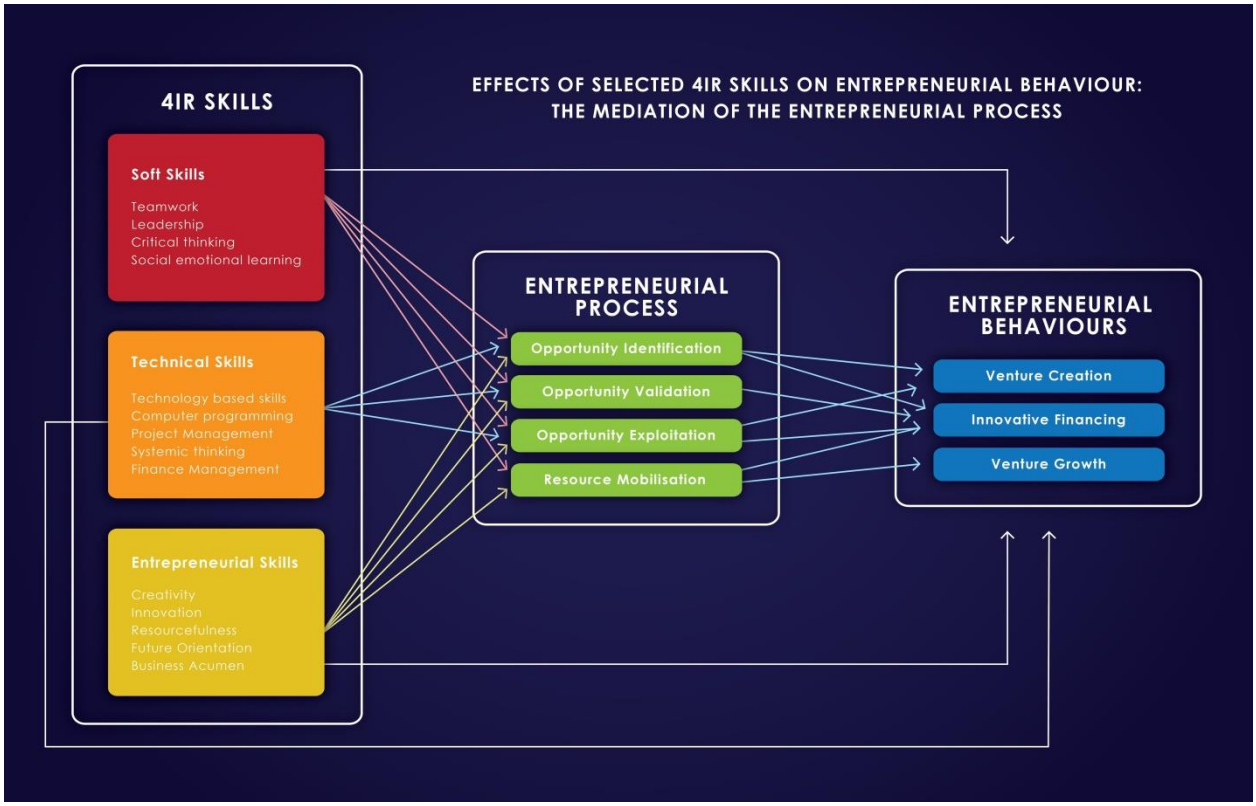

Figure 5. 5: Proposed conceptual framework

Figure 5.5 indicates that each variable has a direct relationship with each other. However, the knowledge of the entrepreneurial process seems to mediate the interaction between 4IR skills and entrepreneurial behaviours.

5.5 RELATIONSHIP BETWEEN ENTREPRENEURIAL READINESS BEHAVIOURS AND THE ENTREPRENEURIAL PROCESS

Entrepreneurs demonstrate behaviours that support entrepreneurship by initiating skills that support the entrepreneurial process in which new ventures are created through identification, validation and exploitation of opportunities. Although the entrepreneurial process is initiated through opportunity identification and individual execution (Shane & Venkataraman, 2000; Alvarez et al., 2014), Xie (2017) explores the entrepreneurial process further by indicating that opportunity identification is a combination of entrepreneurial activities and cognitive processes but regards the entrepreneurial process as a precursor of entrepreneurial actions, such as opportunity identification and opportunity exploitation. Therefore, decisions regarding the identification of new venture opportunities (Welpe et al., 2012; Wang et al., 2019) and

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entrepreneurship rate are influenced by actions such as risk aversion (Vaillant & Lafuente, 2007). The ability to display entrepreneurial behaviour whilst performing actions to achieve goals is dependent on the level of an individual's self-efficacy (Gist & Mitchell, 1992; Bandura, 1997; Chen et al., 1998). Furthermore, the perception of individuals' self-efficacy connects positively with entrepreneurship. An individual with these characteristics can potentially contribute to the results that accumulate from creating new ventures (Wennberg et al., 2013).

Previous studies explain that the variables and assumptions differ from the entrepreneurial process of new venture creation, but include similar dimensions (Mueller & Thomas, 2001). The entrepreneurial process contains two broad dimensions: opportunity identification and resource acquisition (Pretorius et al., 2005). This extends to Gruber (2002), who identified three distinct stages to the entrepreneurial process, known as pre-founding stage (opportunity identification and opportunity evaluation), founding stage (market entry, business plan, incorporation and resource gathering) and development stage (market penetration and building the venture). Baron (2004a) recognised three stages of the entrepreneurial process: identifying ideas for feasibility, developing a venture and assembling needed resources. Bhave (1994) explores four main stages, which are opportunity identification, set up technology, venture creation and exchange resources. Sullivan and Meek (2012) support these four stages by articulating that the entrepreneurial process consists of opportunity identification and motivation, opportunity exploitation, resource acquirement and successful performance. Furthermore, Mets et al. (2013) identified a four-phase model of entrepreneurial process, opportunity recognition, idea generation, opportunity development and venture creation.

5.5.1 Individual dimensions of each entrepreneurial readiness behaviour and their relationship to dimensions of each entrepreneurial process

For this study, entrepreneurship is a process which promotes entrepreneurial readiness behaviours of university students to create new ventures. Entrepreneurship is further defined as the pursuit of opportunities that have been identified, validated and exploited, leading to venture creation (Kirzner, 1973; Dess et al., 1999; Shane & Venkataraman, 2000; Fox, 2004; Rusu et al., 2012). This definition argues that the

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process of new venture creation manifests in entrepreneurship (Baron, 2004a; Hisrich et al., 2005). The entrepreneurial process in this study affects students' entrepreneurial readiness behaviour and involves actions, activities and functions associated with the identification and evaluation of opportunities through the mobilisation of resources necessary for successful venture creation (Bygrave, 1997; Cornwall & Naughton, 2003). Successful ventures continually adapt behaviours to keep abreast with changing opportunities (Sackett et al., 2003; Rwigema & Venter, 2004; Thrassou et al., 2018) brought about by the ever-changing landscape of 4IR. The entrepreneurial process becomes a cyclical progression of decisions regarding value added opportunities and the allocation of resources (Glancey, 1998; Kodithuwakhu & Rosa, 2002) and mediates the entrepreneurial readiness behaviour of university students. Each dimension of the entrepreneurial readiness behaviour is discussed and the relationship between these behaviours and the entrepreneurial process is further investigated.

5.5.1.1 The relationship between venture creation and entrepreneurial process

The different dimensions of the entrepreneurial process such as opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation affect venture creation, as shown in Table 5.1. The relationship postulated between these concepts can be summarised as follows: (a) *There is a direct positive relationship between opportunity identification and venture creation,* (b) *There is a direct positive relationship between opportunity validation and venture creation,* (c) *There is a direct positive relationship between opportunity exploitation and venture creation and* (d) *There is a direct positive relationship between resource mobilisation and venture creation.*

Table 5. 1: The relationship between venture creation and entrepreneurial process

Venture creation			
Opportunity identification	**Opportunity validation**	**Opportunity exploitation**	**Resource mobilisation**
Successful venture creation relies upon the ability to identify opportunities (McCline et al., 2000; Lundberg & Rehnfors, 2018).	Opportunity screening and validation is a vital component of the entrepreneurial process (Ucbasaran et al., 2004).	Timely adaptation of recognised opportunities for market needs is important for the success of new venture creation (Morris & Zahra, 2000).	Opportunity development is part of the process of resource mobilisation when pursuing identified market opportunities

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		Successful opportunity exploitation is required for the process of new venture creation (George, 2018).	(Kodithuwakhu & Rosa, 2002).

5.5.1.2 The relationship between innovative financing and entrepreneurial process

As indicated in Table 5.2, the dimensions of the entrepreneurial process facilitate innovative financing. The relationship postulated between these concepts can be summarised as follows: (a) *There is a direct positive relationship between opportunity identification and innovative financing, (b) There is a direct positive relationship between opportunity validation and innovative financing, (c) There is a direct positive relationship between opportunity exploitation and innovative financing* and (d) *There is a direct positive relationship between resource mobilisation and innovative financing*.

Table 5. 2: The relationship between innovative financing and entrepreneurial process

Innovative financing			
Opportunity identification	**Opportunity validation**	**Opportunity exploitation**	**Resource mobilisation**
The transforming financial ecosystem is identifying opportunities and potential risks to the system. Financial inclusion involves the potential digital innovation to improve access to a variety of financial services and products, regardless of location and income (COEFS, 2017).	Innovative individuals that take risks and are proactive in validating opportunities to revitalise ventures in a competitive market environment, gains financial growth and equity (Guth & Ginsberg, 1990; Zahra & Covin, 1995; Lumpkin & Dess, 1996; Hsiao, 2021).	The entrepreneurial process demonstrates a propensity to risk-taking as the result of opportunity exploitation that may be uncertain (Coetzee, 2017). Risks are a reality, as it may contribute to unsuccessful ventures, missed opportunities and consequently, the revealing of lower profits (McClelland, 1965).	Gathering all necessary resources could be acquired by subcontracting or outsourcing skills and resources to minimise the financial impact and maximise profit (Brown et al., 2001; Kuratko et al., 2011; Urban, 2012).

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5.5.1.3 The relationship between venture growth and entrepreneurial process

Table 5.3 indicates the relationship between the different dimensions of the entrepreneurial process and venture growth. The relationship postulated between these concepts can be summarised as follows: (a) *There is a direct positive relationship between opportunity identification and venture growth, (b) There is a direct positive relationship between opportunity validation and venture growth, (c) There is a direct positive relationship between opportunity exploitation and venture growth and (d) There is a direct positive relationship between resource mobilisation and venture growth.*

Table 5. 3: The relationship between venture growth and entrepreneurial process

Venture growth			
Opportunity identification	**Opportunity validation**	**Opportunity exploitation**	**Resource mobilisation**
Venture growth is dependable on the discovery and identification of new opportunities.	Venture growth includes validation of opportunities, such as taking action, new risks, funding growth strategies and exploring financial resources.	Continuous scanning transformation of business opportunities and exploiting these opportunities ahead of competitors lead to the growth of ventures.	The development of a venture to increase competitive advantage and the ability to evolve, support growth. Venture growth is reliant on the ability to gather new resources.

(Source: Adapted from Gundry & Welsch, 2001; Man et al., 2002; Rwigema & Venter, 2004).

5.6 RELATIONSHIP BETWEEN ENTREPRENEURIAL READINESS BEHAVIOURS AND SELECTED 4IR SKILLS

Selected 4IR skills are critical to entrepreneurial behaviour of university students. Walls (2018) posits that these skills required by student entrepreneurs are not provided by HEIs. The purpose of this study is to investigate the relationship between entrepreneurial readiness behaviours and selected 4IR skills to establish how HEIs could contribute to entrepreneurial behaviours. This coheres with and seeks to address H3: There is a positive and statistically significant relationship between entrepreneurial skills and entrepreneurial readiness behaviours. The skills required in 2020 differ from the identified skills in 2015 due to the rapid changes brought about by

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4IR. However, individuals who can cultivate these new skills will be in demand and therefore ten specific skills have been identified as necessary skills for entrepreneurs (Walls, 2018) in the following Table.

Table 5. 4: Top 10 skills needed due to 4IR

2015	2020
1. Complex problem solving	1. Complex problem solving
2. Coordinating with others	2. Critical thinking
3. People management	3. Creativity
4. Critical thinking	4. People management
5. Negotiation	5. Coordinating with others
6.Quality control	6. Emotional intelligence
7. Service orientation	7. Judgment and decision making
8.Judgment and decision making	8. Service orientation
9. Active listening	9. Negotiation
10. Creativity	10. Cognitive flexibility

(Source: Adapted from Majid, 2018)

In 4IR, workers are valued for their capability to innovate s thus outpacing their competition. Entrepreneurs are encouraged to obtain certain skills in preparation for the future. Walls (2018) lists the newly required skills as the following:

1. Complex problem solving

Complexity is per definition the number of inputs or variables in a system. Every new input causes a problem to be exponentially more complex. Skilled workers can handle these complexities and derive outputs and strategies from them. Frameworks that implement solutions to complex problems are vital to entrepreneurs globally in order to make an impact.

2. Critical thinking

Critical thinking is defined as logical argument construction executed by clearly defining statements and then organising these statements into arguments or conclusions. It is and is an ongoing process.

3. Creativity

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Creativity is the ability to produce innovative ideas and subsumes five key behaviours: associating, questioning, observing, networking and experimenting. Entrepreneurs will benefit from implementing generated innovations by unlocking their creativity.

4. People management

Two components are identified namely, people (leading, encouraging, motivating inspiring and emotional intelligence) and management (directing, training, disciplining and evaluating). Effective people managers balance self-motivating trust, cooperation, as well as respect, and therefore know the internal actions of the business.

5. Coordinating with others

Coordinating with others is about recognising when dependencies are one sided or mutual in any specific situation. Understanding individuals, managing relationships and maintaining a balanced environment are vital aspects in coordinating other people in the workplace.

6. Emotional intelligence

Emotional intelligence is capacity of managing and understanding the emotions of others and oneself. Three important aspects of emotional intelligence are emotional awareness, harnessing emotions and managing emotions.

7. Judgment and decision making

Judgment and decision making is recognising the possibilities, understanding the implications, harnessing the organisational resources both externally and internally, overseeing the implementation of solutions and analytically assessing the situation. The daily routine of a successful entrepreneur should include mental discipline, focus and willpower. Business leaders should harness these entrepreneurial skills when proactively confronting problems unique to the value proposition.

8. Service orientation

Service orientation entails the desire and ability to recognise, anticipate and meet people's needs even before those needs are communicated. To ensure customer and employee satisfaction, it is important to guarantee the people's highest priority needs is served first.

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9. Negotiation

Negotiation consists of both parties compromising on terms without disputes and arguments. The factors driving negotiations are maintained relationships, mutual benefit and fairness. To negotiate successfully, an entrepreneur requires a clear understanding of the current position and what strategy is needed to achieve the desired outcome.

10. Cognitive flexibility

Cognitive flexibility means being able to think about different concepts simultaneously. Entrepreneurs constantly switch between various tasks and dealing with different scenarios of similar problems. More solutions from various disciplines could be identified by reducing the cognitive “switching cost” and therefore being capable to operate in an uncertain environment.

4IR is propelled by AI signifying a transformation in the work environment from tasks centred characteristics to human centred characteristics. This will cause the reduction of subject distance and therefore require interdisciplinary research, teaching and innovation. In a world transformed by technology, the set of skills required in the third industrial revolution will have to change from information technology as the key driver to intelligent technology with skills such as emotional intelligence, negotiation, judgment, critical thinking, cognitive flexibility, knowledge production and people management (Xing & Marwala, 2017). Therefore, these skills will align with the selected 4IR skills known as soft skills, technical skills and entrepreneurial skills to stimulate entrepreneurial readiness behaviour.

5.6.1 Individual dimensions of each entrepreneurial readiness behaviour and their relationships here to dimensions of each selected 4IR skill

Substantial human and financial resources improve performance of entrepreneurship, whilst institutions that encourage entrepreneurship influence the resources that individuals require for new venture creation (Millan et al., 2014). Furthermore, decision formation (De Clercq et al., 2013) accelerates entrepreneurship in individuals with the

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required capabilities, skills and willingness to improve the relationship between entrepreneurial entry and entrepreneurial readiness (Raza et al., 2019).

Every operational aspect of entrepreneurial readiness behaviours has a direct impact on which 4IR skills will be required. Entrepreneurial readiness behaviours aimed at growth will require specific skills to overcome challenges and to deploy resources optimally in an ever-changing technological environment. Technological change necessitates the increase in technical knowledge (Gundry & Welsch, 2001; Man et al., 2002; Rwigema & Venter, 2004; Tidd & Bessant, 2020).

5.6.1.1 The relationship between venture creation and selected 4IR skills

Table 5.5 indicates the relationship between venture creation and the selected 4IR skills such as soft skills, technical skills and entrepreneurial skills. The relationship between these concepts can be summarised as follows: (a) *There is a direct positive relationship between soft skills and venture creation, (b) There is a direct positive relationship between technical skills and venture creation* and (c) *There is a direct positive relationship between entrepreneurial skills and venture creation*.

Table 5. 5: The relationship between venture creation and skills

Venture creation		
Soft skills	**Technical skills**	**Entrepreneurial skills**
Motivation is needed for successful venture creation (Robertson et al., 2003; Murnieks et al., 2020).	**Technical proficiency** is a necessary requirement for successful venture creation (Tustin, 2001; Odinaka, 2019).	Setting up **business plans** leads to successful ventures (Pretorius & Shaw, 2004; Lackéus & Williams Middleton, 2018).
Human resource management skills are considered as an important factor for venture creation (MacMahon & Murphy, 1999; Clover & Darroch, 2005; Salamzadeh et al., 2019).	Entrepreneurs should allow their **problem solving** abilities to overcome challenges to create a successful venture (Davila et al., 2003; Lackéus & Williams Middleton, 2018).	Continuous **adaptability** is vital for successful venture creation in an era of transformation and uncertainty (Mazzarol et al., 1999; Ijeoma, et al., 2020).
Entrepreneurial **networking** is vital for the acquisition and mobilisation of resources that are important for venture creation (Jack & Robson, 2002; Senjem & Reed, 2002; Hertel et al., 2021).	Successful venture creation lies in accurate **decision-making** skills (Baron, 2004b; Lackéus & Williams Middleton, 2018).	A successful entrepreneur takes **calculated risks** and avoids the cognitive bias of miscalculating the risks involved when creating a new venture (Baron, 2004a; Rașcă & Deaconu, 2018).

5.6.1.2 The relationship between innovative financing and selected 4IR skills

Differentiating 4IR skills using Table 5.6 illustrates the relationships between innovative financing and soft skills, technical skills and entrepreneurial skills. The

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relationship between these concepts can be summarised as follows: (a) *There is a direct positive relationship between soft skills and innovative financing, (b) There is a direct positive relationship between technical skills and innovative financing and (c) There is a direct positive relationship between entrepreneurial skills and innovative financing*.

Table 5. 6: The relationship between innovative financing and skills

Innovative financing		
Soft skills	**Technical skills**	**Entrepreneurial skills**
Critical thinking improves the identification of opportunities in innovative financing (COEFS, 2017).	Developing **job specific skills** are required to access existing finance (Cardone & Fonseca, 2006; Moll & Yigitbasioglu, 2019).	Understanding critical **risk-taking** is important for improving innovative financial communities (COEFS, 2017).
Entrepreneurial **motivation** influences the decision of creating new innovative values that increases sustainable advantages and successful outcomes (Eniola, 2021).	**Digital literacy** is an essential skill needed as innovation in 4IR has thrived in markets where a digital ecosystem exists (COEFS, 2017).	Entrepreneurs are encouraged to be **innovative** to develop their entrepreneurial potential into financial growth and profitability (Kuratko et al., 2011; Eniola, 2021).
	Financial management is accessed through developing skills to reduce capacity constraints (Cardone & Fonseca, 2006; Herawati et al., 2018).	Implementing a goal orientated **business plan** improves business development and could be used for a financial application (Hisrich & Peters, 2002; Mughan et al., 2004; Mazzucato, 2018).
	Problem solving is critical for successful innovative financing (COEFS, 2017).	

5.6.1.3 The relationship between venture growth and selected 4IR skills

The relationship between venture growth and selected 4IR skills are discussed in Table 5.7. The relationship postulated can be broken down as follows: (a) *There is a direct positive relationship between soft skills and venture growth, (b) There is a direct positive relationship between technical skills and venture growth and (c) There is a direct positive relationship between entrepreneurial skills and venture growth.*

Table 5. 7: The relationship between venture growth and skills

Venture growth		
Soft skills	**Technical skills**	**Entrepreneurial skills**
Situational-specific **motivation** is needed for venture growth (Durand, 1975; Murnieks et al., 2020).	**Problem solving** skills are identified as key abilities for successful venture growth (Darroch & Clover, 2005; Kim et al., 2018).	**Creativity** is important to sustain a competitive advantage (Friedrich et al., 2003; Lund et al., 2017).

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Successful entrepreneurs have the ability to **communicate** their vision for growth effectively and clearly (Nieman, 2006; Eunice Abdul, 2018).	**Job-specific** skills are important during the growing stage of a venture (Tustin, 2003; Rwigema & Venter, 2004).	Growth is dependent on the planning of **innovation** and innovative techniques (Schamp & Deschoolmeester, 1998; Marri et al., 2003; Eniola, 2021).
Entrepreneurs that invest in venture growth, have to build lasting **long-term relationships** (Rwigema & Venter, 2004; Nieman, 2006).	Entrepreneurs with the ability of **decision-making** skills, stimulate growth in ventures (Glancey et al, 1998; Cohen & Wirtz, 2021).	The application of **business systems management** supports venture growth (Viviers et al., 2001).
Practices of **networking** and strong networks foster venture growth (Drakopoulou, 2002; Jansen, 2003).		The **learning abilities** of an entrepreneur are vital for venture growth (Deakins & Freel, 1998; Larsson et al., 2003).
Technological transformation necessitates the **adaptability** to change during venture growth (Morris & Zahra, 2000).		Successful entrepreneurs tend to **take risks** to grow new ventures (Man et al., 2002).

5.7 RELATIONSHIP BETWEEN ENTREPRENEURIAL PROCESS AND SELECTED 4IR SKILLS

The acquisition of skills is a requirement of the entrepreneurial process (Kunene, 2009), although their importance may vary in each of the four dimensions of the entrepreneurship process. This section, therefore, seeks to address the following: There is a direct positive relationship between the entrepreneurial process selected 4IR skills.

Prerequisite entrepreneurial behaviours, attributes and skills of individuals, as well as the entrepreneurial process are the solid foundation of entrepreneurship. Entrepreneurship, related theories and entrepreneurial behaviour form part of the entrepreneurial process. Entrepreneurship should be encouraged among students by incorporating their entrepreneurial behaviour and skills in universities (Heinonen & Poikkijoki, 2006).

Entrepreneurship entails the identification of opportunities, breaking patterns in a creative manner, co-ordinating and organising resources, as well as managing and taking risks (Landström, 1998; Gibb, 2002). According to Schumpeter (1934), entrepreneurial process is an action. The process is further defined as an entrepreneur who perceives opportunities and creates ventures through actions (Bygrave & Hofer, 1991). Therefore, entrepreneurship involves interaction of entrepreneurial individuals

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with their environment by identifying, evaluating and exploiting opportunities (Shook et al., 2003).

5.7.1. Individual dimensions of each entrepreneurial process and their relationships here to dimensions of each selected 4IR skills

Once an entrepreneur has validated and exploited the necessary strategies and resources into a business plan, they should assemble the resources required for addressing the opportunity (Hellman, 2007). Gathering resources is as important as discovering opportunities. Subsequently the absence of vital resources might result in the failure of the entrepreneurial process (Gartner et al., 1999).

After a strategy is formulated by an entrepreneur, a business plan should be designed (Wickham, 2001). An effective business plan is vital to exploit the identified opportunity and defining the resources necessary, gathering those resources and managing the resulting venture successfully (Hisrich et al., 2005; Nieman, 2006). Awareness of entrepreneurial opportunities is important, but an entrepreneur should also acquire the necessary skills to exploit these identified opportunities and successfully manage the resulting venture (McCline et al., 2000; Hisrich et al., 2005).

Once the necessary resources are acquired, an entrepreneur should utilise these resources to execute a business plan (Hisrich et al., 2005). Executing this action includes goal definition, goal development, detailed planning, monitoring the plan, implementing quality action, developing a vision for the future and processing feedback (Rauch & Frese, 2000). The activities applied in this stage include creating organisational capabilities, setting up structures, systems and production processes, developing managerial competencies, collecting finances, cost effectiveness, quality control, working with suppliers and distributors, resolving operational problems, selling to customers, determining the significant variables of success and managing the goals of the organisation (Gartner et al., 1999; Man et al., 2002; Rwigema & Venter, 2004; Hisrich et al., 2005).

Different types of skills are required for the various dimensions of the entrepreneurial process (Pretorius, 2001). Also, different factors of success and challenges will vary

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according to the distinctive dimensions of the entrepreneurship process (McMahon, 2001). The necessary skills needed for each dimension of the entrepreneurial process l signify the interactive nature of vital skills influencing each dimension (Carter et al., 1996; Kickul & Gundry, 2002). For an opportunity to be deemed successful, is has to be developed by a group of individuals with prominent skills (Bygrave, 1997). This section explores the relationship between the four dimensions of the entrepreneurial process and the selected 4IR skills. The skills needed for success in each dimension of the entrepreneurial process are further discussed.

5.7.1.1 The relationship of opportunity identification and selected 4IR skills

Table 5.8 illustrates the relationships between opportunity identification and selected 4IR skills such as soft skills, technical skills and entrepreneurial skills. The relationship can be broken down as follows*: (a) There is a direct positive relationship between opportunity identification and soft skills, (b) There is a direct positive relationship between opportunity identification and technical skills and (c) There is a direct positive relationship between opportunity identification and entrepreneurial skills.*

Table 5. 8: The relationship between opportunity identification and skills

Opportunity identification		
Soft skills	**Technical skills**	**Entrepreneurial skills**
The ability to interact with different individuals from various backgrounds with interpersonal skills namely persuasive **communication** and listening that is linked to successful opportunity identification (Guzman & Santos, 2001).	A successful entrepreneur has skills to formulate **strategic plans** for establishing a business (Man et al., 2002; Lussier & Pfeiffer, 2005).	**Creativity** is an essential part for identifying business opportunities (Friedrich et al., 2003; Pretorius et al., 2005).
Personal **motivation** is a vital success factor for scanning market opportunities (Rwigema & Venter, 2004).	**Job specific skills** are required from entrepreneurs to improve opportunity identification (Davila et al., 2003).	**Innovation** is considered as significant for opportunity identification (Wickham, 2001; Freel & Robson, 2004).
Networking form pathways through which opportunities would be successfully identified (Drakopoulou & Patra, 2002).	**Problem solving** abilities are required to successfully identify opportunities (Baron, 2004b).	**Risk-taking** impacts the process of opportunity identification and development (Baron, 2004b).

5.7.1.2 The relationship between opportunity validation and selected 4IR skills

Table 5.9 indicates the relationship between opportunity validation and soft skills, technical skills and entrepreneurial skills. *The relationship postulated can be*

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summarised as follows: (a) There is a direct positive relationship between opportunity validation and soft skills, (b) There is a direct positive relationship between opportunity validation and technical skills and (c) There is a direct positive relationship between opportunity validation and entrepreneurial skills.

Table 5. 9: The relationship between opportunity validation and skills

Opportunity validation		
Soft skills	**Technical skills**	**Entrepreneurial skills**
An entrepreneur must evaluate opportunities and incorporate it with the **team's skills** (Robertson et al., 2003).	The ability to **manage a project** and people is an important skill in opportunity evaluation (Kahneman & Lovallo, 1993; Simon et al., 2000).	**Innovation** is needed in both the internal and external environment to validate opportunities (Shane, 2003; Stevenson & Jarillo, 2007; Rwigema et al., 2008; Kuratko et al., 2011; Venter et al., 2015).
Critical thinking forms part of evaluating opportunities that gather sources of information and synthesise information in order to draw conclusions (Wei et al., 2014).		**Risk-taking** contributes to the successful evaluation of opportunities in an entrepreneurial environment (Shane, 2003; Stevenson & Jarillo, 2007; Rwigema et al., 2008; Kuratko et al., 2011; Venter et al., 2015).
Networking allows an entrepreneur to benefit from market transformation (Miller et al., 2003) and different information to improve new opportunities (Harris et al., 2000; Hite, 2005).		

5.7.1.3 The relationship between opportunity exploitation and selected 4IR skills

Differentiating 4IR skills using Table 5.10 illustrates the relationships between opportunity exploitation and soft skills, technical skills and entrepreneurial skills. The relationship postulated can be summarised as follows: (a) *There is a direct positive relationship between opportunity exploitation and soft skills, (b) There is a direct positive relationship between opportunity exploitation and technical skills and (c) There is a direct positive relationship between opportunity exploitation and entrepreneurial skills.*

Table 5. 10: The relationship between opportunity exploitation and skills

Opportunity exploitation		
Soft skills	**Technical skills**	**Entrepreneurial skills**
An entrepreneur needs **communication** skills to convince	Technical skills are exploited with **job specific** requirements and are vital to	A **risk-taking** entrepreneur pursues business without market research and

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employees to be an asset for the business (Addis, 2003).	achieve success (Perks & Struwig, 2005).	exploits new products required for success (Markman & Baron, 2003).
Motivation is a vital factor that determines the entrepreneurial intention that will lead to action (Timmons, 1999; Nasser et al., 2003).	The ability of **problem solving** allows an entrepreneur to exploit challenges deprived from opportunities (Davila et al., 2003).	The **ability to learn** provides opportunities for entrepreneurs that are needed in an ever-changing environment (Man et al., 2002).
An entrepreneur must have the ability to **organise a team** and facilitate the exploitation of an organisational strategy, goal and vision (Carter et al., 1996).		A goal-oriented **business plan** entails important documents from entrepreneurs which includes gaps between opportunities and resources (Hisrich & Peters, 2002; Mughan et al., 2004).
Networking exploits the need for human contact, especially in a working environment (Drakopoulou, 2002).		
The **adaptability to change** exploits the ability and willingness to adjust as the business environment evolves (Morris & Zahra, 2000).		

5.7.1.4 The relationship between resource mobilisation and selected 4IR skills

The relationship between resource mobilisation and selected 4IR skills are discussed in Table 5.11. The relationship postulated can be broken down as follows: (a) *There is a direct positive relationship between resource mobilisation and soft skills, (b) There is a direct positive relationship between resource mobilisation and technical skills and (c) There is a direct positive relationship between resource mobilisation and entrepreneurial skills.*

Table 5. 11: The relationship between resource mobilisation and skills

Resource mobilisation		
Soft skills	**Technical skills**	**Entrepreneurial skills**
Achievement **motivation**, commitment, self-efficacy and positive attitudes contribute to entrepreneurial success (Nieman, 2001; Baron, 2003; Darroch & Clover, 2005; Pretorius et al., 2005).	**Decision making** skills are required from an entrepreneur to implement action, accomplish goals and manage risks (Man et al., 2002; Baard & van den Berg, 2004)	A successful business incorporates **innovation** for new opportunities, resources, ideas and processes whilst implementing business plans (Rwigema & Venter, 2004; Pretorius et al., 2005).
Comprehensible **communication**, clear information and active listening are essential for optimal business performance (Nieman, 2006).	A successful entrepreneur has the ability to **solve problems** and challenge circumstances in the work environment (Nieuwenhuizen & Kroon, 2002).	**Creativity** is vital for successful venture performance in a demanding and competitive environment (Hankinson, 2000; Nieuwenhuizen & Kroon, 2003; Pretorius et al., 2005).
Managing **human resources** is a significant factor in successful ventures (Baron, 2003).	The lack of **planning** and prioritising resources leads to venture failure (Orser et al., 2000).	Successful entrepreneurs are efficient and capable managers take advice from]relatable experts and **learn** from

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		previous experiences (Nieman, 2001; Kodithuwakhu & Rosa, 2002).
Networking improves the performance of ventures through sharing information, discussing solutions, peer advice and access to complementary skills (Ladzani & Van Vuuren, 2002).	**Specific job skills** are important for an entrepreneur to create new products (Cornwall & Naughton, 2003; Czinkota & Ronkainen, 2003).	Competent entrepreneurs engage in risk associated matters with numerous strategies and have the ability to **take calculated risks** (Rogerson, 2001; Baron, 2004b).
The fast pace of transformation in business, encourages the ability to **adapt** to technological innovation (Gadenne, 1998).		

5.8 LITERATURE REVIEW TABLE

Recent studies have explored links between three key constructs significant to this research study. A summary of research on the nexus between 4IR skills, entrepreneurial process and entrepreneurial readiness behaviour is provided in the following Table.

Table 5. 12: Summary of the literature review

4IR skills	**Entrepreneurial process**	**Entrepreneurial readiness behaviour**	**Author**
Soft skills	Opportunity identification and opportunity validation	Venture creation	Schillo et al. (2016)
Soft skills and technical skills	Opportunity identification	Innovative financing	COEFS (2017)
Entrepreneurial skills	Opportunity identification	Venture creation	Jardim (2019)
Soft skills	Resource mobilisation	Venture creation	Hertel et al. (2021)

5.9 CHAPTER SUMMARY

This chapter addressed the relationship between entrepreneurial readiness behaviour and the entrepreneurial process, followed by a discussion of the individual dimensions regarding behaviour and their relationships to the dimensions of each process. The relationship between entrepreneurial readiness behaviour and 4IR skills was also investigated and the individual dimensions of behaviour in relation to the dimensions of 4IR skills were clarified. Thereafter, the relationship between the entrepreneurial process and 4IR skills was addressed and the subsequent discussion regarding the dimensions of the process and their relationships to dimensions of selected 4IR skills. The dimensions discussed above have an important effect on each other. Supporting

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research evidence from various research studies that were discussed in this chapter established that the relationships amongst entrepreneurial readiness behaviour, the entrepreneurial process and 4IR skills exist and are increasingly gaining acknowledgement. This study investigates the effects of selected 4IR skills on entrepreneurial readiness behaviour considering the mediation of the entrepreneurial process. The next chapter discusses the methodology used in this study.

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CHAPTER 6 RESEARCH METHODOLOGY

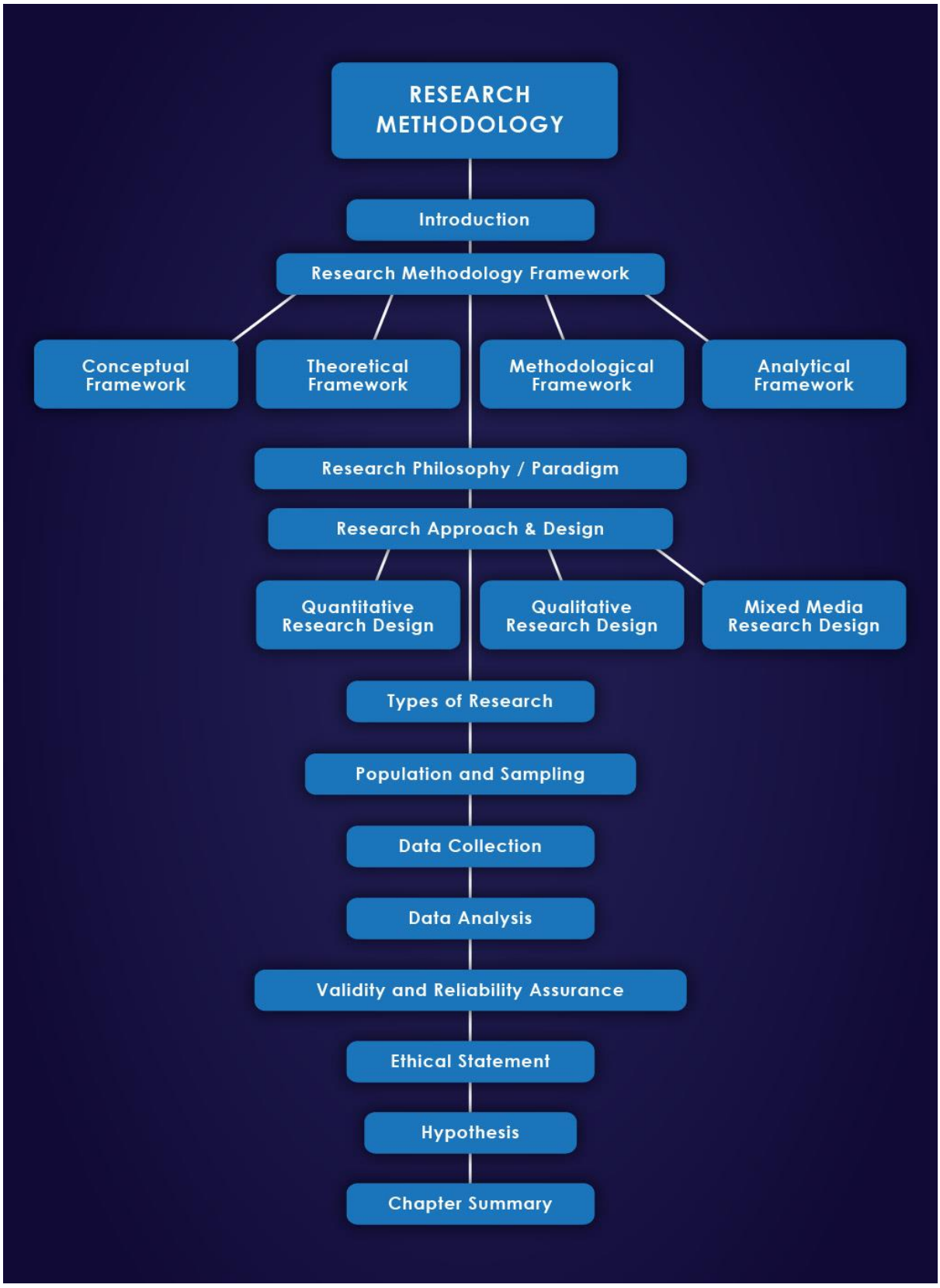

Figure 6. 1: Flow diagram indicating the structure of Chapter 6

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6.1 INTRODUCTION

The previous chapter provided a review of the interrelationships among key concepts of this research study namely, 4IR skills, entrepreneurial readiness behaviour and the entrepreneurial process. The current chapter presents, discusses and justifies the research methodology of this study. The outlines of the research strategy, research method, research design, selection of the sample, methods of data collection, type of data analysis, and ethical considerations of this research study are elaborated in this chapter. The research methodology outlines the way data was collected and analysed to determine the outcome of this study.

6.2 RESEARCH PHILOSOPHY/PARADIGM

A scientific research paradigm comprises of ontology, epistemology and methodology (Žukauskas et al., 2018). Three main components of research paradigm are discussed in Table 6.1 to understand the philosophy of scientific research.

Table 6. 1: Components of scientific research paradigm

Components of research paradigm	Description
Ontology	General assumptions generated to identify and understand the real nature of society.
Epistemology	General assumptions and parameters associated with exploring the real-world nature.
Methodology	Combination of different techniques utilised by scientists to explore various situations.

(Source: Adapted from Easterby-Smith et al., 2008)

The epistemological position of this study is positivism. The positivist paradigm supports the application of the approaches of natural sciences to social reality studies (De Vos et al., 2011; Bryman, 2012; De Vos et al., 2019). The paradigm advocates that scientific knowledge is obtained through the gathering of verifiable facts which are available in a controlled environment. Positivism involves the researcher taking a non-interactive, neutral position to research components to ensure the validity and reliability of the outcome (De Vos et al., 2011). Positivism applies a scientific approach to define the specific effects of different relationships (Collins, 2010; Bryman & Bell, 2011; Dudovskiy, 2022). A positivist paradigm is thus suitable for a study such as this one that seeks to develop a conceptual model where clearly defined associations

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among the constructs can be validated by accurate quantitative measurements (Ndofirepi, 2016). This philosophical paradigm is deemed appropriate for this study that strives to examine quantifiable variables (i.e., 4IR skills, entrepreneurial process, and readiness behaviours), the nature of their relationships, the significance and strengths of these relationships.

6.3 RESEARCH APPROACH

Research design can be defined as a blueprint for fulfilling objectives and answering research questions (Cooper & Schindler, 2014). A research design helps to find the answers to research questions as objectively and accurately as possible. This procedural plan contains the various methods utilised during the research process, offering a clear understanding of how the respondents are selected, how the data is collected, analysed and discussed to ultimately clarify the interpretation of the findings (Kumar, 2019). There are three different types of research designs, namely quantitative research design, qualitative research design and mixed research design.

This research study employs quantitative research, focusing on objectively measuring of variable data and then analysing the data numerically. The goal of this study is to identify the relationships among the different variables and determine the possibility of making some generalisations about the population based on the sample data. This study applies numerical analysis of collected data and objective measurements with the aim of generalising the results across various groups, as well as identifying relationships amongst variables (Quinlan et al., 2015). Therefore, since the variables measured and analysed are quantifiable and the sequence and significance of relationships can be analysed statistically using statistical models, a quantitative research is ideal for this study. Churchill and Iacobucci (2002) state that the quantitative research design is scientifically grounded, reliable and trustworthy, and many different authors agree with this statement (Bassey, 2003; Churchill & Iacobucci, 2005; Moss, 2007; Drew et al., 2008; Iacobucci & Churchill, 2010; Cooper & Schindler, 2011).

There are three approaches to the different research designs. Firstly, the deductive approach, that is relevant to quantitative data. Secondly, the inductive approach, that

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is applicable to qualitative data. Lastly, the abductive approach, that is relevant to both quantitative and qualitative data. Deductive reasoning is used in quantitative research where replication attempts act as empirical tests of the fundamental theory. Inductive reasoning is used in qualitative research where replication attempts act to explore the boundary of the theory. The deductive approach, characterised by variable-based models (Borgstede & Scholz, 2021), was adopted in this research study.

6.3.1 Quantitative research design

Quantitative research focuses on measuring data objectively and then analysing the captured data numerically. The goal of this study is to identify the relationships among the different variables and determine the possibility of making a generalised statement on the analysed data. Numerical analysis of collected data and objective measurements with the aim of probable generalisation of the results across various groups, as well as identifying relationships amongst variables forms the primary focus of quantitative studies (Quinlan et al., 2015).

The researcher utilises questionnaires to collect numeric data in quantitative studies. Quantitative research is managed in a structured environment that allows the researcher to control research questions and study variables. Quantitative research is used to determine the relationship between different variables and outcomes (Rutberg & Bouikidis, 2018).

Therefore, a quantitative research approach is applicable in this study where the research objectives are addressed. This approach encompasses the formulation of the hypothesis, data gathering, testing of the hypothesis that results in conformation or rejection of the hypothesis (Ndofirepi, 2016). This process enables the formulation of precise inferences from the gathered sample data to the target population (Nenty, 2009). Muijs (2011) indicates that this approach is further characterised by statistics and figures in relation to the target population. This study uses this approach to ascertain the effect selected 4IR skills have on students' entrepreneurial readiness behaviour and the mediation of the entrepreneurial process. The quantitative research techniques therefore enable the measurement of predictive relationships between dependent and independent variables (Ndofirepi, 2016).

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6.4 TYPES OF RESEARCH

Three types of research are identified and can be utilised with quantitative or qualitative or mixed methods research designs. The type of research is determined by the information required from the research problem. The three types of research are known as exploratory, descriptive and explanatory research (Sheppard, 2020).

Table 6. 2: Types of research

Types of research	Description
Exploratory research	Exploratory research guides the research study in the early stages of examining the topic and theory development. Exploratory research is used when certain behaviour or new knowledge is sought and causes for events or actions need discovering (Sheppard, 2020). This type of research is necessary when the available data is limited in certain topic areas (Cooper & Schindler, 2008). Exploratory research is the first step in assessing the feasibility and possible progression to conducting an effective study (Hallingberg et al., 2018).
Descriptive research	Descriptive research is an appropriate strategy when the aim of research is to describe a particular phenomenon or pattern (Sheppard, 2020). According to Cooper and Schindler (2008), descriptive studies offer descriptions of characteristics associated with the questions: "who, what, where, when and how". Descriptive research makes use of interviews, observations, surveys and reports data using averages, percentages and frequencies.
Explanatory research	Explanatory research identifies the cause and effect of the topic being studied (Sheppard, 2020). Explanatory research, also known as causal research, focuses on the analysis of a problem to identify the patterns of relationships among variables. Experiments are the primary data collection method in causal research and are conducted in the later stages of decision-making, following a highly structured research approach (Zikmund et al., 2012).

(Source: Adapted from Sheppard, 2020)

Consistent with a quantitative research approach, a descriptive, exploratory, explanatory cross sectional survey design best suits this study. Survey research is relevant to identifying, exploring, and examining respondents' opinions and perspectives on specific constructs (Curtis & Curtis, 2011). The study is descriptive and cross sectional to the extent that it provides a broad view on respondents' opinions on different matters at a specific point in time. Descriptive research is implemented in this study where surveys are distributed for the purpose of investigating the topic identified. Exploratory research is conducted in the initial stages of this study as new knowledge is accumulated and a specific behaviour is identified. The study is

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exploratory as there are some grey areas underexplored in previous research such as the limited understanding of the role of knowledge of the entrepreneurial process in mediating the selected 4IR skills and entrepreneurial readiness behaviour. The study is explanatory as it employs statistical modelling to predict the extent to which identified skills explain changes in entrepreneurial readiness behaviours.

6.5 POPULATION AND SAMPLING

6.5.1 Population

All individuals, organisations or groups with specific characteristics and qualities that are important to the researcher's examination of phenomenon are known as a population (Pandey & Pandey, 2015). It is important to carefully select the population of interest, since it influences whether the objectives of the research study can be met (Wildemuth, 2016). A suitable population must be identified for the researcher to effectively draw a sample from the population (Goldstein et al., 2015).

This study focused on final year university students in different fields of study at the Central University of Technology (CUT) and the University of the Free State (UFS). These universities represented this research study as they are proximate to each other, both universities have a clearly defined mentorship structure and emphasise training students in entrepreneurship. The entrepreneurial potential of students in different disciplines was tested whether they exhibited similar or different levels of entrepreneurial readiness behaviours. Final year students were targeted than beginner students because of their experience and exposure. The total population of final year students in CUT (three study fields) is approximately 2 973 and in UFS (three study fields) are approximately 4 379. Therefore, the population of students in various fields of study is 7 352 (Economic and Management Sciences, Natural and Agricultural Sciences, Health and Environmental Sciences, Engineering and Information Technology, Education, as well as Management Sciences). These fields of study were chosen as they have students who often exhibit entrepreneurial potential needed in future careers, while other faculties which lack dedicated programmes on entrepreneurship qualities were excluded.

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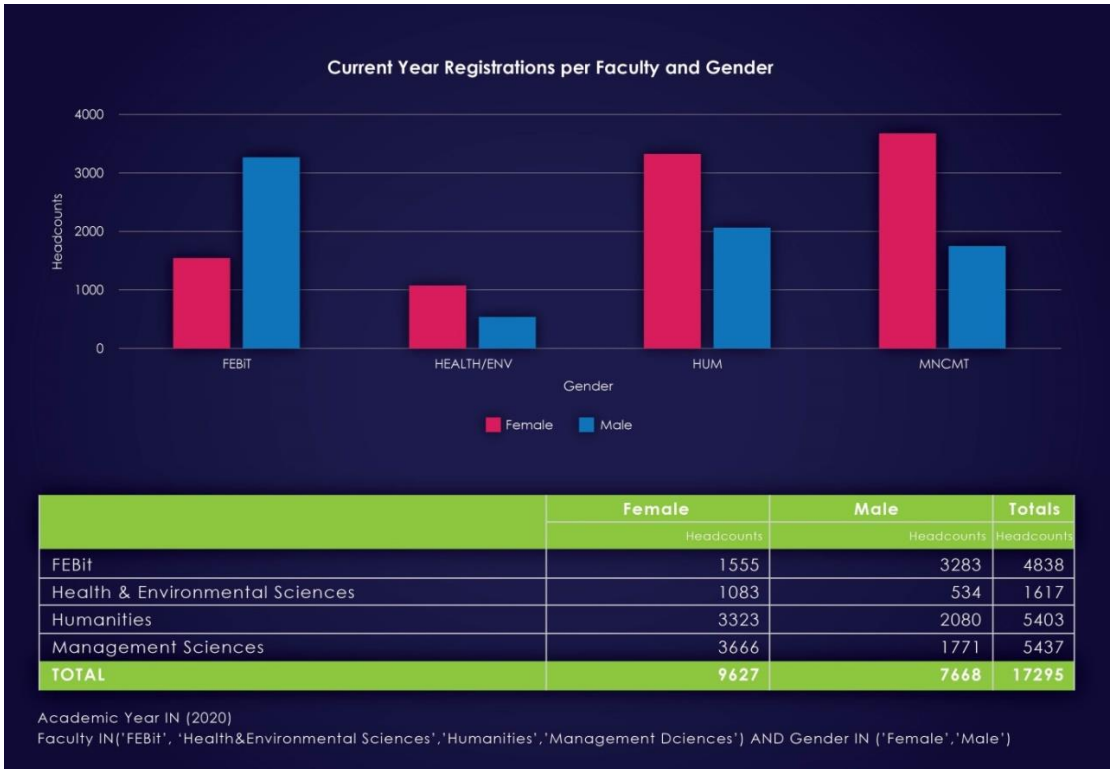

	Female	Male	Totals
	Headcounts	Headcounts	Headcounts
FEBit	1555	3283	4838
Health & Environmental Sciences	1083	534	1617
Humanities	3323	2080	5403
Management Sciences	3666	1771	5437
TOTAL	9627	7668	17295

Academic Year IN (2020)
Faculty IN('FEBit', 'Health&Environmental Sciences','Humanities','Management Dciences') AND Gender IN ('Female','Male')

Figure 6. 2: Population of CUT



Study Fields	Totals
	Population of Students
Education	6399
Economic and Management Studies	5931
Natural and Agricultural Sciences	5189
Humanities	4963
Health Scineces	2632
Law	2605
Theology	241
TOTAL	27960

UFS (University of the Free State). 2012. Strategic Plan: 2012 - 2016.

Figure 6. 3: Population of UFS

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The determination of the CUT population was informed by Figure 6.2. Students from the Faculty of Humanities were not part of the CUT sample and were excluded from the CUT sample. The population of UFS, identified in Figure 6.3, was obtained by adding the number of students (University of the Free State, 2012) in the three identified study fields and then using the same method.

6.5.2 Sample

Sampling is the procedure of selecting a subgroup from the population of interest and using the sample in predicting the outcome concerning the bigger group (Kumar, 2019). In the selection process of an acceptable sample for the study, it is necessary to identify and adopt a sampling technique. An act where characteristics of the entire population are selected or the selective method where samples are gathered within determined parameters is known as sampling. Recruitment of participants, population, sample and sampling techniques are all components of the sampling process (Quinlan et al., 2015).

This study used probability sampling technique, and cluster sampling since disciplines and universities comprise clusters around which students could be sampled. For this technique, students from CUT formed one cluster and those from UFS another cluster as much as disciplines can also form clusters from which students were randomly selected.

The identified fields of study comprised the following faculties:

- Economic and Management Sciences (UFS) and Management Sciences (CUT). These faculties engage in the entrepreneurial education curricula.
- Natural and Agricultural Sciences (UFS), Health and Environmental Sciences (CUT). These faculties are often involved in product development, engineering design and develop technical skills.
- Engineering and Information Technology (CUT): this faculty was selected to investigate if technology driven students have entrepreneurial skills and potential. Students in these departments are exposed to technology entrepreneurship and changes brought about by 4IR.

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- Education (UFS): This faculty was selected to measure the entrepreneurial skills which are needed to teach future students entrepreneurship and thereby equip the new generation of future entrepreneurs.

6.5.2.1 Sample size

Qualtrics (2020) recommends a formula to determine the sample size from the chosen population, where the margin of error, fraction of responses, critical value and the confidence level are calculated in the following method:

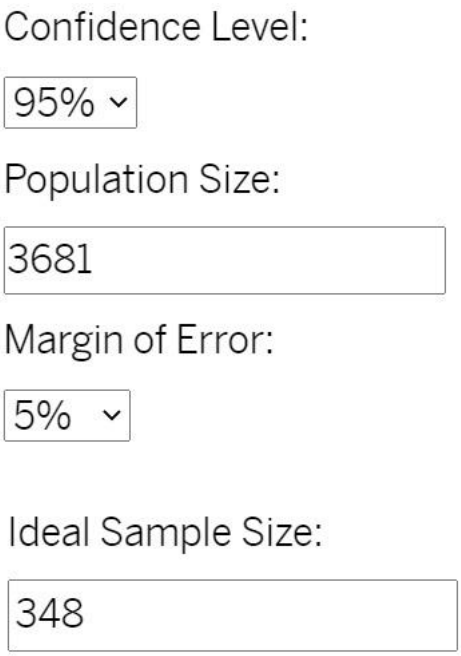

Figure 6. 4: Qualtrics online calculator for sample size

In short, the sample was calculated as follows: the total number of final year students at the two institutions was 7 362. Setting the online Qualtrics sample size calculator at 95% confidence level, margin of error of 5% and sample distribution of 50%, the adapted population generated a sample of 348.

6.6 DATA COLLECTION

The data collection method of this research study captured data by answering research questions online with the purpose of addressing the research problem. The online questionnaire had a short explanation of the research with appropriate questions that contribute to this research study. When the researcher collected data

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for this study, primary data was assembled (Quinlan et al., 2015). The survey method was selected to represent this research study and online questionnaires utilised to collect data. The data were collected from different HEIs in the Free State by completing online questionnaires in their respective study field. This study collected information by using the numerical data gathered from the chosen population.

To adhere to lockdown regulations of social distancing, the data for this research study was collected using an online questionnaire tool, Google Forms. Students were expected to rate their extent of agreement or disagreement with statements that measured the three variables namely, selected 4IR skills, entrepreneurial readiness behaviour and the entrepreneurial process. The advantages of utilising an online survey tool include gathering data from a large population in a limited timeframe, at no additional cost and easy tabulation of the results (McMillan & Schumacher, 2006). Online surveys are identified as non-experimental research as no planned intervention took place (Welman et al., 2005).

The structured questionnaire developed using Google Forms to capture data that provided answers to the research questions for this research study (Quinlan et al., 2019). The questionnaire comprised of a cover page with instructions for completing the questionnaire and research ethics followed in the study, personal demographics (Section A), 4IR skills (Section B), entrepreneurial process (Section C) and entrepreneurial readiness behaviours (Section D). Section B, Section C and Section D used items related to the Likert scale to measure the results of the respondents' beliefs contained in the online questionnaire. Respondents were requested to indicate to which extent they disagreed or agreed with a specific statement while completing the online questionnaire. The respondents' agreement with the statements is measured on a five-point Likert scale (1=Strongly Disagree, 5=Strongly Agree).

Each construct had a different number of variables and measurements. 4IR skills were divided into 3 variables, namely soft skills (13 measurement items), technical skills (5 measurement items) and entrepreneurial skills (13 measurement items) (Deloitte, 2018b). Furthermore, the entrepreneurial process was divided into 4 variables, such as opportunity identification (4 measurement items) (Morris & Zahra, 2000; Markman & Baron, 2003; Du Toit, 2016; Hampel et al., 2020), opportunity validation (11

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measurement items) (Carter et al., 1996; Gartner et al., 1999; Timmons, 1999; Rwigema & Venter, 2004), opportunity exploitation (5 measurement items) (Hisrich, 2005; Nieman, 2006; Kunene, 2008) and resource mobilisation (4 measurement items) (Bradley, 2002; Kodithuwakhu & Rosa, 2002; Densford et al., 2018). Lastly, entrepreneurial readiness behaviour was divided into 3 variables, namely venture creation (4 measurement items) (Reymen et al., 2015; Antonioli et al., 2016; Cooper, 2017; Barba-Sánchez & Atienza-Sahuquillo, 2018; Nieuwenhuizen, 2019), innovative financing (4 measurement items) (Cooper et al., 1994; Nieman, 2006; Hall & Lerner, 2010; Block et al., 2016) and venture growth (4 measurement items) (Morris & Zahra, 2000; Rwigema, 2004; Nieman, 2006; Župič & Giudici, 2017).

The online questionnaire delivered through the Google Forms platform was sent to students via email and the students' university portals were used for online classes. For those who accessed the questionnaire via these options, the researcher also used Question Pro to deliver the questionnaire as CUT already has this technology. This made the process of collecting data much easier, especially during the Covid-19 pandemic.

6.7 DATA ANALYSIS

Data analysis determines whether the results respond to the concepts and research theory so that research findings are interpreted in relation to the research questions (Quinlan et al., 2015). Statistical software, known as Statistical Package for the Social Science (SPSS), Smart Partial Least Squares (PLS), together with Process macro were used for analysing the collected data. For this research study, the descriptive statistics such as graphs and frequency tables established how the data is structured. This research study also utilised inferential statistics such as cross tabulation, correlation and regression analysis for detailed data analysis, techniques that are already available to SPSS and Smart PLS. To test for mediation effects the study employed Hayes' (2013) Process macro supported by bootstrapping 5 000 times at 95% bias-corrected confidence intervals.

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6.8 VALIDITY AND RELIABILITY ASSURANCE

Research reliability refers to the degree of consistency and stability as products of the research method. Measurement is considered as reliable when the same results are gained after repetitive studies on the same object of measurement are conducted (Dudovskiy, 2018). To ensure reliability, research instrument was pilot tested with 30 respondents to ensure that repetitive tests on individual concepts yielded comparable results.

Data reliability can be tested by using Cronbach's Alpha in SPSS. Measurement procedure must first be reliable and reliability is thus considered as a requirement, but is not a necessary condition for a research study to be considered as valid (Mohajan, 2017). Validity can be described as how logical, truthful, meaningful, reasonable and useful the research measurement is (Quinlan et al., 2015).

The validity of constructs of the measurement model was assured using face validity and content validity. Moreover, during data analysis validity was determined using convergent and discriminant validity (Hair et al., 2011; Rambe & Khaola, 2021). Face validity was assured by inviting the supervisor and the statistician to comment on the measuring instrument to ensure that the questions were concise, free from ambiguity and were accessible to the respondents. Content validity was assured by drawing on mainstream literature covering these concepts to ensure that the universe of content that the variable represents is sufficiently covered.

In Smart PLS, convergent validity was confirmed when all standardised loadings (outer loadings in SmartPLS) are at least 0.7 and statistically significant; the average variance extracted (AVE, average amount of variation that a latent variable explains in the observed variable) is 0.50 or higher; and composite reliability is 0.70 or higher (Nel & Boshoff, 2019). For discriminant validity, we used Fornell-Larcker criterion. According to this criterion, the square-root of the AVE of each variable should be greater than the correlations of that variable with other variables in the model (Hair et al., 2011; Nel & Boshoff, 2019). To test for mediation effects the study employed Hayes' (2013) Process macro supported by bootstrapping 5 000 times at 95% bias-corrected confidence intervals.

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6.9 ETHICAL STATEMENT

Grant and Sherrington (2006) indicate that the Economic and Social Research Council (ESRC) Ethics Framework sets out seven important principles that are expected of any research study:

- The researcher should set an objective to ensure that the risk potential to harm the research staff is less than the benefits obtained from the research study.
- The research staff and participants must be informed about the risks and benefits that are involved, as well as the purpose, the method and the intended possible use of the research study should also be communicated.
- The research study must be designed and reviewed to ensure that the integrity and quality standard are met.
- The anonymity of individual or group participants must be respected and requests concerning personal data, information and privacy of participants must be valued.
- The outcome of the research study must be secured on a password protected digital device.
- The independence of the research study must be clear and any conflict of interest should be communicated.
- The research staff may not partake or cohere in a voluntary manner.

This ethical framework was taken into consideration during the completion of this study. The students from the identified HEIs adhered to the ethical standards and the researcher ensured that no harm was done to individuals or institutions. Individuals that participated in this research study did not have to mention their personal credentials when completing the online questionnaire and will be protected from any misuse of information. The identified HEIs were represented in a positive light and the students from different study fields were treated equally. The analysed data was handled in an orderly manner and with discretion when evaluating the results.

6.10 CHAPTER SUMMARY

This chapter discussed the research methodology used in this study. The research methodology followed the positivist epistemology and drew comparisons among

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students of CUT and UFS. The research approach and design, the formulation of the research tool, the target population, the sampling procedure, the administration of online questionnaires, data collection and data analysis are outlined. The survey research method was the best option as a large population was being targeted in this research study. Quantitative research was chosen to source data aligned to fulfil the research objectives and answer the research questions. The SPSS-system was selected to analyse the data through completing the online questionnaires. Research ethics were adhered to throughout the study. The data analysis techniques and the results of this research study were utilised to test the hypotheses and analyse the data in the next chapter.

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CHAPTER 7 PRESENTATION AND DISCUSSION OF RESULTS

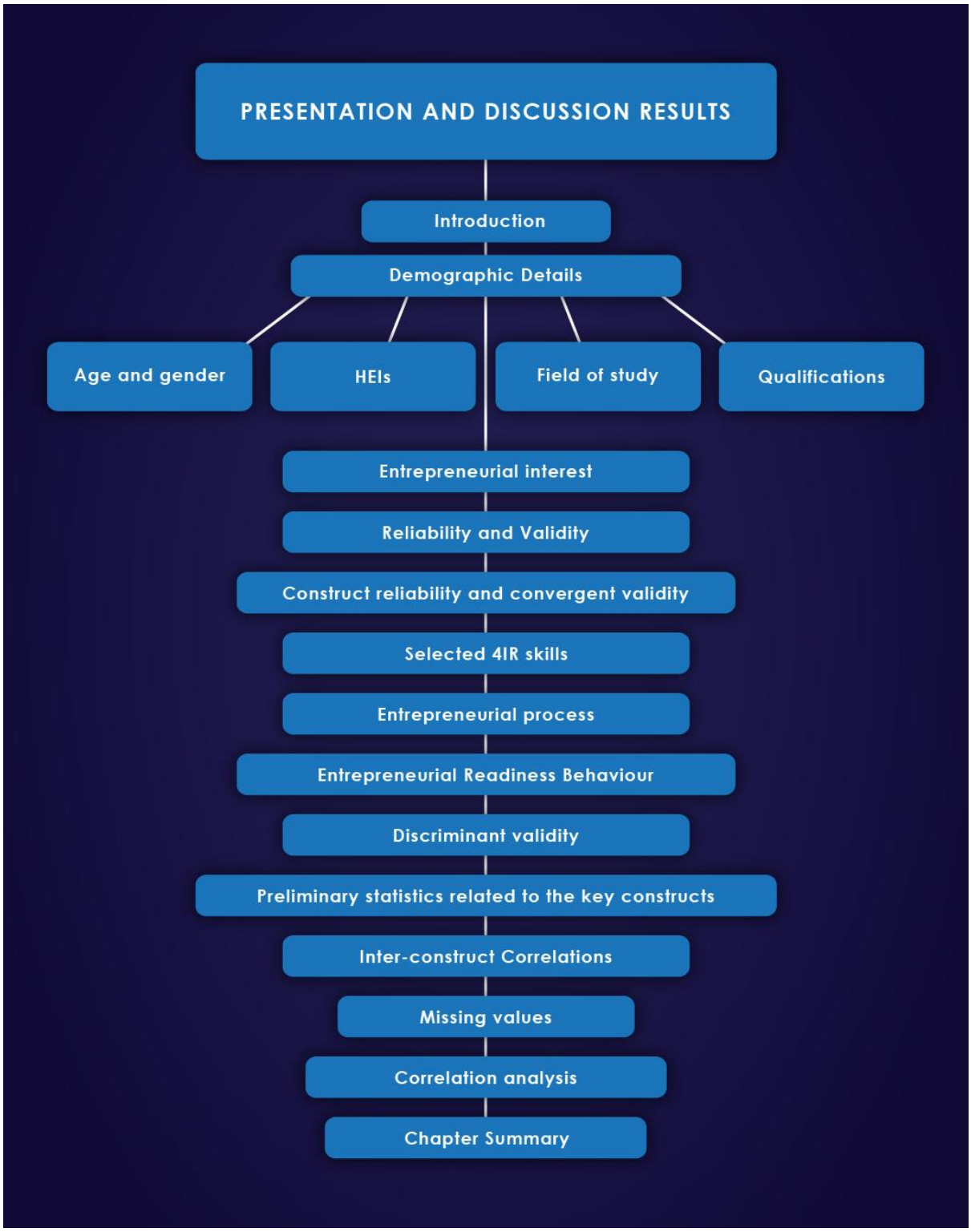

Figure 7. 1: Flow diagram indicating the structure of Chapter 7

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7.1 INTRODUCTION

The previous chapter provided a detailed methodology account of the processes and justification for the epistemology, design, data collection, data analysis and ethical standards adopted in this study. This chapter builds on the previous one through an extensive presentation and discussion of the research findings consistent with the research objectives as formulated in Chapter 1. The study examined the effect of 4IR skills on students' entrepreneurial readiness behaviour, including the extent to which the entrepreneurial process mediates this relationship. This chapter commences with the demographic details of the respondents, followed by results of the construct reliability and validity. The results of the selected 4IR skills are presented first. Thereafter, the results of the entrepreneurial process and entrepreneurial readiness behaviour are discussed.

7.2 DEMOGRAPHIC DETAILS

The first section of this chapter presents the demographic information of the sample which included respondents' age, gender, education levels and their interest in entrepreneurship. The respondents were asked to indicate the Higher Education Institution (HEI) they attended and the field of study for which they enrolled. This demographic information is illustrated in the following sections, starting with age and gender.

7.2.1 Age and gender

Since the responses elicited covered respondents' age and gender, cross tabulations were used to capture such demographic information as depicted in Table 7.1. There was a total of 149 male respondents, 150 female respondents and 1 transgender respondent studying at the two HEIs. A total of 201 respondents were between the age group of 18-25. The dominance of this age group could be attributed to the fact that most matriculants (i.e. high school graduates) often immediately enrol for university education upon completion of their high school. This consummates Stats SA's (2017) observation that the highest attendance rates at HEIs were among students aged 18-24 years.

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The relatively balanced representation of males and females in different age groups suggest that the two universities at which the respondents were enrolled considered gender equality enrolments seriously. In contrast to this finding, Akala (2018) highlights the complexity of gender equality in university enrolments. Furthermore, Klevan et al. (2016) determined that more females are enrolled at universities than males.

Table 7. 1: Gender and age

			Age of respondents				
			18-25	26-35	36-49	50+	
Gender	Male	Count	99	27	17	6	149
		%	66,4%	18,1%	11,4%	4,0%	100,0%
	Female	Count	101	35	14	0	150
		%	67,3%	23,3%	9,3%	0,0%	100,0%
	Other	Count	1	0	0	0	1
		%	100,0%	0,0%	0,0%	0,0%	100,0%
Total		Count	201	62	31	6	300
		%	67,0%	20,7%	10,3%	2,0%	100,0%

In terms of the respondents' age groups, Table 7.1 indicates that most respondents studying at HEIs were between 18-25 years (67%). The second most prevalent age groups were 26-35 years (20.7%). The dominance of the 18-35 years in the sample suggests that an adult youth population enrols and registers at HEIs in South Africa. This statistic resonates with the view that most South African students enrolled at HEIs were within these age groups: 19-24 (52.3%), followed by 25-29 (17.9%), 30-39 (14%) and the lowest represented age group of 50+ (1.6%) (Department of Higher Education and Training, 2023). Tema (2021) concurs that in 2019, most students enrolled in HEIs were aged 20-24 years (41,4%), followed by the category 19 years and below (18,4%). At UFS, 72% of students entering the university for the first time are between 19 and 22 years old (Strydom, 2021). The age group of 50+ years (2%) reflects the minority group of respondents that are currently studying. This evidence also supports the view that very few (50 years=1.6%) mature adults enrol for tertiary education especially university education (Department of Higher Education and Training, 2023).

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The demographic profile of enrolled students at the Central University of Technology (CUT) has changed significantly and is still evolving. The demographics in the CUT sample resonates with the 2018 student demographics at this university where there was a fairly balanced representation between females (52%) and males (48%) (CUT, 2020). At the University of the Free State (UFS), from 2016-2021, the gender distribution of first-time entering students has consistently been 60% females and 40% males (Strydom, 2021), which is marginally more than those of CUT.

7.2.2 HEIs

Table 7.2 indicates the students from different HEIs who participated in the survey. Within the South African context, the Free State province was represented by CUT and UFS, two public HEIs. The target audience was CUT, a predominantly applied research-based HEI, and UFS, a basic research-based HEI. These were the closest to the researcher, who studied at CUT. However, students from "Other" HEIs also responded to the survey since it was conducted online. "Other" HEIs such as NWU, NMMU, UP, TUT, US, UCT, UKZN and UNISA also participated in the survey.

Table 7. 2: Higher education institutions

		Frequency	Percent
HEIs	CUT	118	39,3
	UFS	118	39,3
	Other	64	21,3
	Total	300	100,0

Even though the two universities (CUT and UFS) were different in terms of their research foci, they operated in the same entrepreneurial ecosystem and had comparable entrepreneurship programmes, and provided a logical basis for comparison. These two institutions are part of the Higher Education Regional Development in the Central Region of South Africa (HERDIC), a consortium of universities and TVET colleges in the central region focus on advancing entrepreneurship and innovation (HERDIC, 2023). Not only do these institutions exist

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in the same regional entrepreneurship ecosystem located in proximity to each other (6km apart), but they experience comparable challenges regarding entrepreneurship education, innovation and entrepreneurship. The fact that these institutions operated in the same regional entrepreneurial ecosystem manifest in their comparable visions regarding the fostering of entrepreneurial ecosystems. For instance, CUT expresses the importance of an entrepreneurial ecosystem through developing progressive entrepreneurship curriculum (De Jager et al., 2017). Similarly, the UFS embraces a similar vision of using entrepreneurship education as a vehicle for realising entrepreneurship. For instance, anticipated direction of UFS over the next few years reportedly aims at the establishment of a high-growth entrepreneurial incubator and a small business academy (UFS Business School, 2023). The alignment of their visions at these HEIs do not only suggest the commonality of vision regarding developing opportunities for supporting entrepreneurship, but also demonstrates the identification of similar strategies for realising their visions.

7.2.3 Field of study

The different fields of study of all respondents from CUT, UFS and other HEIs are shown in Table 7.3, Table 7.4, Table 7.5 and Table 7.6. These study fields consist of Education, Economic and Management Sciences, Theology, Health Sciences, Natural and Agricultural Sciences and Humanities.

Table 7. 3: Different fields of study of CUT

Higher Education Institution (HEI)	Field	Counts	% of Total
CUT	Education	2	1.47 %
	Economic and Management Sciences	71	52.21 %
	Theology	0	0.0 %
	Health sciences	20	14.71 %
	Natural and agricultural sciences	0	0.0 %
	Humanities	11	8.09%
	Other	14	10.29 %
	Total	**118**	**100**

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The academic offerings of UFS and CUT differ, where CUT has four faculties: the faculties of Health and Environmental Sciences, Humanities, Engineering, Built Environment and Information Technology and lastly, Management Sciences. UFS has seven faculties: Health Sciences, The Humanities, Economic and Management Sciences, Education, Theology and Religion, Law, and Natural and Agricultural Sciences. The Faculty of Management Sciences had the largest enrolment in 2019 at CUT (32,2%) (CUT, 2020). Therefore, it is not surprising that the highest number of respondents come from the faculty of Economic and Business Management Sciences.

Table 7. 4: Different fields of study of UFS

Higher Education Institution (HEI)	Field	Counts	% of Total
UFS	Education	28	24.35 %
	Economic and Management Sciences	43	37.39 %
	Theology	13	11.31 %
	Health Sciences	6	5.22 %
	Natural and Agricultural Sciences	17	14.78 %
	Humanities	8	6.96 %
	Other	3	2.61 %
	Total	**118**	**100**

The dominance of Economic and Management Sciences students in the samples at UFS is attributed to the fact that most entrepreneurship programmes are offered in the Economic and Management Sciences (EMS) faculty. These findings support Aparicio et al. (2019) findings that the EMS faculty has the highest orientation towards entrepreneurship in their educational programmes compared to other faculties. Since entrepreneurship subjects are offered in business schools and the Economic and Management Sciences faculty at UFS, this could explain why a sizable percentage of the sample was drawn from this discipline.

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Table 7. 5: Different fields of study of other HEIs

Higher Education Institution (HEI)	Field	Counts	% of Total
Other	Education	10	13.51 %
	Economic and Management Sciences	17	22.97 %
	Theology	0	0.0 %
	Health Sciences	20	27.03 %
	Natural and Agricultural Sciences	3	4.05 %
	Humanities	6	8.11 %
	Other	8	10.81 %
	Total	**64**	**100**

A total of 64 respondents from other HEIs are represented in Table 7.5. Most students from other HEIs were in the field of Health Sciences (27.03%) and EMS (22.97%).

Table 7. 6: Total different fields of study

		Frequency	Percent	Cumulative Percent
Study field	Education	40	13,3%	13,3%
	Economic and Management Sciences	131	43,7%	57,0%
	Theology	13	4,3%	61,3%
	Health Sciences	46	15,3%	76,7%
	Natural and Agricultural Sciences	20	6,7%	83,3%
	Humanities	25	8,3%	91,7%
	Other	25	8,3%	100,0%
	Total	300	100,0%	

Economic and Management Sciences (43.7%) represented the highest proportion of students' field of study. This may be the case since this research study focus on various entrepreneurial aspects and most entrepreneurial courses are offered in this disciplinary field. Theology (4.3%) had the least number of respondents, as the number of students in this study fields is significantly lower. CUT has an engineering

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faculty, not offered by UFS, while UFS has faculties of Theology and Religion and Law, not offered by CUT. This explains the low number of respondents of the Faculty of Theology in this study (CUT, 2020).

7.2.4 Qualifications

The different levels of qualifications obtained by students are represented in Table 7.7, Table 7.8, Table 7.9 and Table 7.10. These qualifications consist of a course, certificate, diploma, advanced diploma, Bachelor's degree, Honours' degree, Master's degree and Doctoral degree.

Table 7. 7: Highest level of qualification obtained by CUT students

Higher Education Institution (HEI)	Highest qualification	Counts	% of Total
CUT	Course	23	19,49
	Certificate	25	21,19
	Diploma	11	9,32
	Advanced diploma	5	4,24
	Bachelor's Degree	24	20,33
	Honours Degree	8	6,78
	Master's Degree	18	15,25
	Doctoral Degree	4	3,39
	Total	118	100

The majority of CUT student enrolments are for undergraduate courses judging from the fact that, for example, between 2013 to 2017, postgraduates constituted between 6% to 7% of total enrolment. Since 2015, the number of postgraduates has risen steadily (CUT, 2020). Both of these findings are confirmed in this study, that most CUT students have obtained a Bachelor's degree or below, while the increase of postgraduate students is also visible.

Table 7. 8: Highest level of qualification obtained by UFS students

Higher Education Institution (HEI)	Highest qualification	Counts	% of Total
UFS	Course	6	5,08

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	Certificate	28	23,73
	Diploma	11	9,32
	Advanced diploma	2	1,69
	Bachelor's Degree	43	36,44
	Honours' Degree	21	17,8
	Master's Degree	6	5,08
	Doctoral Degree	1	0,85
	Total	118	100

The number of UFS students in 2020 totalled 41 653 students with 83.78% being undergraduates and 16.22% postgraduates. The undergraduate enrolment rate of UFS also increased from 17% to 20% in 2020 (Strydom, 2021). This is reflected in this study as most respondents of UFS obtained a Bachelor's degree (36.44%) or lower, while Honours degree (17,8%) was the third most obtained qualification from UFS students.

Table 7. 9: Highest level of qualification obtained by other HEIs

Higher Education Institution (HEI)	Highest qualification	Counts	% of Total
Other	Course	5	7,81
	Certificate	19	29,69
	Diploma	3	4,69
	Advanced diploma	2	3,13
	Bachelor's Degree	21	32,81
	Honours Degree	8	12,9
	Master's Degree	5	7,81
	Doctoral Degree	1	1,56
	Total	64	100

A total of 64 respondents from other HEIs are represented in Table 7.9. Most of these students' highest qualification is either a Bachelor's degree (32.81%) or a certificate (29.69%). This is reflected by the total number of respondents, which is indicated in Table 7.10.

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Table 7. 10: Total number of highest level of qualification obtained

		Frequency	Percent	Cumulative Percent
Qualifications	Course	34	11,3%	11,3%
	Certificate	72	24,0%	35,3%
	Diploma	25	8,3%	43,7%
	Advanced Diploma	9	3,0%	46,7%
	Bachelor's Degree	88	29,3%	76,0%
	Honours' Degree	37	12,3%	88,3%
	Master's Degree	29	9,7%	98,0%
	Doctoral Degree	6	2,0%	100,0%
	Total	300	100,0%	

As shown in Table 7.10, the respondents had obtained different levels of qualification, with 29.3% having obtained a Bachelor's degree. Doctoral students (2%) also participated in the research study. The dominance of students with either a degree or certificate is consistent with the enrolment structure of the two universities sampled where senior high school student enrolling for the first time at university or those studying towards their first qualification were enrolled for entrepreneurship programmes (Strydom, 2021). The findings of this research study reflect national statistics by the Department of Higher Education and Training (2023) which suggest that a sizable percentage of students obtained a Bachelor's degree (27.2%), followed by a certificate (26%), diploma (15.4%), Honours' degree (4.4%) and the lowest obtained qualification is a Doctoral degree (0.1%).

7.2.5 Entrepreneurial interest

This section covers the students' entrepreneurial interest upon completion of their studies and the role HEIs play in stimulating entrepreneurial behaviour. The impact of exposure to entrepreneurial education and conditions at HEIs to support entrepreneurs are analysed. This section also analysed entrepreneurial activities that HEIs engaged to enhance students' entrepreneurial behaviour.

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Table 7. 11: Students receiving entrepreneurial education or attending an entrepreneurial course

Response	Frequency	Percent
No	156	52%
Yes	144	48%

From this result, 48% reported having received entrepreneurial education (EE) or attended an entrepreneurial course, which is assumed to be beneficial for nascent entrepreneurs. Most respondents (52%) indicated that they did not receive entrepreneurial education or attend an entrepreneurial course. The fact that most respondents did not receive EE or did not attend an entrepreneurial course was a surprising outcome as previous literature highlights that entrepreneurship courses are offered to students in Business and Management Sciences (Arias et al., 2018; Barba-Sánchez & Atiena-Sahunquillo, 2018; Fiore et al., 2019).

Table 7. 12: Students considering becoming entrepreneurs after studies

Response	Frequency	Percent
No	39	13%
Maybe	67	22%
Yes	194	65%

Students were requested to indicate their intention to pursue entrepreneurial career after leaving HEIs. The majority (65%) highlighted that they intended to become entrepreneurs upon completion of their studies, while 22% submitted that they could become entrepreneurs, and 13% did not want to become entrepreneurs after completing their studies. The dominance of students with interest in pursuing an entrepreneurial career after their university education resonates with Fatoki (2014) who suggests that student entrepreneurs exhibit high levels of entrepreneurial intention after leaving HEIs.

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Table 7. 13: Students' perception of having been equipped by their HEI to become an entrepreneur

Response	Frequency	Percent
No	134	45%
Maybe	86	29%
Yes	80	27%

Even though a sizable number of students did not feel sufficiently equipped by their HEIs to become entrepreneurs (45%), some still believed that they could pursue entrepreneurship after studying. Okolie et al. (2021) contends that the zeal for students to become entrepreneurs upon completion of their studies can be instilled when HEIs focus on the development of students' entrepreneurial competencies and encourage them to create new ventures after graduation. The negative feedback from students regarding themselves having been equipped sufficiently by their universities to pursue entrepreneurship may point to the disjuncture in the efficacy of EE improving students' entrepreneurial behaviour and skills (Carpenter & Wilson, 2022).

Furthermore, a small percentage (27%) of students felt that they were equipped sufficiently by their HEIs to become entrepreneurs. This finding supports literature on the positive influence of entrepreneurial education in encouraging business skills development and honing entrepreneurial intentions (Othman et al., 2022). Research also confirms that entrepreneurial education enhances entrepreneurial competence (Jiang et al., 2017; Byun et al., 2018) and improves entrepreneurial intention (Piperopoulos & Dimov, 2015; Walter & Block, 2016).

Previous literature (Yemini & Haddad, 2010; Barba-Sánchez & Atienza-Sahuquillo, 2018) stress the importance of HEIs integrating entrepreneurial education in tertiary learning to improve the development of entrepreneurial behaviour of students.

7.2.6 The manner in which the university supports their students

Respondents were asked to identify ways through which their university developed student ideas and the results are illustrated in Figure 7.2. Most respondents

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highlighted that conducting lectures (n=223) was the most common way of developing student ideas while conducting simulations (n=40) was the least preferred option.

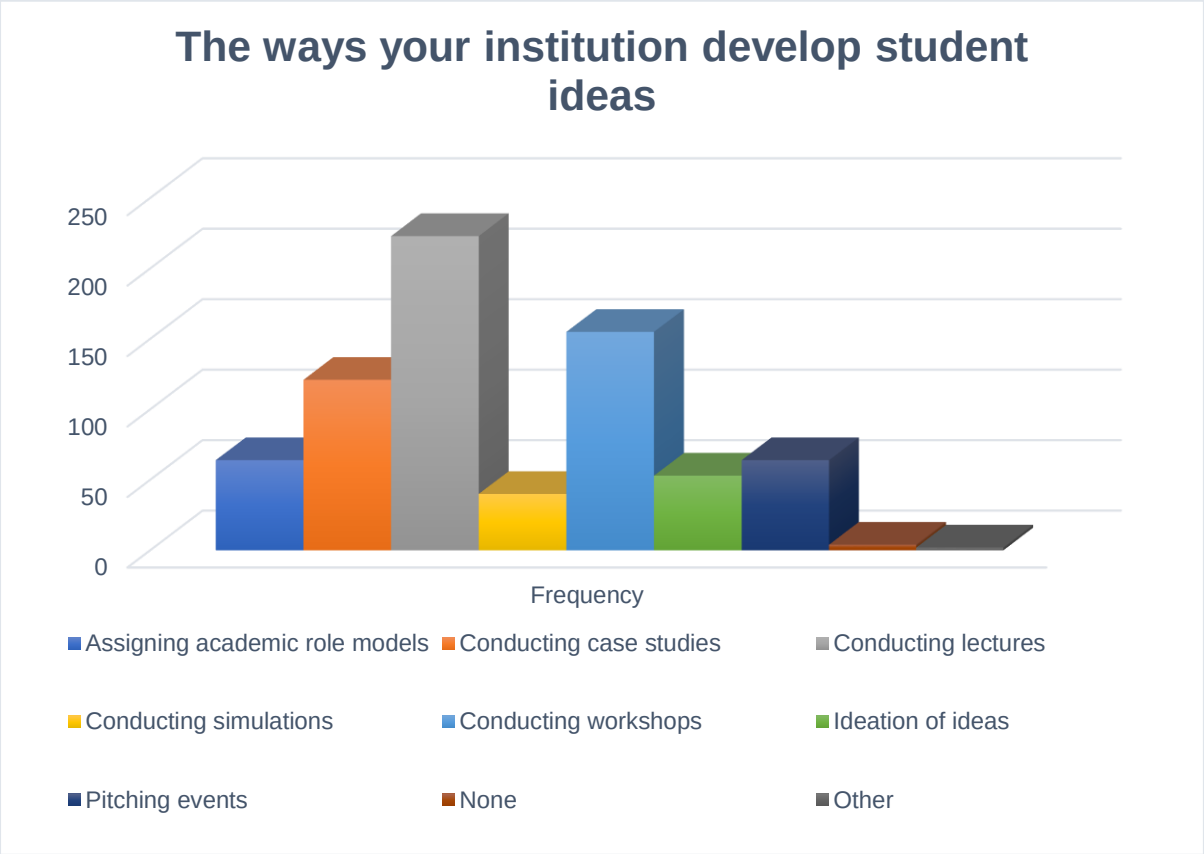

Figure 7. 2: The ways your institution develop student ideas

Lectures are still the most used pedagogical mode at HEIs. This finding was surprising given the limited capacity of lectures in delivering intended entrepreneurial outcomes. For instance, research on students who attended lectures indicated that interaction between the lecturer and students was rather limited even though support from peer networks was one of the primary benefits emanating from their attendance. Despite these limitations, students could potentially benefit from the structure and routine offered by lecturers as far as infusing networking and collaboration skills is concerned – critical skills needed in nascent entrepreneurship. The popularity of lectures could be attributed to the fact that such a modality accommodates for large classes compared to other pedagogical modes (Loughlin & Lindberg-Sand, 2023) and therefore is an inexpensive strategy of instilling entrepreneurial behaviours.

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Conducting a simulation and workshop is adaptable depending on the number of participants. The conductor should divide students into smaller groups and encourage each participant to share their insights with the entire group. The setting for such a workshop works well for simulations when policies are agreed upon (Zimmermann et al., 2021).

7.2.7 Conditions universities create to support student entrepreneurs

Students were requested to identify the methods their university availed to support them in becoming entrepreneurs. Normally, universities create conditions to support students to become entrepreneurs, such as idea pitching events, venture capital workshops, business acceleration support, business incubations support and business networking events.

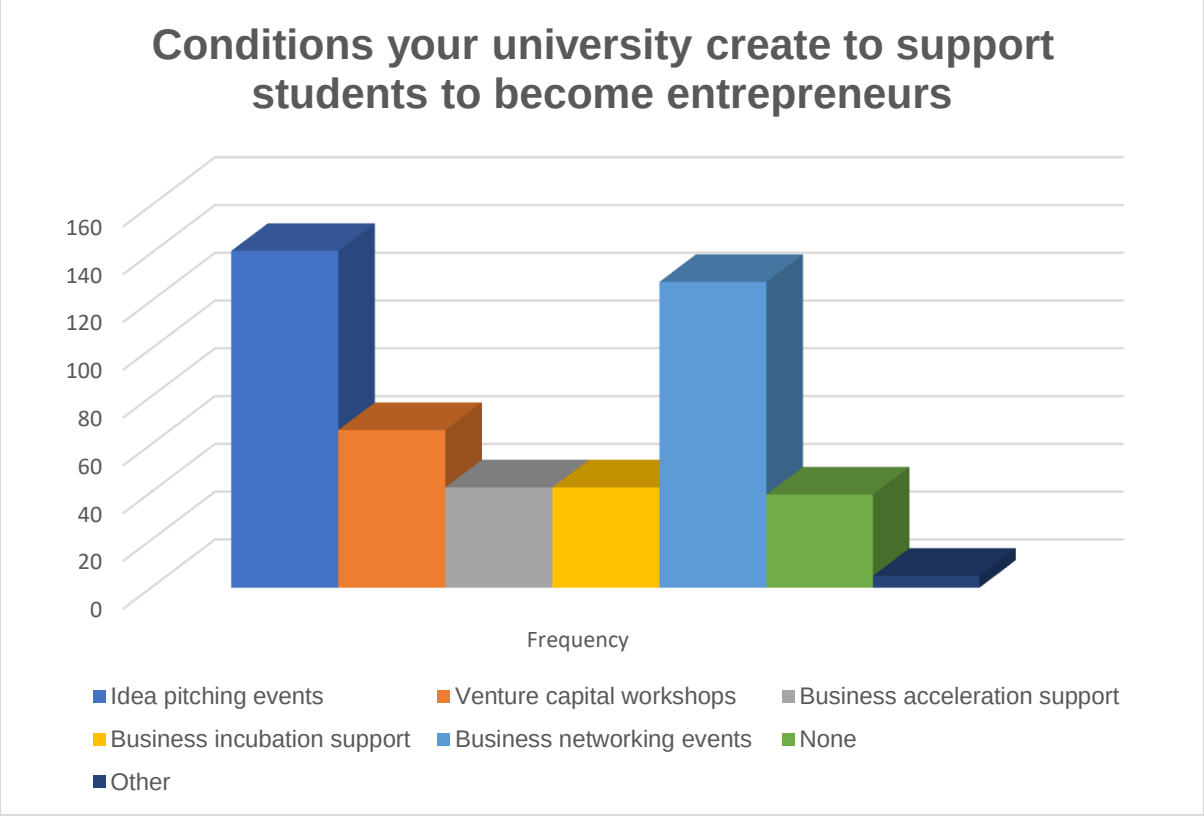

Figure 7. 3: Conditions the university create to support students to become entrepreneurs

The respondents considered idea pitching events (n=141) as the most common condition that their university availed to support their journeys of becoming

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entrepreneurs. Idea pitching events not only form a key part of the entrepreneurial curriculum where students are provided with experimental learning experiences, but also motivate universities to explore the larger ecosystem through new venture creation (Shirokova et al., 2017; Watson et al., 2018; Xu et al., 2023) by forming business networks. Idea pitching events are therefore popular as students learn how to handle crises emerging in actual business settings. These events further allow students to develop presentation skills while receiving immediate feedback in a safe environment (Smith et al., 2022). Business acceleration support (42) and business incubation support (n=42) were the least picked options, and some respondents selected none (n=39). This suggests that for some programmes, universities have some room for improving the conditions they create to support potential entrepreneurs.

7.2.8 Entrepreneurial activities used by universities to encourage students

The study also investigated other entrepreneurial activities that universities used to support entrepreneurship such as community empowerment projects, Entrepreneurship Development in Higher Education (EDHE) events, Enactus, entrepreneurship competitions and ideation workshops. Enactus is a network of students, business and academic leaders striving to enable progress and transformation through entrepreneurial action (Enactus South Africa, 2022).

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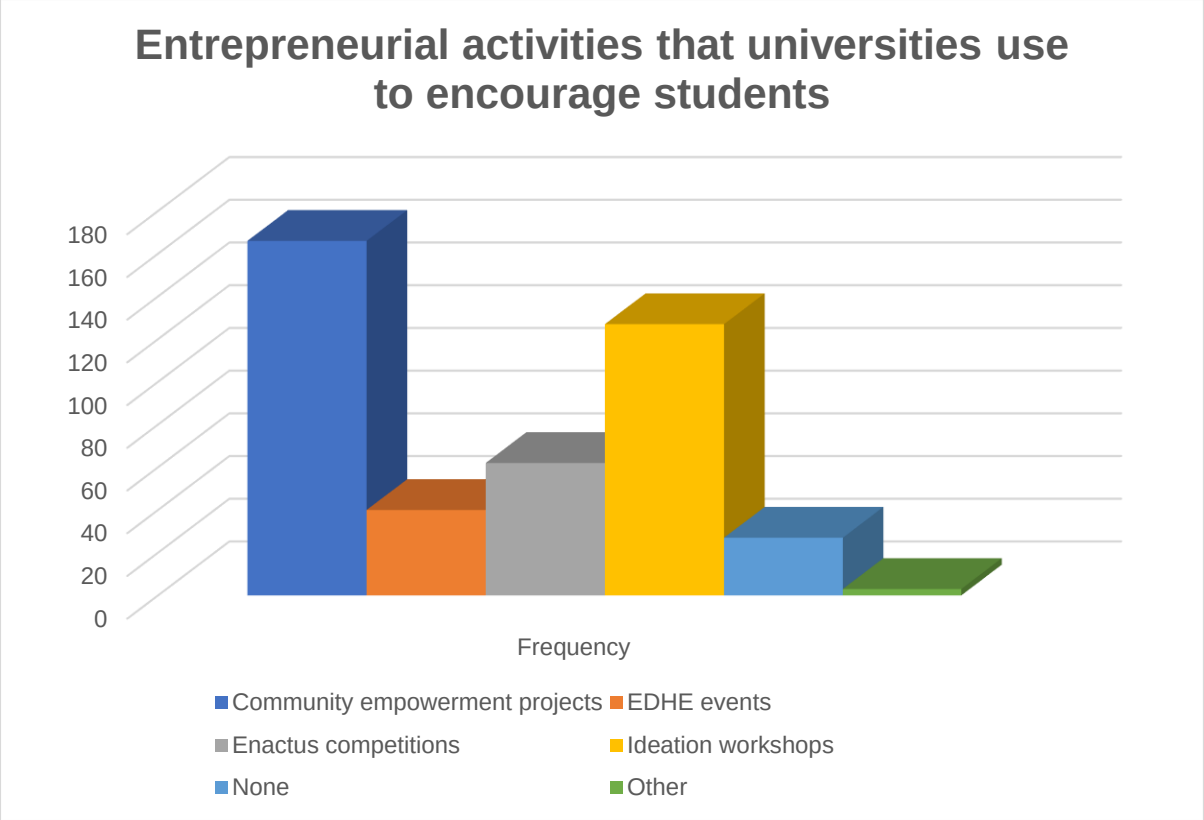

Figure 7. 4: Entrepreneurial activities that universities use to encourage students

Community empowered projects (n=166) was the most common entrepreneurial activity that universities used to encourage students to become entrepreneurs. Community empowerment projects have the potential to empower entrepreneurs by giving them the entrepreneurship skills for addressing poverty and underdevelopment in South Africa (Baloyi, 2022) and hence their popularity among students. At CUT, ideation workshops are initiatives popularised by i-GYM, which offers training programmes in entrepreneurship development, technical innovation entrepreneurship and social enterprise. These workshops provide guidance in design-thinking process to determine market needs and to assist with the development of innovative ideas through challenge-based gameplay (Oosthuizen, 2022). At UFS, the newly developed Agribusiness Park stimulates entrepreneurial activities of students and provides opportunities for hands-on training (Topco Media, 2021).

Some students indicated that there were no entrepreneurial activities (n=27) at their university to encourage students to become entrepreneurs and the least considered entrepreneurial activity was Entrepreneurship Development in Higher Education

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(EDHE) events (n=40). Even though EDHE programmes are supposed to foster innovation, encourage entrepreneurship and support the development of new ventures (Enactus South Africa, 2022), they were not popular at these two universities because most of the academic staff teaching entrepreneurship at these institutions were not actively participating in EDHE communities of practice- continual workshops availed by the Department of Higher Education and Training, Higher Education South Africa and Universities to foster a culture of entrepreneurship among university educators and researchers.

7.3 RELIABILITY AND VALIDITY

Reliability and validity analyses were conducted to test the appropriateness of the various scales used to measure the constructs explored in this study. The outcome of these tests is presented in 7.3.1.

7.3.1 Construct reliability and convergent validity

Construct reliability is a measure of the consistency and stability of a construct or concept over time, across different measurement instruments, and among different populations. It reflects the degree to which the scores obtained from multiple items or indicators that are supposed to measure the same construct are consistent with one another and can be used to make meaningful inferences about the construct of interest. A reliability index is an essential prerequisite for valid measurement as it ensures that the observed scores are a true reflection of the underlying construct, rather than random or inconsistent variation in the measurement process (Fornell & Larcker, 1981).

Construct reliability is typically assessed using statistical techniques such as internal consistency reliability, test-retest reliability, and inter-rater reliability. Internal consistency evaluates the consistency and validity of research results across constructs within a test. Internal consistency reliability test determines how different constructs relate to all other constructs (Hajjar, 2018) and deliver reliable scores. In the current study, the internal consistency approach was used to measure the reliability of the questionnaire items used to measure the following items: soft skills, technical skills, entrepreneurial skills, opportunity identification, opportunity validation,

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opportunity exploitation, resource mobilisation, venture creation, innovative financing, and venture growth.

Cronbach's Alpha is used to measure the reliability, known as internal consistency. Internal consistency reliability refers to the extent to which the items in a scale or questionnaire measure the same construct and is assessed using the Cronbach's alpha coefficient. Reliability means it measures one item and that one item is the sum of what each item evaluates. Cronbach's Alpha tests multiple statements' reliability using the Likert scale (Quinlan et al., 2015). The more consistent mean scores differ from the total score on the Cronbach's Alpha test, the higher the value. When computing Cronbach's Alpha, the score for each value is correlated with the total score of the number of selected items (Salkind, 2008). A high level for the Cronbach's Alpha establishes that the tested items highly correlate. Total scores between 0.8 and 0.9 are regarded to have great internal consistency, while total scores between 0.6 and 0.7 are considered questionable (Tavakol & Dennick, 2011). A high coefficient (at least 0.7) is an essential prerequisite for reliable measurement of a construct.

Convergent validity refers to the extent to which scores on a particular measure are positively related to other measures of the same construct or similar constructs (Krabbe, 2016). In other words, convergent validity assesses whether a measure is measuring the same attribute as other measures that are theoretically supposed to measure the same construct. Convergent validity can be measured using statistical techniques such as factor analysis and average variance extracted (AVE).

Factor analysis involves examining the extent to which the items on the measure of interest load onto the same factor as other items that measure the same construct. If the items on the measure of interest load onto the same factor as the items of other measures of the same construct, then it can be concluded that the measure has good convergent validity. Factor loadings of 0.5 or higher is generally considered to indicate adequate convergent validity.

AVE measures the amount of variance captured by the indicators of a latent construct in relation to the measurement error, which represents the variance that is unrelated to the construct. In other words, AVE assesses the extent to which the items in a scale

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or questionnaire are measuring the same construct, and not just measuring random or unrelated factors. An AVE value of 0.5 or higher is generally considered to indicate adequate convergent validity. Table 7.14 summarises the results of the construct reliability and convergent validity tests before and after adjustments.

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Table 7. 14: Cronbach's alpha, factor loadings and av[illegible]ed

Indicator	Variable/Construct	Factor loadings	Cronbach's alpha(α) (before)	Average variance extracted (AVE) (before)	Cronbach's alpha(α) (after)	Average variance extracted (AVE) (after)
SS1	Soft skills	0,7872	0,9491	0,6220	0,9491	0,6220
SS2		0,8089				
SS3		0,8176				
SS4		0,7489				
SS5		0,8217				
SS6		0,7634				
SS7		0,8127				
SS8		0,8018				
SS9		0,8456				
SS10		0,8402				
SS11		0,8088				
SS12		0,6708				
SS13		0,7046				
TS1	Technical skills	0,4982	0,8546	0,4220	0,7314	0,5786
TS2		0,4130				
TS3		0,6717				

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TS4		0,6235				
TS5		0,9227				
ES1	Entrepreneurial skills	0,8034	0,9650	0,7053	0,9650	0,7053
ES2		0,8569				
ES3		0,8612				
ES4		0,8735				
ES5		0,8566				
ES6		0,8520				
ES7		0,8147				
ES8		0,7811				
ES9		0,8590				
ES10		0,8859				
ES11		0,7731				
ES12		0,8725				
ES13		0,8180				
OI1	Opportunity identification	0,7381	0,7362	0,5601	0,7362	0,5601
OI2		0,7930				
OI3		0,7803				
OI4		0,6767				

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OV1	Opportunity validation	0,7382		0,6251	0,9396	0,6251
OV2		0,7308				
OV3		0,8087				
OV4		0,7443				
OV5		0,7334				
OV6		0,8083				
OV7		0,8088				
OV8		0,8437				
OV9		0,8562				
OV10		0,8243				
OV11		0,7868				
OE1	Opportunity exploitation	0,8142	0,8966	0,7090	0,8966	0,7090
OE2		0,7874				
OE3		0,8893				
OE4		0,9007				
OE5		0,8122				
RM1	Resource mobilisation	0,8099	0,8345	0,6687	0,8345	0,6687
RM2		0,8278				
RM3		0,8475				
RM4		0,7844				

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VC1	Venture creation	0,7959		0,6350	0,8116	0,6350
VC2		0,8056				
VC3		0,8038				
VC4		0,7819				
IF1	Innovative financing	0,7864	0,8043	0,6411	0,8132	0,6411
IF2		0,8356				
IF3		0,8014				
IF4		0,7783				
VG1	Venture growth	0,7819	0,8043	0,6247	0,8132	0,6247
VG2		0,8245				
VG3		0,7451				
VG4		0,8145				

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Table 7.14 presents the factor loadings, Cronbach's alpha (α), and AVE scores both before and after removing certain indicator/measurement items that had low factor loadings (marked in red). Items with factor loadings less than 0.5 on a particular construct/latent variable were removed where identified. These items were deleted because they were less related to the variable they were supposed to measure. After removing these items, composite scores were then calculated by adding the remaining indicators to represent the constructs/variables. If reliability measures are lower than 0.7, it suggests that multiple concepts are measured, whereas measures above 0.95 imply that the exact same concept is inquired about, just in other words. The desired value is met when reliability of a concept measures between 0.7 to 0.95 (Taber, 2018).

7.3.2 Selected 4IR skills

7.3.2.1 The importance of soft skills for future entrepreneurs

Soft skills are aptitudes or attributes that allow humans to be more effective in job performance such as founding a new venture or engagement in a specific entrepreneurial behaviour. This section presents soft skills and the extent to which students regarded them as important for their engagement in entrepreneurship. The 13 measurements of soft skills were first tested for construct reliability and validity. The soft skill scale comprised 13 skills namely, leadership, critical thinking, communication, creative thinking, teamwork, collaboration, social emotional learning, initiative, adaptability, self-confidence, empathy, cultural awareness and growth mind-set. All 13 items had factor loadings greater than 0.5, the Cronbach alpha value was equal to 0,9491, and the AVE was equal to 0,6220. No items for this variable were deleted. The 13 measurement items for soft skills were therefore highly reliable and valid, with good internal consistency.

Adaptability (SS9) was the soft skill with the highest factor loading score (0.8456), thus indicating that the capacity to adjust to new situations is regarded as seminal for successful engagement in entrepreneurship. This importance can be attributed to the fact that in complex and uncertain events, adaptability of an entrepreneur would be required to adjust their ability, actions and behaviour to deal with such events (Zong et al., 2021). In emerging countries contexts characterised by policy uncertainty, price volatility, continued exposure to risks (e.g., crime, lack of security of property),

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adaptability would be critical to the success of venture as entrepreneurs need to navigate these uncertain terrains.

Growth mind-set (SS10) had the second highest factor loading score (0,8402) of all the soft skills. A growth mind-set is a conviction that an individual's skills, abilities, personality and intelligence can be developed and altered (Murphy & Dweck, 2015; Sahagun et al., 2021). Entrepreneurial students value a growth mind-set to train and develop themselves to be successful in business, especially when pursuing new ideas (Chan, 2012; O'Rourke, 2014; Hanandeh et al., 2021).

Although all soft skills were regarded as highly reliable and having good internal consistency, cultural awareness (SS12) was the only soft skill that had a lower factor loading score of 0.7 (0.6708). One would assume that in countries such as South Africa with a complicated history of segregation of different cultural and racial groups due to apartheid legacy, in which different racial groups had very limited interactions with other cultural groups, cultural sensitivity and awareness of other racial groups would be limited (Hino et al., 2018). Since cultural awareness would be low, it is not surprising that this variable has the lowest factor loading. This view contradicts the popular view that South Africa has a diverse group of entrepreneurs from different cultural backgrounds and therefore, cultural awareness should play an important role in their interactions (Schwebs, 2019).

7.3.2.2 The importance of technical skills for future entrepreneurs

Technical skills enable individuals to handle equipment and tools relevant to any business-related operations or functional area (Maduko & Vidal Puche, 2020). This section focuses on the different technical skills. For 'technical skills', items such as scientific tasks (TS3), mechanical functions (TS4), and job-specific skills (TS5) had factor loadings greater than 0.5. These skills resonate with entrepreneurial tasks such as seeking and identifying market opportunities, while providing tools to develop business plans and ideas (Armuña et al., 2020). The Cronbach alpha value was equal to 0,7314 and the AVE equal to 0,57860, indicating satisfactory reliability and validity, as well as good internal consistency.

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Coding (TS1) (0.4982) and computer programming (TS2) (0.4130) were considered as technical skills with the lowest factor loading scores. The lower factor loadings could be explained by the fact that most students came from Management Sciences and Economic and Management Sciences at CUT and UFS respectively, faculties that made limited use of these technology-focused skills (Faber, 2021). If the same study comprised students from engineering and IT, one would have expected an extensive use of these skills as these departments focus more on skills relevant to digital technology orientated businesses (Nambisan et al., 2017). Job-specific skills (TS5) (0.9227) is regarded as the most important technical skill, as some job specific skills are needed to excel in entrepreneurship activities (Haenfler, 2018). In the entrepreneurial domain, such job specific tasks can the take the form of developing a value proposition for the business, developing some prototypes and concepts, sourcing the market for the product/service and establishing the organisational structure for their firm.

7.3.2.3 The importance of entrepreneurial skills for future entrepreneurs

Entrepreneurial skills are competencies acquired by an entrepreneur to function effectively in identifying and exploiting opportunities necessary to find a venture (Jardim, 2019). Respondents rated the importance of these entrepreneurial skills' statements regarding entrepreneurship from a scale of 1 (not important) to 5 (extremely important). For 'entrepreneurial skills', all 13 items had factor loadings that were greater than 0.5, the Cronbach alpha value was equal to 0,9650, and the AVE was equal to 0,7053. No items were deleted for this variable and no items were deleted from the scale. Thus, the 13 measurement items for entrepreneurial skills were highly reliable and valid and demonstrated good internal consistency.

Ingenuity (ES10) had the highest factor loading score (0.8859), which indicates the importance of being creative, inventive and applying smart approaches to doing things for the successful realisation of entrepreneurial pursuits. Siqueira and Honig (2019) distinguish ingenuity as an important skill that encourages an entrepreneur to improve the environment of any venture. Therefore, the development of ventures improves by incorporating these creative and intelligent methods into entrepreneurial pursuits.
Interestingly, industriousness (ES9) obtained a high factor loading score (0,8590), in contrast with the findings of Kibler et al. (2022), which explained that although

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industriousness is critical to improving the standard of living and well-being of people, it is not necessarily a critical and high priority for successful engagement in entrepreneurial activities. Industriousness is closely linked to determination and perseverance (Murayama & Nakamura, 2021), which can enable entrepreneurs to develop their ventures (Anwar et al., 2020).

Optimism (E11) obtained the lowest factor loading score (0.7731) of all entrepreneurial skills. Previous research found that entrepreneurs are generally optimistic and tend to expect favourable outcomes (Hmieleski et al., 2006; Rigtering et al., 2017; Amore et al., 2021). Adomako et al. (2016) further state that optimism impacts entrepreneurial readiness behaviour. Notwithstanding the fact that optimism stimulates behaviour, Adomako et al. (2021) warns that optimistic entrepreneurs tend to pursue risky opportunities. The danger lies in optimism leading to overconfidence on the probability of being successful entrepreneurs (Akinbinu & Chiloane-Phetla, 2021).

7.3.3 Entrepreneurial process

7.3.3.1 Opportunity identification

Opportunity identification entails the ability to identify economic and social opportunities that lead to more innovative ideas being generated (Ratten, 2020), which makes entrepreneurship tenable. The different statements on opportunity identification were tested to establish how entrepreneurs identify business opportunities. Recent research (Yu et al., 2020) highlights entrepreneurial opportunity identification as central in the entrepreneurial process allowing entrepreneurs to benefit from opportunities availed in the market. Shepherd and Patzelt (2021) affirm the importance of an entrepreneur's ability to identify potential opportunities from transformed environments in realising entrepreneurial outcomes. For 'opportunity identification', all the four items had factor loadings that were greater than 0.5, the Cronbach alpha value was equal to 0,7362, and the AVE equal to 0,5601 (see Table 7.14). No items were deleted for this variable of from this scale. Thus, the four measurement items for opportunity identification were highly reliable and valid, with good internal consistency.

All statements regarding opportunity identification had high factor loading scores. The statement (OI2), *'Opportunity identification requires the ability to effectively use*

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changing information from transformed external environments' had the highest factor loading score (0.7930). For example, Li et al. (2021) supports this notion by suggesting that in this complex knowledge economy, ventures need to be more vigilant as digital technologies are changing information available for entrepreneurs, which complicates their capacity to benefit from identified opportunities, notwithstanding the economic value presented to them by transformed external environments. The respondents recognised the importance of interaction with the environment to notice, interpret and respond to environmental changes that signal new, potential opportunities.

On the other hand, the statement (OI4) '*Opportunity identification involves conducting systematic research to cultivate an idea to a high potential opportunity that transforms into marketable items'* had the lowest factor loading score (0.6767). Research from Dias et al. (2021) explains that although identifying opportunities leads to new ideas that transforms into the testing of new services and products, it may not necessarily generate marketable items. Hampel et al. (2020) therefore suggest that an acceptable marketable item is achieved when a defensible and appropriate idea is matched with the needs experienced by a group of potential customers.

7.3.3.2 Opportunity validation

Opportunity validation may involve comparing and testing innovative ideas in the market to determine their market value (Musteen et al., 2018). For 'opportunity validation', all the 11 items had factor loadings that were greater than 0.5, the Cronbach alpha value was equal to 0,9396, and the AVE equal to 0,62510. No items were deleted for this variable or from this scale. Thus, the 11 measurement items for opportunity validation were highly reliable and valid, with good internal consistency.

The statement (OV9) *'Opportunity validation involves determining the gross margins of the venture'* had the highest factor loading score (0,8562). Rwigema and Venter (2004) confirm that the validation of opportunities involves among other things, the importance of determining the gross margins of any venture. From a venture performance perspective, a gross margin statement can be regarded as a key financial statement that showcases venture effectiveness and profitability, that is evident in the ability of a venture to apply available resources which generate profit (Veldsman, 2017). However, the statement (OV2) *'Opportunity validation involves ascertaining the*

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required customers of a product/service' had the lowest factor loading score (0.7308). There is no surprise that this statement had the lowest score as there are many market and technological uncertainties in product development where opportunity validation remains complex to ensure that the products meet the requirements of customers (Albers et al., 2017).

7.3.3.3 Opportunity exploitation

Opportunity exploitation comprises the actual actions that are implemented by a business founder to take advantage and make effective use of an identified opportunity (Parente & Feola, 2013). The relevant indicators that describe opportunity exploitation in this research were statements such as developing a good business plan, managing a venture successfully, determining the required resources for successful launch of a venture, obtaining the appropriate resources (Hisrich, 2005; Nieman, 2006) and dealing with competition (Kunene, 2009). For 'opportunity exploitation', all the five items had factor loadings that were greater than 0.5, the Cronbach alpha value was equal to 0,8966, and the AVE equal to 0,7090. No items were deleted for this variable or from this scale. Thus, the five measurement items for opportunity exploitation were highly reliable and valid, with good internal consistency.

The opportunity exploitation statement (OE4), '*Opportunity exploitation involves obtaining the appropriate resources'* had the highest factor loading score (0.9007). Katsikeas et al. (2020) underlines the importance by determining the required capabilities and obtaining the appropriate resources as vital to the exploitation of opportunities. The opportunity exploitation statement (OE2), *'Opportunity exploitation involves the management of a venture successfully'* had the lowest factor loading score (0.7874). Although the successful management of a venture is important, literature suggests that such management is largely dependent on the availability of appropriate resources to allow the founder to take full advantage of a venture (Bianchi & Mathews, 2016). Such resource dependence could explain why this statement was rated comparatively lower than other statements that described opportunity exploitation. Nonetheless, all opportunity exploitation statements had high factor loading scores and the results from Table 7.8 are statistically significant.

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7.3.3.4 Resource mobilisation

Resource mobilisation is the process of accumulating and integrating diverse resources to execute an identified economic opportunity (Marquis & Tilcsik, 2013). For 'resource mobilisation', all the four items had factor loadings that were greater than 0.5, the Cronbach alpha value was equal to 0,8345, and the AVE equal to 0,6687. No items were deleted for this variable or from this scale. Thus, the four measurement items for resource mobilisation were highly reliable and valid, with good internal consistency.

All resource mobilisation statements had high factor loading scores. '*Resource mobilisation involves determining how an entrepreneur will secure resources*' (RM3) had the highest factor loading score (0.8475). These findings corroborate those of Atandi (2021) who underscores that resource mobilisation requires all activities and resources to be secured for a venture to be successfully developed. This is necessary for a venture to effectively manage resources for their intended purpose. *'Resource mobilisation involves impacting employees with training intellectual abilities'* (RM4) had a factor loading score (0.7844) lower than 0.8. This is consistent with other studies, such as Granziera et al. (2021), who indicated that resource mobilisation necessitates that employees are adequately capacitated through improving their abilities. Since this factor loading was deemed favourable but not high enough, such a finding is in consonance with Atandi (2021) who recommends entrepreneurs to attend training on resource mobilisation to be fully capacitated to develop their new ventures.

7.3.4 Entrepreneurial readiness behaviour

This study defines entrepreneurial readiness behaviour as the understanding and control of human behaviour that determines the success of ventures. Although such behaviour manifests in multiple ways, such as employment creation (Mitchell et al., 2002; Ayalew & Zeleke, 2018), regional development (Megginson, 2004), creation of incubation structures (Elbahjaoui & Elabjani, 2021), for convenient and logical conceptualisation this study characterises such behaviour to manifest in the actual creation of a venture, the innovative financing of the venture and the growth of a new

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venture. Each of these entrepreneurial readiness behaviours are discussed in the sections below.

7.3.4.1 Venture creation

New venture creation is one of the dimensions of entrepreneurial readiness behaviour. Venture creation is defined as denoting the journey of an entrepreneur's non-existing venture to the existence of a new venture (Wood, 2017; Wood & McKinley, 2020). For 'venture creation' all the four items had factor loadings that were greater than 0.5, the Cronbach alpha value was equal to 0.8116, and the AVE equal to 0.6350. No items were deleted for this variable. Thus, the four measurement items for venture creation were highly reliable and valid, with good internal consistency. No items were deleted from the scale.

The venture creation statements had slight variations in factor loadings. The highly ranked statement (VC2) was 'Venture creation involves filing for corporate tax' with the highest factor loading score (0.8056). This finding demonstrates that filing for corporate tax is an unavailable requirement in the formalisation of a business in emerging country contexts. This finding is somewhat inconsistent with Block's (2021) claim that higher corporate tax rates reduce entrepreneurial entry in new ventures. One could argue that even though filing for corporate tax is an inevitable component of business formalisation, the cost of paying corporate tax is a deterrent for most businesses regarding the formalisation of their activities.

Although the statement (VC4) 'Venture creation involves marketing the operations of a business' has the lowest factor loading score (0.7819), such a finding was largely inconsistent with the requirements of successful business operations. For instance, Fürst et al. (2023) consider marketing activities as vital for new ventures even though their study concludes that despite the considerable theoretical knowledge on the importance of marketing in new ventures in entrepreneurship studies, research lacks clarity on when and how marketing activities should be conducted. This may therefore explain why marketing the operations of business remains comparatively underdeveloped compared to other aspects of venture creation.

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7.3.4.2 Innovative financing

Innovative financing, which is a dimension of entrepreneurial readiness behaviour, indicates the financial discipline and resourcefulness of an entrepreneur that leads to better venture growth. Innovative financing refers to initiatives concerning the application of traditional funding resources or the raising of new funding for venture development to address the funding gap (Bonini & Capizzi, 2019). For 'innovative financing', all the four items had factor loadings that were greater than 0.5, the Cronbach alpha value was equal to 0,8132, and the AVE equal to 0,6411. No items were deleted for this variable or from the scale. Thus, the four measurement items for innovative financing were highly reliable and valid, with good internal consistency.

All innovative financing statements had great factor loading scores. 'Innovative financing involves the different ways through which firms attempt to influence productivity growth' (IF2) had the highest factor loading score (0.8356), while 'Innovative financing contributes to the increases in turnover' (IF4) had the lowest factor loading score (0.7783). Since productivity growth and turnover are different expressions of growth, these findings seem to gel with mainstream entrepreneurship literature. For example, Hendrickson et al. (2015) suggest that innovative financing is an extremely important enabler of new venture creation for entrepreneurs, which drives economic growth. Literature also affirms that continual access to innovative financial sources is essential for the creation, growth and survival of new ventures (Alinejad et al., 2015). There is also evidence to suggest that in venture financing, the gap between actual available resources and the resources required to achieve goals is narrowed using innovative financing (OECD, 2015). However, rather than discuss innovative financing as a component of entrepreneurial readiness behaviours, some existing literature articulates it as an antecedent of venture creation. For instance, the Treasury (2012) suggests that the venture capital sector plays an important role in encouraging skills development and driving innovation which makes venture creation possible.

7.3.4.3 Venture growth

Venture growth, the last dimension of entrepreneurial readiness behaviour, is vital for entrepreneurship success, as it signifies the outcome of strategic entrepreneurial behaviour. Gupta et al. (2013) suggest that ventures go through different cycles of

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growth. The stages of growth encompass the start stage, then growth stage which may involve firms going through some crises, maturity stage and finally decline or stability. For this study, venture growth was conceived as involving value addition, revenue generation or expansion of the volume of a venture. For 'venture growth', all the four items had factor loadings that were greater than 0.5, the Cronbach alpha value was equal to 0,8132, and the AVE equal to 0,6411. No items were deleted for this variable and no items were deleted from the scale. Thus, the four measurement items for venture growth were highly reliable and valid, with good internal consistency.

The statement (VG2) 'Venture growth involves firms' exploiting new products and markets to sustain strategic change' had the highest factor loading score (0.8245). Consistent with this statement, Hitt et al. (2017) highlight that the development of new markets or product extensions are the new strategies through which a venture augments its body of knowledge. Similarly, literature (Honig & Hopp, 2019) postulates that strategic activities of the firm may include planning and experimentation with new products and markets to achieve firm growth. It is not surprising that experimentation with new products, processes and markets based on market feedback is integral to venture growth as this construct allows for the firm to adapt to environmental conditions (Ott et al., 2017). This explains the highest factor loading score of VG2.

The following statement (VG3) 'Venture growth involves using the venture's internal systems to promote structural change' had the lowest factor loading score (0.7451). Neffke et al. (2018) contend that entrepreneurs often find it hard to grow their venture using internal systems to facilitate structural change while at the same time running the activities of their start-up. This is largely because at the start-up phase of a firm, internal systems and processes either rarely exist or they are rudimentary, and hence the complexity of using them as a lever to drive change.

7.4 DISCRIMINANT VALIDITY

In addition to construct reliability and convergent validity, discriminant validity tests were also conducted. Discriminant validity refers to the extent to which scores on a particular measure are not correlated with scores on measures of different, unrelated constructs (Hajjar, 2018). In other words, discriminant validity assesses whether a

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measure is measuring what it is supposed to measure, and not measuring something else. For instance, measure of soft skills should be different from those of technical skills. Discriminant validity helps to ensure that a measurement instrument is not confounded by other constructs or factors that could influence the scores on the measure.

The Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio were used to measure discriminant validity in this study. The Fornell-Larcker criterion compares the square root of the average variance extracted (AVE) of each construct to the correlations between the constructs. According to the Fornell-Larcker criterion, a construct has good discriminant validity if its AVE is higher than its correlation with other constructs in the model. This indicates that the construct shares more variance with its own indicators than with the indicators of other constructs in the model.

However, the Fornell-Larcker criterion has been criticised for being too conservative in detecting the lack of discriminant validity, particularly in complex models with many constructs (Franke & Sarstedt, 2019). Therefore, the Heterotrait-Monotrait (HTMT) ratio was proposed as an alternative measure of discriminant validity that addresses the limitations of the Fornell-Larcker criterion. The HTMT ratio compares the correlations between the constructs to the correlations between the constructs and their indicators. The HTMT ratio for a pair of constructs is the correlation between the constructs divided by the square root of the product of the average variance extracted of each construct. If the HTMT ratio is less than 0.9, discriminant validity between two reflective constructs is confirmed (Henseler et al., 2015). The results of the two tests for discriminant validity are presented in Tables 7.15 and 7.16. Based on the information in the two tables, all the constructs tested had satisfactory levels of discriminant validity.

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Table 7. 15: Fornell-Larcker criterion results

Construct	Opportunity validation	Soft skills	Technical skills	Entrepreneurial skills	Opportunity identification	Opportunity exploitation	Innovative financing	Venture creation	Venture growth	Resource mobilisati
Opportunity validation	0,6251									
Soft skills	0,0487	0,6220								
Technical skills	0,0209	0,2755	0,5786							
Entrepreneurial skills	0,0787	0,6704	0,2432	0,7053						
Opportunity identification	0,2832	0,0838	0,0366	0,1358	0,5601					
Opportunity exploitation	0,2534	0,0227	0,0044	0,0277	0,1920	0,7090				
Innovative financing	0,2865	0,1140	0,0541	0,1232	0,2629	0,2897	0,6411			
Venture creation	0,1736	0,0192	0,0190	0,0276	0,1785	0,1461	0,1907	0,6350		
Venture growth	0,2394	0,0415	0,0366	0,0573	0,2040	0,3662	0,3165	0,2826	0,6274	
Resource mobilisation	0,4263	0,0574	0,0282	0,0883	0,3591	0,3315	0,3548	0,2499	0,3423	0,6687

Squared correlations, AVE in the diagonal.

Table 7.15 highlights that the AVE of all measurements was higher than its correlation with other constructs. Therefore, it is determined that each construct has good discriminant validity according to the Fornell-Larcker criterion. The HTMT was also determined to further confirm the presence of discriminant validity among the constructs. Table 7.16 summarises the results of the HTMT test.

Table 7. 16: HTMT results

Construct	Opportunity validation	Soft skills	Technical skills	Entrepreneurial skills	Opportunity identification	Opportunity exploitation	Innovative financing	Venture creation	Venture growth	Resource mobilisation
Opportunity validation										
Soft skills	0,2243									
Technical skills	0,1230	0,5495								
Entrepreneurial skills	0,2912	0,8506	0,4979							

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Opportunity identification	0,6451	0,3417	0,2302	0,4344						
Opportunity exploitation	0,5442	0,1525	0,0093	0,1773	0,5416					
Innovative financing	0,6064	0,3780	0,2415	0,3932	0,6622	0,6275				
Venture creation	0,4614	0,1572	0,2636	0,1835	0,5341	0,4195	0,5201			
Venture growth	0,5485	0,2182	0,2491	0,2598	0,5780	0,6890	0,6834	0,6694		
Resource mobilisation	0,7369	0,2602	0,1565	0,3269	0,7662	0,6651	0,7217	0,5955	0,6986	

Table 7.16 indicates that the HTMT ratio of each measurement was less than 0.9, thus demonstrating a good discriminant validity. The HTMT result with the highest score was soft skills paired with entrepreneurial skills (0.8506), which was closest to 0.9. The HTMT result with the lowest score was technical skills paired with opportunity exploitation (0.0093) and was by far the lowest HTMT ratio.

7.5 PRELIMINARY STATISTICS RELATED TO THE KEY CONSTRUCTS

Having ascertained the validity and reliability of the measurement instrument, the next step was to determine and discuss the descriptive statistics. The following descriptive statistics were generated for the main study constructs: mean, standard deviation, and the Shapiro-Wilk test. Firstly, the mean is a measure of central tendency that represents the average score on a particular construct. It provides an indication of the typical level of the construct in the sample. It can be used to compare the level of the construct between different groups or to track changes in the construct over time (Yue & Baleanu, 2019).

Secondly, the standard deviation is a measure of variability that represents the spread of scores around the mean. In short, it is a measure of dispersion of the scores from the mean. It provides an indication of how much variability there is in the scores on the construct. A large standard deviation indicates that the scores are widely spread out, while a small standard deviation indicates that the scores are tightly clustered around the mean (Mertler et al., 2021).

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Lastly, the Shapiro-Wilk test is a statistical test that assesses whether a set of data is normally distributed. The test compares the observed distribution of scores to the expected normal distribution. The Shapiro-Wilk test produces a test statistic (W) and a p-value. If the p-value is less than 0.05, then the data are significantly non-normal. The Shapiro-Wilk test is useful for determining whether parametric statistical tests can be used to analyse the data. If the data are not normally distributed, non-parametric tests may be more appropriate (Avram & Mărușteri, 2022). However, if the data is normally distributed, parametric tests are used.

The three preliminary statistics for the 10 constructs explored in the current study are presented in Table 7.17. For all the 10 constructs, the mean scores are greater than 3 (the midpoint), where all the measurement items had minimum values of 1 (strongly disagree) and maximum values of 5 (strongly agree). This suggests that the respondents generally agreed with the statements being measured. This indicates that the respondents, on average, had a positive attitude or perception towards the construct being measured.

Additionally, the standard deviations for the 10 variables presented in Table 7.17 are generally small indicating that the scores are tightly clustered around the mean (Darling, 2022). Nevertheless, there is no strict definition for what constitutes a small standard deviation, as it depends on the context of the data analysed. However, a general rule of thumb is that a standard deviation of 0.5 is moderate and 0.2 is considered small (Barde & Barde, 2012).

Lastly, the Shapiro-Wilk test p-values for all the variables were statistically significant (less than 0.05), suggesting that the data are not normally distributed, and non-parametric tests would be more appropriate. Orcan (2020) asserts that non-parametric tests are statistical tests that do not make assumptions about the underlying distribution of the population from which the sample was drawn. Unlike parametric tests, which require that the data meet certain assumptions (such as normality and homogeneity of variance), non-parametric tests can be used with any type of data, including ordinal or non-normal data. Although non-parametric tests are often considered less powerful than their parametric counterparts (Demir et al., 2016), they provide a robust and reliable method for analysing data that do not meet the

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assumptions of parametric tests and are referred to as distribution-free tests (Taylor, 2020).

The following Table presents the preliminary statistics of the selected 4IR skills, the dimensions of entrepreneurial readiness behaviour and the dimensions of the entrepreneurial process. The mean, standard deviation and Shapiro-Wilk test results are shown after data was extracted using a five-point Likert scale to measure these variables.

Table 7. 17: Preliminary statistics

	Soft skills	Technical skills	Entrepreneurial skills	Opportunity identification	Opportunity validation	Opportunity exploitation	Resource mobilisation	Venture creation	Innovative financing	Venture growth
N	300	300	300	300	300	300	300	300	300	300
Mean	4.09	3.47	4.06	4.22	4.11	4.00	4.12	3.80	4.09	4.03
Standard deviation	0.706	0.830	0.768	0.528	0.644	0.752	0.618	0.721	0.656	0.638
Shapiro-Wilk W	0.937	0.960	0.930	0.893	0.883	0.899	0.885	0.926	0.903	0.918
Shapiro-Wilk p	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001	< .001

7.5.1 Preliminary statistics of selected 4IR skills

Selected 4IR skills formed the major research focus of this thesis. In this section the respondents provided information that was needed to address the secondary objectives and to establish which skills are regarded as the most important. These secondary objectives are included to investigate the effect of soft skills, technical skills and entrepreneurial skills on entrepreneurial readiness behaviours. The respondents stated which skills are regarded as important and the statements were measured on a five-point Likert scale (1=Not Important, 5=Extremely Important). Each selected 4IR skills (soft skills, technical skills and entrepreneurial skills) was tested.

Soft skills (4.09) had the highest mean score of all selected 4IR skills, therefore suggesting that students considered it to be an extremely important skill for becoming an entrepreneur. This finding validates Fletcher and Thornton's (2023) study which established soft skills as more valuable than hard skills in a thriving work environment.

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This finding also resonates with Kačamakovic (2021), who reported that soft skills accounted for between 75% to 85% of the success of a business.

The study also examined the qualities that constituted these soft skills. Most respondents suggest that communication (4.337) is the most important soft skill for an entrepreneur as the ability to receive and express information cannot be underestimated. This finding coheres with Dean and East (2019) who consider the ability to use communication skills to interact in organisational contexts such as new ventures, as critical for the development of ventures. Empathy (SS13) was regarded as the soft skill with most disagreement (3.733) as some respondents did not feel that the need to share other persons' feelings even through it is critical to the business environment. This resonates with Dean and East's (2019) study, that although feelings form the basis of a person's behaviour, circumstances in an entrepreneurial context will determine whether the sharing of feelings is considered positive or negative. For instance, since the business is created to make profit, a business owner would not be empathetic to a customer who cannot afford their product and therefore, he may not be keen to negotiate the price with a customer. Contrastingly, the same entrepreneurs would show empathy to a loyal customer who bought a malfunctioning product and would be willing to recall the product and give the customer a new one.

Of all selected 4IR skills examined, technical skills (3.47) had the lowest mean score and therefore, compared to other skills, technical skills were not considered as the most important skill necessary for becoming an entrepreneur. This finding resonates with Kačamakovic (2021), whose study highlights that hard skills (also known as technical skills) only accounted for 15% to 25% of the success of a business. Coding (TS1) was regarded as the least important (3.077) technical skill by the respondents of this study. This was expected since most respondents came from the Management sciences (CUT) and Economics and Management Sciences (UFS), faculties that did not have coding as programme or activity. Literature asserts that only prospective and nascent entrepreneurs who operate in a digital environment often consider coding as an important skill (Avle et al., 2019). This could be contrasted with other entrepreneurs operating in non-technical environments who do not consider coding a necessary skill. Our findings on the limited importance attached to technical skills relative to other skills somewhat contrasts other findings from literature. For instance, Matsouka and Mihail

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(2016) postulate that technical skills, acquired for knowledge to perform a specific job, are important to successful engagement in entrepreneurship. Although job-specific skills (TS5) had the highest mean score (3.963) of technical skills, technical skills were considered by respondents as the least important of the selected 4IR skills.

Entrepreneurial skills (4.06) were nearly regarded as the most important skill of the selected 4IR skills with a great mean score. In a context where the execution of specific business tasks such as strategic planning, evaluation, teamwork, networking, resolution of problems and decision-making (Jardim, 2021), business plan development, feasibility planning and finance (Vrchota & Rehor, 2017) requires the acquisition and possession of specific business skills, entrepreneurial skills are deemed important to successfully engage in entrepreneurial activity (Bowen & Johnson, 2019). The findings cohere with Leon (2017) who regards entrepreneurial skills as very important for entrepreneurs as they predict a top performance by founders in entrepreneurial development.

Innovation (ES2) had the highest mean score (4.193), suggesting that the ability to transform a new idea into a practical reality is regarded as the most important entrepreneurial skill. The high value attached to innovation is in consonance with literature (Işık et al. 2015; Ertekin, 2021) which regards innovation as one of the most important skills for entrepreneurship with the potential to increase the competitive advantage, contribute to entrepreneurial success and reduce business risks (Şahbaz, 2017). There is also literature that acknowledges the intricate connection between entrepreneurship and innovation and their capacity to complement each other (Ertekin, 2021). The same findings on the significance of innovation (i.e. among a range of entrepreneurial skills) gels with Hatthakijphong and Ting (2019) who found that in contrast with existing entrepreneurs, aspiring entrepreneurs tended to overestimate the importance of innovation in their prospective entrepreneurship journeys. In contrast to this, curiosity (ES13) had the lowest mean score (3.887) of all entrepreneurial skills. Although entrepreneurial curiosity has been studied widely (Jeraj, 2014; Jeraj et al., 2015; Arikan et al., 2020), curiosity is rather considered as important for an entrepreneur's innovativeness (Peljko & Auer Antončič, 2022) and not for entrepreneurship per se.

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7.5.2 Preliminary statistics of the entrepreneurial process

The entrepreneurial process forms the next section of the questionnaire. The respondents' extent of agreement with the statements was measured by a five-point Likert scale (1=Strongly Disagree, 5=Strongly Agree). Each stage of the entrepreneurial process (opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation) was analysed separately.

Opportunity identification (4.22) had the highest mean score of all stages of the entrepreneurial process, therefore being the most agreed upon and important concept. According to Rahman et al. (2022), opportunity identification is recognised as one of the most important components of the entrepreneurial process. This is in line with the findings of this study, where respondents considered opportunity identification as an imperative stage in the entrepreneurial process. Given that entrepreneurship involves taking advantage of an identified economic, social or cultural opportunity, the entrepreneurial process would not be complete without recourse to opportunity identification. Therefore, this is an imperative stage in the entrepreneurial process. Following this argument, it is surprising that "scanning the environment for information that enhances the business" (OI1) was the opportunity identification statement which respondents most strongly agreed upon (mean 4.310). Ploum et al. (2018) and Rahimia et al. (2019) further assert that the ability to leverage entrepreneurial environmental factors through identification do influence entrepreneurs' performance.

As a stage in the entrepreneurial process, opportunity validation also had a high mean score (4.11). All statements of opportunity validation had similar mean scores indicating their comparable contribution to the construction of this concept. Opportunity validation involves comparing and testing the value of ideas in the market (Musteen et al., 2018). Entrepreneurs consider these processes as critical to the pursuit of entrepreneurial opportunities. It is therefore unsurprising that all statements which contribute to this construct, were highly affirmed. This finding is consistent with literature that considers ascertaining competitiveness of the market, establishing the costs of raw materials, products and services as entrepreneurial activities that founders consider as vital components of opportunity validation (Rwigema & Venter, 2004; Falcone et al., 2019).

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Compared with all stages of the entrepreneurial process, opportunity exploitation had the lowest mean score (4.00). The most agreeable statement (4.067) of opportunity exploitation was 'Opportunity exploitation involves the management of a venture successfully' (OE2). Such good mean scores could be attributed to the fact even though most students were not practising entrepreneurs, they would have learnt that the entrepreneurial process would be incomplete without opportunity exploitation and hence their affirmation of its significance. This aligns with Wang et al (2017) who conceives opportunity exploitation is as critical to overcoming liabilities of venture performance.

Resource mobilisation had the second highest mean score (4.12) of all entrepreneurial process stages. Most respondents agreed on these statements on resource mobilisation. 'Resource mobilisation involves determining how an entrepreneur secures resources' (RM3) had the lowest mean score (4.050). This suggests the lack of clarity on how resources are generated within and beyond organisational settings. This finding resonates with Shi and Shi's (2022) findings that the information on the process of securing resources is less known and needs further investigation.

7.5.3 Preliminary statistics of entrepreneurial readiness behaviour

The entrepreneurial readiness behaviour constituted the last section of the questionnaire. Venture creation, innovative financing and venture growth were identified as the different dimensions of entrepreneurial readiness behaviour and were measured individually. The students' agreement with the statements was measured on a five-point Likert scale (1=Strongly Disagree, 5=Strongly Agree).

Venture creation (3.80) had the lowest mean score of all dimensions of entrepreneurial readiness behaviour. Although student entrepreneurs possess business ideas, few can identify opportunities to turn these ideas into a viable new venture. A new venture depends on entrepreneurial readiness to participate in entrepreneurial activities (Olugbola, 2016). The low level of readiness is a result of the lack of required skills to engage in entrepreneurial activities (Barringer, 2015). The highest mean score (3.947) of the venture creation statements was 'Venture creation involves marketing the

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operations of a business' (VC4). The strong affirmation of the marketing of business operations gels with literature which suggests that venture creation requires that entrepreneurs demonstrate competence in business planning and marketing of their products and services (Din et al., 2016; Kolade, 2018) to increase the size of their market and performance of their businesses.

Innovative financing had the highest mean score (4.09) of all entrepreneurial readiness behaviour dimensions, which indicates that the financial aspect of entrepreneurship is critical to the success of entrepreneurs. 'Innovative financing involves human resources which increases the growth of new ventures' (IF3) had the lowest mean score (3.990) of the innovative financing statements. This finding is inconsistent with Business Essentials (2018), which contends that coordinating and assembling human resources that integrate different financial resources is integral to the profitability of organisations and effective entrepreneurship. One can infer that most students did not associate innovative financing of business with development of human resources for the realisation of business growth.

The results of venture growth suggest that growing a venture is more important than focusing on the details of creating a venture, had the second highest mean score (4.03) of all entrepreneurial readiness behaviour dimensions. 'Venture growth involves firms' exploiting new products and markets to sustain strategic change' (VG2) was regarded the most agreeable statement (4.143) of venture growth. Respondents therefore considers the effectiveness of strategic change through exploiting new products and business operations as very important. This corroborates the findings in Varadarajan (2017) and Moyano-Fuentes et al. (2018) who consider marketing new products, strategic change and operation management as critical to the growth of an entrepreneurial venture.

7.6 INTER-CONSTRUCT CORRELATIONS

Inter-construct correlations are important to indicate variables related to one another, in other words no cause-effect relationship can exist without correlations. When variables show a high correlation, common factors are usually shared. Inter-construct correlations are important in this study, for they are found in some of the hypotheses.

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The p-value in hypothesis testing is indicated as the level of marginal significance, which utilises the calculated probability of the required statement to determine if there is evidence to reject the null hypothesis. The null hypothesis is a specific statement that is tested to establish its value. A p-value of 0.05 is recognised as a typical threshold utilised to evaluate the null hypothesis. The results obtained are not significant when the p-value is above the significance level, therefore the null hypothesis is accepted (McDonald, 2014). When the p-value is below 0.05, it is regarded as positive and significant, suggesting that the independent variable exerts some influence on the dependent variable, while a p-value above 0.05 suggests the lack of significance. A positive correlation shows that two variables are related to each other, while a negative correlation shows that there is no relationship between them. The results of the inter-construct correlations among selected skills, the entrepreneurial process and entrepreneurial readiness behaviour are shown in Table 7.18.

Table 7. 18: Inter-construct correlations

	Soft skills	Technical skills	Entrepreneurial skills	Opportunity identification	Opportunity validation	Opportunity exploitation	Resource mobilisation	Venture creation	Innovative financing	Venture growth
Soft skills	—									
Technical skills	0.437***	—								
Entrepreneurial skills	0.807***	0.434***	—							
Opportunity identification	0.359***	0.168**	0.431***	—						
Opportunity validation	0.284***	0.141	0.350***	0.557***	—					
Opportunity exploitation	0.240***	0.076	0.278***	0.501***	0.594***	—				
Resource mobilisation	0.356***	0.196***	0.391***	0.606***	0.644***	0.655***	—			
Venture creation	0.191***	0.212***	0.182**	0.383***	0.400***	0.387***	0.477***	—		
Innovative financing	0.414***	0.232***	0.419***	0.497***	0.590***	0.567***	0.585***	0.386***	—	
Venture growth	0.267***	0.234***	0.329***	0.413***	0.490***	0.558***	0.556***	0.501***	0.497***	—

Note. * p < .05, ** p < .01, *** p < .001

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This correlation matrix depicts the strength and direction of the relationships/associations that exist between various skills, as well as the numerous sub-elements of the mediating and independent variables. Each cell in the matrix displays the correlation coefficient, and the correlation's significance level is represented by asterisks (*, **, ***), with more asterisks indicating greater significance. In the above-mentioned table, this suggests that, while the correlations between the variables are positive, they are not statistically significant.

There are only two pairs of variables that had a p-value more than 0.05. Technical skills with opportunity validation (0.141) and technical skills with opportunity exploitation (0.076), both had p-values of more than 0.05. This suggests there is no statistically significant relationship between the variables. Sailer et al. (2021) indicate that these technical skills, which is necessary for students to validate and exploit opportunities, are not taught in an operational environment such as a university. This could explain the negative correlations between these variables. All other variables had a significant level of less than 0.05, which suggests there are statistically significant relationships between them, and the alternative hypothesis are supported.

A visual inspection of the inter-construct correlational matrix indicates that not all constructs in this study had a significant difference. Therefore, further research of the proposed relationships is encouraged. However, the results confirm that there is a reciprocal association amongst soft skills, entrepreneurial skills and the entrepreneurial process, which may suggest that entrepreneurs consider these skills more important (Gieure et al., 2020) in shaping the entrepreneurial process.

7.7 MISSING VALUES

The information presented in Table 7.17 suggests that no variable had any missing values. All the variables had 300 responses.

7.8 CORRELATION ANALYSIS

Before examining the predictive relationships among the variables, a correlation test was performed. Alfadda and Mahdi (2021) suggest that correlation analysis is a statistical method used to ascertain the strength and direction of the relationship

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between two variables. The output of a correlation analysis comprises a correlation coefficient, which gauges the degree of association between the variables, and a p-value, which evaluates the statistical significance of the correlation. The correlation coefficient ranges from -1 to +1, where -1 denotes a perfect negative correlation, 0 denotes no correlation, and +1 denotes a perfect positive correlation. The strength of the correlation is typically interpreted based on the size of the correlation coefficient, with values nearer to +1 or -1 indicating a stronger relationship between the variables. Along with the correlation coefficient and p-value, effect sizes are usually reported to estimate the practical significance of the correlation. Shaw (2022) postulate that the most employed effect size for correlation analysis is Cohen's p, which is the difference between the means of the two variables divided by the pooled standard deviation. Effect sizes can assist in contextualising the strength of the correlation and can be used to compare the size of correlations among studies or between different variables. The strength of a correlation coefficient can be classified into the following ranges:

- 0.00 - 0.19: Very weak correlation
- 0.20 - 0.39: Weak correlation
- 0.40 - 0.59: Moderate correlation
- 0.60 - 0.79: Strong correlation
- 0.80 - 1.00: Very strong correlation

Table 7.18 presents the inter-construct correlations based on Spearman's test. It shows the correlation between ten constructs, including ‘soft skills’, ‘technical skills’, ‘entrepreneurial skills’, ‘opportunity identification’, ‘opportunity validation’, ‘opportunity exploitation’, ‘resource mobilisation’, ‘venture creation’, ‘innovative financing’, and ‘venture growth’. The Spearman’s test was used because the information in Table 7.8 suggests that the data relating to the 10 constructs was not normally distributed. The focus was on how the other constructs/variables correlate with the indicators of entrepreneurial readiness behaviour i.e., venture creation, innovative financing, and venture growth.

Firstly, ‘Venture creation’ was found to have significant positive correlations with soft skills ($r=0.191$, $p < .05$), technical skills ($r=0.212$, $p < .01$), entrepreneurial skills ($r=0.182$, $p < .01$), opportunity identification ($r=0.383$, $p < .001$), opportunity validation ($r=0.400$, $p < .001$), opportunity exploitation ($r=0.387$, $p < .001$), resource mobilisation

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(r=0.477, p < .001), and innovative financing (r=0.386, p < .001), as well as venture growth (r=0.501, p < .001). The only correlation above 0.5 is between venture creation and venture growth. Welter et al. (2019) determines that although there is a higher correlation between these variables, external conditions can still influence the ability of an entrepreneur who created a new venture to further grow that venture.

Secondly, 'Innovative financing' was also found to have significant positive correlations with soft skills (r=0.414, p < .001), technical skills (r=0.232, p < .001), entrepreneurial skills (r=0.419, p < .001), opportunity identification (r=0.497, p < .001), as well as venture growth (r=0.497, p < .001). Opportunity validation (r=0.590, p < .001) had the strongest correlation with innovative financing. This demonstrates that the need to validate discovered opportunities can be realised through innovative financing. Gras et al. (2017) explicate the historical roots between innovative financing and validating opportunities, by linking different types of crowdfunding with entrepreneurial outcomes and their study establish a positive relationship between opportunity validation and financing. Opportunity exploitation (r=0.567, p < .001) had a correlation above 0.5 with innovative financing. This is consistent with Kuckertz et al. (2017) who characterise opportunity exploitation as a process that requires the entrepreneur to develop a service or product based on acquiring financial resources and a perceived entrepreneurial opportunity. Resource mobilisation (r=0.585, p < .001) also had a correlation above 0.5 with innovative financing. Kraus et al. (2018) supports this and Steininger (2019), who suggests that although the resources required in innovative financing can significantly vary, they remain important from the start-up phase of a venture.

Lastly, 'venture growth' was also found to have significant positive correlations with soft skills (r=0.267, p < .001), technical skills (r=0.234, p < .001), entrepreneurial skills (r=0.329, p < .001), opportunity identification (r=0.413, p < .001) and opportunity validation (r=0.490, p < .001). Opportunity exploitation (r=0.558, p < .001) had the strongest correlation amongst variables with venture growth. Kuckertz et al. (2017) support this relationship by highlighting the importance of the utilisation and exploitation of opportunities in measurement and establishment of the growth of a venture. Resource mobilisation (r=0.556, p < .001) was the only other variable that had a correlation of more than 0.5 with venture growth. Murray et al. (2020) underlines

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the importance of this relationship by providing a holistic framework of resource mobilisation which enables an entrepreneur to generate critical resources to develop and grow their ventures.

Consistent with the research of Mamabolo and Myres (2020), it is determined that each stage in the entrepreneurial process requires different skills to complete activities in order to move to the next stage. It can be argued that our findings demonstrate that the development of selected 4IR skills is critical to the realisation of all the stages of the entrepreneurial process. These variables further have significant and positive correlations with the dimensions of the entrepreneurial readiness behaviour.

7.9 CHAPTER SUMMARY

Chapter 7 dealt with the empirical results of this study. The results were discussed through descriptive and inferential statistics. Demographic information of respondents ranging from age, gender, qualifications, field of study and HEIs were discussed. The findings on selected 4IR skills (the statements of soft skills, technical skills and entrepreneurial skills) were also presented and discussed. Section C was devoted to the entrepreneurial process (the statements on opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation were presented and discussed). Lastly, section D attended to the entrepreneurial readiness behaviour (the statements of venture creation, innovative financing and venture growth were presented and discussed). Valuable information regarding the research objectives and research questions were amplified in this chapter. The next chapter dwells on further discussion of pertinent conclusions connected to the study.

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CHAPTER 8 FINDINGS AND DISCUSSION

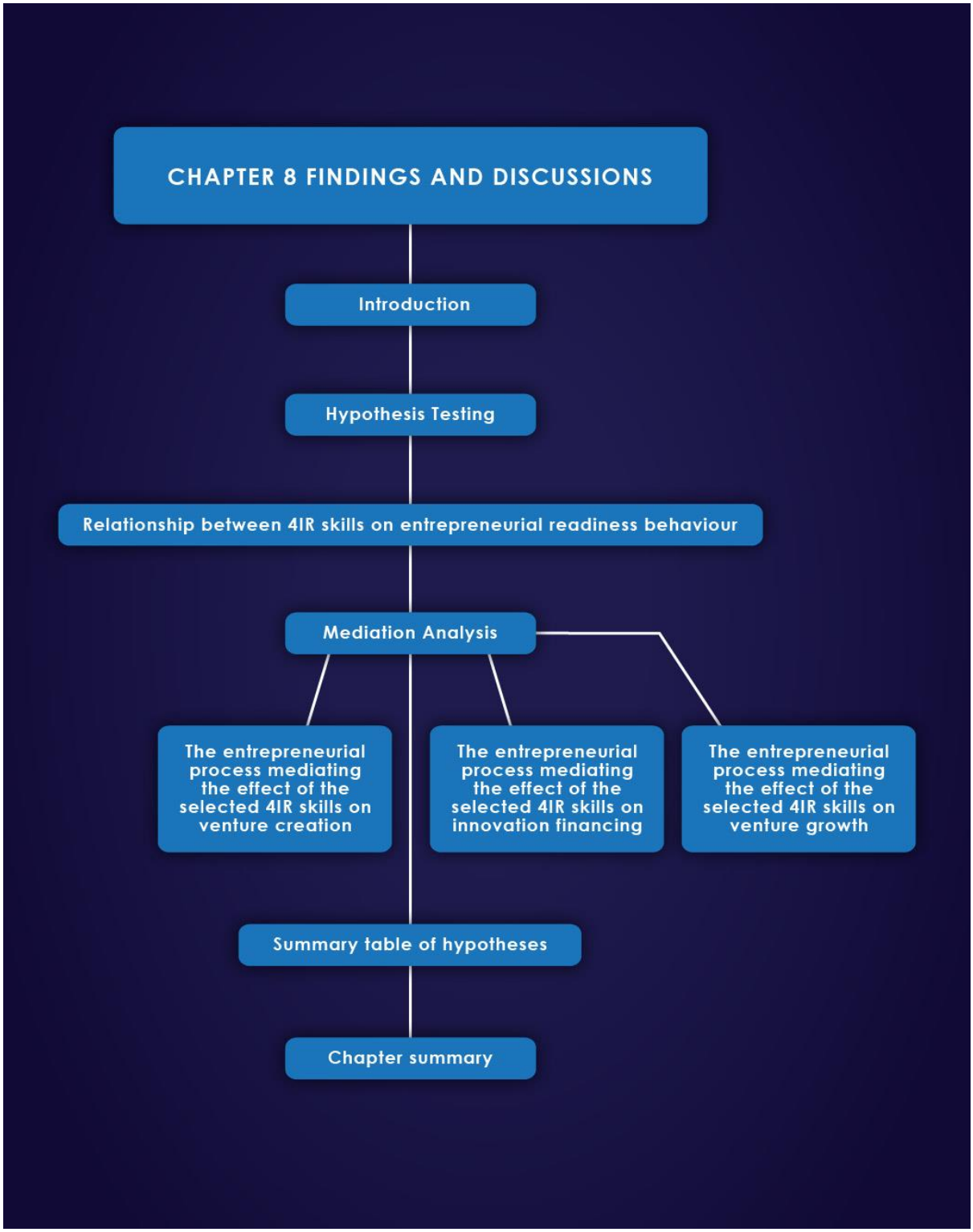

Figure 8. 1: Flow diagram indicating the structure of Chapter 8

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8.1 INTRODUCTION

In Chapter 7, a detailed discussion was provided on the effect of 4IR skills on students' entrepreneurial readiness behaviour, including how this relationship was mediated by the entrepreneurial process. To empirically determine these relationships, descriptive and inferential statistics were used to discuss the empirical results.

The current chapter constitutes the second segment of the presentation and discussion of the results. Building on the previous chapter, the current chapter reports on hypothesis tested and discusses the relationships between the selected 4IR skills, (namely soft skills, technical skills and entrepreneurial skills) and students' entrepreneurial readiness behaviour. These variables address research questions 1-3. Section 8.9 discusses the mediation analysis, specifically how the entrepreneurial process mediates the relationship between 4IR skills and entrepreneurial readiness behaviour, (whose dimensions include venture creation, innovative financing and venture growth). This section addresses hypotheses 4-6, (presented as H4, H5 and H6). This chapter concludes with a summary of the results on the mediation effect of the entrepreneurial process variables in the 4IR skills-entrepreneurial readiness relationship. The next section presents the hypotheses tested and the discussion based on literature.

8.2 HYPOTHESIS TESTING

To test the hypotheses, different versions of linear regression analysis such as hierarchical regression analysis and general linear modelling mediation analysis were employed. Linear regression analysis is a statistical method used to create a model that articulates the relationship between a dependent variable and one or more independent variables. The objective of linear regression is to predict the value of the dependent variable based on the values of the independent variables. This method assumes that the relationship between the dependent variable and independent variables is linear, implying that any changes in the independent variable generate proportional changes in the dependent variable (Maulud & Abdulazeez, 2020).

Moreover, the linear regression model assumes that the dependent variable follows a normal distribution and that the error terms (residuals) have a normal distribution with

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a mean of zero and constant variance (homoscedasticity). Additionally, the model assumes that there is no perfect multicollinearity between the independent variables, meaning that there is no exact linear relationship between the independent variables. If these assumptions are not met, the results may need to be interpreted with caution (Lee, 2022).

Consistent with previous literature (Qurrata & Ramadhani, 2021), this table indicates normality, heteroskedasticity, and collinearity statistics. Normality speaks to a set of transformation-estimating functions that is utilised to normalise data. Normality statistics for all applicable transformations are compared and then estimated. Establishing the normality of data is critical in determining which transformations are viable or not (Peterson, 2021). Heteroskedasticity is a measure of volatility (extent of dispersion of the graphical plots) in the relationship between variables as expressed on a scatter graph. It happens when the standard deviations of a predicted variable, monitored over different values of an independent variable or as related to prior time periods, are non-constant (Hayes, 2022). Therefore, heteroskedasticity refers to the error variance, or dependence of scattering, within a minimum of one independent variable in a particular sample. These variations can be used to calculate the margin of error between data sets, such as expected results and actual results, as it provides a measure of the deviation of data points from the mean value (Hayes, 2022). To the extent that, heteroskedasticity is a violation of the assumptions for linear regression modelling bearing on the validity of statistical analysis and therefore, must be established first before additional analysis can be performed to ensure credibility of results. Collinearity, or often termed multicollinearity, is when independent variables (two or more) are highly correlated, so that one of the values can be more accurately predicted by the other variable. This influences the standard error and size of the regression coefficients associated with the collinear variables and their interpretation thereof (Johnston et al., 2018). It is therefore important that collinearity tests are performed to establish relations among independent variables (Fan et al., 2021).

The Shapiro-Wilk test indicates that the data is not normally distributed (SW statistic=0.953, $p < .001$), due to a low p-value. Avram and Mărușteri (2022) suggest that the normality of data is critical to determining whether parametric or non-parametric tests should be used, with the latter being applied when the data set is not

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normal (i.e. when it does not generate a normal distribution curve if it were plotted on a distribution curve).

Furthermore, the Goldfeld-Quandt test does not provide evidence of heteroscedasticity (GQ statistic=0.782, p=0.913). Heteroscedasticity is defined as a non-constant error variance, which determines the remaining residual variability changes of an area that is not measured in the regression model (Field, 2009).

Lastly, the Variance Inflation Factor (VIF) values are less than 1.5, implying that there is no evidence of multicollinearity among the predictors. The tolerance values were less than 1, which is also consistent with low multicollinearity. The presence of multicollinearity is problematic as it often leads to poor statistical inferences when the researcher fits the data to the model and interprets it (Frost, 2017). The results show that none of the demographic variables were significant predictors of venture creation in Model 1, indicating that they did not explain a significant proportion of the variance in venture creation. It is therefore important to isolate those variables that have limited predictive relevance on entrepreneurial readiness behaviour to establish the exact effect of soft skills on entrepreneurial readiness behaviour in an uninterrupted way.

The Shapiro-Wilk test indicates that the data is not normally distributed (SW statistic=0.953, $p < .001$). Avram and Măruşteri (2022) suggest that normality of data is critical to determining whether parametric or non-parametric tests should be used, with the latter being applied when the data set is not normal.

Furthermore, the Goldfeld-Quandt test does not provide evidence of heteroscedasticity (GQ statistic=0.782, p=0.913). Lastly, the Variance Inflation Factor (VIF) values are less than 1.5, which indicates that there is no evidence of multicollinearity among the predictors. The tolerance values were less than 1, which is also consistent with low multicollinearity. The presence of multicollinearity is problematic as it often leads to poor statistical inferences when the researcher fits the data to the model and interprets it (Frost, 2017).

The following section tests the statement of hypotheses:

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H_1: There is a positive and statistically significant relationship between soft skills and entrepreneurial readiness behaviours.

H_2: There is a positive and statistically significant relationship between technical skills and entrepreneurial readiness behaviours.

H_3: There is a positive and statistically significant relationship between entrepreneurial skills and entrepreneurial readiness behaviours.

H_4: The entrepreneurial process fully mediates the 4IR skills-entrepreneurial readiness behaviours relationship.

H_5: Opportunity identification fully mediates the relationship between soft skills and venture creation.

H_6: Opportunity validation fully mediates the relationship between technical skills and innovation financing.

H_7: Opportunity exploitation fully mediates the relationship between entrepreneurial skills and venture growth.

8.3 RELATIONSHIP BETWEEN 4IR SKILLS AND ENTREPRENEURIAL READINESS BEHAVIOUR

Given that 4IR skills is a multi-dimensional construct comprising soft skills, technical skills and entrepreneurial skills, it was critical to disintegrate these dimensions and then ascertain their independent effect on individual dimensions of entrepreneurial readiness behaviour identified as venture creation, innovative financing and venture growth. Consistent with this reasoning, the effect of soft skills on entrepreneurial readiness behaviour is hypothesised in three sub-hypotheses, namely H1a, (covering the venture creation dimension), H1b (covering the innovative financing dimension) and H1c (covering the venture growth dimension).

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Since the second dimension of 4IR skills was identified as technical skills, the next set of hypotheses tested the effect of technical skills on entrepreneurial readiness behaviour by connecting this dimension to the individual dimensions of entrepreneurial readiness behaviour. These relationships were captured in three sub-hypotheses that connected technical skills to venture creation (H2a), innovative financing (H2b) and venture growth (H2c). Lastly, the effect of entrepreneurial skills, the third dimension of 4IR skills, on entrepreneurial readiness behaviour is hypothesised in three sub-hypotheses, namely H3a (covering venture creation), H3b (emphasising innovative financing) and H3c (highlighting venture growth). The results and findings for each hypothesis are summarised below.

8.3.1 Relationship between soft skills and venture creation

The significance of soft skills in the formation of entrepreneurial readiness behaviour manifests in the prediction that soft skills have a direct impact on venture creation. The study hypothesised that:

H1a: *There is a positive and statistically significant relationship between soft skills and venture creation while controlling for demographic variables.*

Table 8.1 presents the results of a hierarchical regression analysis examining the relationship between soft skills and venture creation while controlling for demographic variables, (discussed in Chapter 7). Since other demographic factors such as gender, age and personality are also predictors of entrepreneurial readiness behaviour (López-Núñez et al., 2022), the current study controlled some of these variables to isolate the effect of soft skills on entrepreneurial readiness behaviour. The demographic variables included in the analysis were age, gender, Higher Education Institution (HEI), field of study, whether a student considered an entrepreneurial career upon study completion, the extent to which HEI prepared students for entrepreneurship entrepreneurial preparation, exposure to entrepreneurship education, and highest qualification. The analysis was conducted in two steps, where Model 1 included demographic variables as predictors and Model 2 added soft skills as an additional predictor.

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Table 8. 1: Soft skills predicting venture creation while controlling for demographic variables

	Model 1		Model 2			
Predictors	Standardised Estimate	p-value	Standardised Estimate	p-value	Collinearity	
					VIF	Tolerance
Intercept [a]		< .001		< .001		
Age:					1.21	0.828
26-35 years – 18-25 years	0.10340	0.545	0.0188	0.913		
36-49 years – 18-25 years	-0.00542	0.983	-0.0604	0.816		
50+ years – 18-25 years	-0.42991	0.377	-0.4989	0.301		
Gender:					1.13	0.882
Female – Male	0.10791	0.440	0.0570	0.682		
Other – Male	1.90070	0.060	1.6776	0.094		
Higher Education Institution (HEI):					1.29	0.776
UFS – CUT	-0.08709	0.632	-0.0392	0.828		
Other – CUT	0.03696	0.837	0.0209	0.906		
Field of study:					1.11	0.898
Economic and Management Sciences – Education	-0.20511	0.300	-0.2248	0.251		
Theology – Education	-0.79566	0.025	-0.9601	0.007		
Health sciences – Education	-0.28010	0.237	-0.2672	0.254		
Natural and Agricultural Sciences – Education	-0.60960	0.029	-0.6525	0.018		
Humanities – Education	-0.27633	0.288	-0.3746	0.149		
Other – Education	-0.39324	0.143	-0.3284	0.218		
Considered an entrepreneurial career:					1.12	0.890
No – Yes	0.23199	0.247	0.2566	0.195		
Maybe – Yes	-0.22072	0.148	-0.2251	0.136		
Entrepreneurial preparation by HEI:					1.13	0.888
No – Yes	-0.11927	0.467	-0.1625	0.318		
Maybe – Yes	-0.06289	0.693	-0.0889	0.573		
Exposure to entrepreneurship education:					1.28	0.782
No – Yes	-0.30074	0.035	-0.2459	0.085		
Highest qualification:					1.11	0.898

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Certificate – Course	0.12255	0.571	0.1371	0.522		
Diploma – Course	0.38348	0.154	0.4277	0.108		
Advanced diploma – Course	0.28208	0.473	0.2808	0.470		
Bachelor – Course	0.18385	0.395	0.2492	0.247		
Honours – Course	0.09023	0.738	0.1812	0.500		
Master's – Course	0.10651	0.722	0.2422	0.420		
Doctoral – Course	-0.89369	0.075	-0.7754	0.120		
Soft skills			0.1675	0.007	1.10	0.910
R^2	0.133		0.156			
Change in R^2			0.0232			
F-value	F(25,274)1.68,p=0.0025		F(26,273)1.94, p=0.005	(		

Table 8.1 shows how much of the change in venture creation behaviour is due to the respondents' soft skills, after the influence of demographic variables is removed. In Model 1 of this table the demographic variables, (excluding soft skills), account for 13.3% of the variance in venture creation behaviour. In Model 2, the combination of demographic variables + soft skills affect 15.6% of the variance in venture creation behaviour. Therefore, if the effect of demographics is excluded, soft skills explain just 2.32% of the change in venture creation behaviour. This change is indicated in the R^2 value at the bottom of the table. The capacity of soft skills to predict certain entrepreneurial behaviours has been affirmed by literature. For instance, National Association of Colleges and Employers (NACE, 2021) considered certain soft skills such as critical thinking, creative thinking, collaboration and communication as having potential to increase entrepreneurial readiness behaviour. Studies by Al-Shehab et al. (2021) and, Kumar and Shukla (2022) found that soft skills such as creativity and critical thinking were predictors of entrepreneurial intent to create new ventures. Dada et al. (2023) also considers critical thinking as an important skill for venture creation. Critical thinking enables entrepreneurs to identify potential opportunities and risks, to assess viability of new business ideas, and make informed decisions that lead to positive outcomes (Agbi et al., 2022). Dada et al. (2023) further found that leadership skills are vital for venture creation. Leadership skills enable entrepreneurs to manage

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and lead a team, inspire others, make strategic decisions and to communicate effectively in new ventures (Drewery et al., 2020).

The results show that none of the demographic variables were significant predictors of venture creation in Model 1 (see Table 8.1), indicating that they did not explain a significant proportion of the variance in venture creation. This result differs from previous literature as it demonstrated that age (Muin et al., 2016; Meika & Lukman, 2017), gender (Bullough et al., 2015; Kelley et al., 2016) , field of study (Yanling & Hock, 2023), academic discipline (Adeniyi & Ganiyu, 2021; Al-Lawati et al., 2022; Sim et al., 2023) and previous exposure to entrepreneurship (Foo & Turner, 2019; Saadat et al., 2022) have been identified as key predictors of readiness to engage in entrepreneurship behaviours.

In Model 2 (see Table 8.1), soft skills were added as a predictor variable. The results show that soft skills were a significant predictor of venture creation (β=0.1675, p=0.007), indicating that participants with higher levels of soft skills were more likely to engage in entrepreneurial activities. These findings support previous studies that identify entrepreneurs' intentions to pursue entrepreneurial activities as dependent on the attainment of specific combinations of soft skills such as leadership, creative thinking, communication and teamwork (Rosique-Blasco et al., 2016; Entika et al., 2017). The change in R^2 from Model 1 to Model 2 was significant ($\Delta R2$ =0.0232, p=0.005), suggesting that soft skills explained a significant proportion of the variance in venture creation beyond the demographic variables. Such a finding is quite instructive as it validates evidence from literature. For instance, Sadq (2019) highlights that there is a positive correlation between soft skills and the realisation of entrepreneurship outcomes. It can be inferred that soft skills are vital for the success of any venture, including its effective management post creation.

Therefore, the findings provide support for the hypothesis that *there is a positive and statistically significant relationship between soft skills and venture creation while controlling for demographic variables.*

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8.3.2 Relationship between soft skills and innovative financing

The significance of soft skills in the formation of entrepreneurial readiness behaviour was hypothesised in H1b in Table 8.2. Specifically, the hypothesis sought to predict the effect of soft skills on innovative financing, identified as a dimension of entrepreneurial readiness behaviour (Block et al., 2016). This hypothesis was formulated as follows:

Hypothesis 1b: *There is a positive and statistically significant relationship between soft skills and innovative financing while controlling for demographic variables.*

To establish this relationship, hierarchical regression analysis was applied. Hierarchical regression analysis is deemed appropriate when variance on a criterion variable (i.e., dependent variable) is explained by predictor variables that are correlated with each other (Pedhazur, 1997). The results are presented in Table 8.2. The Table 8.2 shows two models: Model 1 which includes only the demographic variables, and Model 2 which adds the predictor variable of interest, namely soft skills. The demographic variables included age, gender, higher education institution (HEI), study field, considering an entrepreneurial career, entrepreneurial preparation by HEI, exposure to entrepreneurship education, and highest qualification.

To establish whether the dataset was normal, the Shapiro-Wilk test was performed on the data (González-Estrada & Cosmes, 2019). This test indicated that the data is not normally distributed (SW statistic=0.951, $p < .001$). To establish heteroskedasticity, the Goldfeld-Quandt test was also performed (Alaba et al., 2019). The Goldfeld-Quandt test did not provide evidence of heteroscedasticity (GQ statistic=0.823, p=0.860). Lastly, the evidence of multicollinearity was tested using Variance Inflation Factor (Kim, 2019). The Variance Inflation Factor (VIF) values are less than 1.5, which indicates that there is no evidence of multicollinearity among the predictors. The tolerance values were less than 1, which is also consistent with low multicollinearity. Multicollinearity is distinguished once the tolerance of each independent variable is examined. Tolerance is the total variability of an independent variable that is not clarified by the other independent variable (Daoud, 2017).

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Table 8. 2: Soft skills predicting innovative financing while controlling for demographic variables

Predictor	Model 1		Model 2		Collinearity	
	Stand. Estimate	p-value	Stand. Estimate	p-value	VIF	Tolerance
Intercept [a]		< .001		< .001		
Age:					1.21	0.828
26-35 years – 18-25 years	0.3390	0.045	0.17686	0.278		
36-49 years – 18-25 years	0.0905	0.726	-0.01488	0.952		
50+ years – 18-25 years	-0.2784	0.562	-0.41051	0.369		
Gender:					1.13	0.882
Female – Male	0.0512	0.710	-0.04638	0.725		
Other – Male	1.5926	0.109	1.16532	0.218		
Higher Education Institution (HEI):					1.29	0.776
UFS – CUT	0.0543	0.762	0.14601	0.394		
Other – CUT	0.0357	0.840	0.00497	0.976		
Field:					1.11	0.898
Economic and Management Sciences – Education	-0.0774	0.691	-0.11513	0.535		
Theology – Education	0.4335	0.213	0.11837	0.724		
Health Sciences – Education	-0.2792	0.232	-0.25447	0.252		
Natural and Agricultural Sciences – Education	0.3618	0.187	0.27955	0.284		
Humanities – Education	-0.3911	0.128	-0.57938	0.019		
Other – Education	-0.5388	0.042	-0.41456	0.101		
Considered an entrepreneurial career:					1.12	0.890
No – Yes	0.1922	0.330	0.23942	0.202		
Maybe – Yes	0.0810	0.590	0.07271	0.610		
Entrepreneurial preparation by HEI:					1.13	0.888
No – Yes	-0.1929	0.233	-0.27568	0.075		

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Maybe – Yes	0.0108	0.945	-0.03903	0.794		
Exposure to entrepreneurship education:					1.28	0.782
No – Yes	-0.1918	0.173	-0.08673	0.520		
Highest qualification:					1.11	0.898
Certificate – Course	0.2024	0.343	0.23016	0.256		
Diploma – Course	0.1980	0.454	0.28266	0.262		
Advanced diploma – Course	0.5738	0.139	0.57143	0.121		
Bachelor – Course	0.0591	0.782	0.18420	0.366		
Honours – Course	0.0799	0.764	0.25416	0.319		
Masters – Course	-0.1952	0.509	0.06470	0.820		
Doctoral – Course	-1.0400	0.036	-0.81346	0.085		
Soft skills			0.32093	< .001	1.10	0.910
R^2	0.157		0.242			
Change in R^2			0.0852			
F-value	F(25,274)2.04, p=0.003		F(26,273)3.36,p<0.001			

The results show that in Model 1 (see Table 8.2), only the demographic variable of age was a significant predictor of innovative financing. Specifically, participants aged 26-35 years (0.045) were more likely to exhibit innovative financing behaviour than other age groups. None of the other demographic variables were significant predictors. The finding on age as a good predictor of innovative financing supports Wiersma et al.'s (2020), view that financial behaviour depends on age and stage of life of an individual. One would assume that the 25-35 age group was a significant predictor of innovative financing, because this is the age around which most young adults struggle least to secure finance from funding agencies, as most would have improved their creditworthiness by virtue of having secured employment. Moreover, due to access to gainful employment, one would expect these young adults to have started accumulating savings and experimenting with a culture of investment via different

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options (for e.g., equity, bonds). It is therefore expected that the age group 26-35 years is inclined to demonstrate a proclivity towards innovative financing (Silinskas et al., 2021).

In Model 2 (see Table 8.2), soft skills were a significant predictor of innovative financing while controlling for the demographic variables. The standardised estimate of soft skills was 0.32093, suggesting that it is statistically significant ($p < 0.001$). This means that participants with higher levels of soft skills are more likely to exhibit innovative financing behaviour. This corroborates literature that associates the thriving of the financial sector with the prevalence of soft skills (Lavrinenko & Shmatko, 2019), and the desirability of soft skills such as critical thinking, problem solving and creative thinking in stimulating innovative financing (Constantino & Rodzinka, 2022).

The overall R^2 for Model 1 (see Table 8.2) was 0.157, indicating that the demographic variables explained 15.7% of the variance in entrepreneurial readiness behaviours (innovative financing). The addition of soft skills in Model 2 increased the R^2 to 0.242, indicating that soft skills explained an additional 8.5% of the variance in innovative financing. Rajapakse (2017) values soft skills such as communication, creative thinking, teamwork, readiness, self-confidence, motivation to learn and develop, together with a positive attitude to work, as imperative to innovative financing.

The F-value for Model 1 (see Table 8.1) was not significant ($F(25,274) = 2.04$, $p=0.003$), while the F-value for Model 2 was significant ($F(26,273) = 3.36$, $p < 0.001$). This suggests that the addition of soft skills significantly improved the prediction of innovative financing beyond the demographic variables alone. This finding also resonates with literature that shows that creative thinking, judgment, emotional intelligence and decision making are soft skills that impact innovative financing (Constantino & Rodzinka, 2022). Research by Polcz (2021) found that an entrepreneur's communication skills influence investor decisions of business angels. The ability to convince possible investors that a new business concept is worth funding is definitively an important soft skill.

This implies that entrepreneurs with a high level of soft skills are more inclined to present entrepreneurial readiness behaviour through their ability to secure different

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forms of innovative financing. Although evidence in existing literature supports the acquisition of general skills as beneficial when accessing financial services (Louman et al., 2020), the findings present soft skills as having the potential to substantially improve behaviour towards innovative financing.

The results support Hypothesis 1b, *which predicted a positive and statistically significant relationship between soft skills and innovative financing while controlling for demographic variables.* Respondents with higher levels of soft skills were more likely to exhibit innovative financing behaviour, even when controlling for age, gender, HEI, field, entrepreneurial career, entrepreneurial preparation by HEI, exposure to entrepreneurship education, and highest qualification.

8.3.3 Relationship between soft skills and venture growth

This research builds on the findings of previous studies (Pratomo et al., 2018; Halim & Sahid, 2020), linking skills to entrepreneurial readiness behaviour. The intention to examine this relationship was partly instigated by previous research (Garcez et al., 2022; Antonovica et al., 2023) that show contrasting results on the effects of soft skills on entrepreneurial readiness behaviour.

The extent to which soft skills shape the formation of entrepreneurial readiness behaviour is hypothesised in H1c in Table 8.3, which predicts that soft skills have a direct impact on venture growth. Informed by previous literature that suggests a positive relationship between soft skills and venture growth (Murnieks et al., 2020), this study hypothesised that there is a positive and statistically significant relationship between soft skills and venture growth.

Hypothesis 1c: *There is a positive and statistically significant relationship between soft skills and venture growth while controlling for demographic variables.*

The hierarchical regression analysis presented in Table 8.3 examines the relationship between soft skills and venture growth while controlling for demographic variables. The analysis tests Hypothesis 1c, which posits that there is a positive and statistically significant relationship between soft skills and venture growth.

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The Shapiro-Wilk test indicates that the data is not normally distributed (SW statistic=0.965, p < .001). Furthermore, the Goldfeld-Quandt test does not provide evidence of heteroscedasticity (GQ statistic=0.801, p=0.896). Lastly, the Variance Inflation Factor (VIF) values are less than 1.5, which indicates that there is no evidence of multicollinearity among the predictors. The tolerance values were less than 1, which is also consistent with low multicollinearity. The collinearity diagnostics in this table suggest that there are no serious issues with multicollinearity among the predictors, as all variance inflation factors (VIFs) are below 1.5 and all tolerances are above 0.7.

Table 8. 3: Soft skills predicting venture growth while controlling for demographic variables

Predictor	Model 1		Model 2		Collinearity	
	Stand. Estimate	p-value	Stand. Estimate	p-value	VIF	Tolerance
Intercept [a]		< .001		< .001		
Age:					1.07	0.935
26-35 years – 18-25 years	0.3290	0.025	0.2700	0.061		
36-49 years – 18-25 years	0.0562	0.789	0.0766	0.710		
50+ years – 18-25 years	-0.4935	0.240	-0.4707	0.253		
Gender:					1.13	0.887
Female – Male	-0.2035	0.139	-0.2739	0.045		
Other – Male	1.5701	0.111	1.2443	0.199		
Higher Education Institution (HEI):					1.23	0.815
UFS – CUT	-0.2684	0.107	-0.1710	0.300		
Other – CUT	0.0173	0.918	0.0313	0.849		
Field:					1.09	0.917
Economic and Management Sciences – Education	-0.0333	0.861	-0.0457	0.807		
Theology – Education	-0.4638	0.167	-0.7150	0.034		
Health Sciences – Education	-0.1725	0.453	-0.1553	0.490		
Natural and Agricultural Sciences – Education	-0.0230	0.932	-0.0927	0.727		

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Humanities – Education	-0.4816	0.059	-0.6138	0.015		
Other – Education	-0.1551	0.556	-0.0695	0.788		
Considered an entrepreneurial career:					1.10	0.913
No – Yes	0.5185	0.007	0.5531	0.003		
Maybe – Yes	0.0480	0.745	0.0305	0.833		
Entrepreneurial preparation by HEI:					1.11	0.902
No – Yes	0.0211	0.894	-0.0387	0.804		
Maybe – Yes	0.0492	0.753	0.0147	0.923		
Exposure to entrepreneurship education:					1.24	0.804
No – Yes	-0.4564	< .001	-0.3832	0.005		
Soft skills			0.2128	< .001	1.08	0.928
R^2	0.132		0.172			
Change in R^2			0.039			
F-value	F(18,281)2.38, p=0.002		F(19,280)13.2,p<0.002			

This table presents two models, Model 1 and Model 2. Model 1 (see Table 8.3) includes the demographic variables as predictors, while Model 2 (see Table 8.3) adds soft skills as a predictor. The results show that in Model 1, none of the demographic variables are statistically significant predictors of venture growth. However, in Model 2, soft skills are a statistically significant predictor of venture growth ($p < .001$), even after controlling for demographic variables. The standardised estimate for soft skills is 0.2128, meaning that an increase in soft skills by one standard deviation leads to a 0.2128 standard deviation increase in venture growth.

The overall fit of the models is evaluated using the R^2 values and the F-tests. Model 1 (see Table 8.3) explains 13.2% of the variance in venture growth, while Model 2 explains 17.2% of the variance, indicating that the addition of soft skills as a predictor leads to a significant improvement in model fit ($\Delta R2 = .039$, $p < .002$). The F-tests for both models are statistically significant ($p < .002$).

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While this finding contradicts Gwija et al.'s (2014) view on entrepreneurs' lack of important soft skills, it partially supports the narrative that the skill to strategically find an opportunity is an important prerequisite for a venture to maintain growth and thereby increase the chances of success (Amankwah-Amoah et al., 2019). Based on the evidence of the findings, especially soft skills as a strong predictor for entrepreneurial readiness behaviour, one could assume that opportunities for growth can significantly benefit ventures. However, with reference to soft skills, there is no consensus on which soft skills affect entrepreneurial readiness behaviour. Education Design Lab (2018) specifies that the following soft skills are necessary to thrive in the 21st century of digital entrepreneurship: critical thinking, creative thinking, oral communication, intercultural fluency, collaboration, initiative and empathy. Without consideration of what effect soft skills have on entrepreneurial readiness behaviours of students, the growth of ventures may be negatively impacted.

The results of the hierarchical regression analysis support Hypothesis 1c: *Soft skills are positively and significantly related to venture growth while controlling for demographic variables.*

8.3.4 Relationship between technical skills and venture creation

Given the complexity of job-specific skills such as financial management and digital literacy required in venture creation, it was necessary to investigate the possible link between technical skills and venture creation. For instance, there is growing literature pointing to the direct impact of financial management on new venture creation (Mamabolo & Myres, 2020) and a nexus between possession of technical skills such as numeracy ability, risk literacy and financial literacy and venture creation (Ruiz-Dotras & Llados-Masllorens, 2022). In view of this body of evidence, we explored the significance of technical skills in the formation of entrepreneurial readiness behaviour, and it was predicted that technical skills have a direct impact on venture creation (see Table 8.4 for H2a). As such, the study hypothesised *there is a positive and statistically significant relationship between technical skills and venture creation while controlling for demographic variables.*

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This table shows the results of a hierarchical regression analysis examining the relationship between technical skills and venture creation while controlling for demographic variables. The analysis includes two models, with Model 1 (see Table 8.4) including demographic variables as predictors and Model 2 (see Table 8.4) which added technical skills as a predictor.

The Shapiro-Wilk test indicates that the data is not normally distributed (SW statistic=0.962, p < .001). Furthermore, the Goldfeld-Quandt test does not provide evidence of heteroscedasticity (GQ statistic=0.7289, p=0.959). Lastly, the Variance Inflation Factor (VIF) values are less than 1.5, which indicates that there is no evidence of multicollinearity among the predictors. The tolerance values were less than 1, which is also consistent with low multicollinearity.

Table 8. 4: Technical skills predicting venture creation controlling for demographic variables

Predictor	Model 1		Model 2		Collinearity	
	Stand. Estimate	p-value	Stand. Estimate	p-value	VIF	Tolerance
Intercept [a]		< .001		< .001		
Age:					1.21	0.826
26-35 years – 18-25 years	0.10340	0.545	7.16e-4	0.997		
36-49 years – 18-25 years	-0.00542	0.983	-0.1365	0.603		
50+ years – 18-25 years	-0.42991	0.377	-0.4924	0.306		
Gender:					1.13	0.883
Female – Male	0.10791	0.440	0.1013	0.462		
Other – Male	1.90070	0.060	1.5212	0.129		
Higher Education Institution (HEI):					1.28	0.779
UFS – CUT	-0.08709	0.632	-0.0512	0.776		
Other – CUT	0.03696	0.837	0.0548	0.757		
Field of study:					1.11	0.900
Economic and Management Sciences – Education	-0.20511	0.300	-0.1928	0.324		
Theology – Education	-0.79566	0.025	-0.7455	0.033		

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Health Sciences – Education	-0.28010	0.237	-0.3731	0.114		
Natural and Agricultural Sciences – Education	-0.60960	0.029	-0.6384	0.021		
Humanities – Education	-0.27633	0.288	-0.3365	0.191		
Other – Education	-0.39324	0.143	-0.4170	0.116		
Considered an entrepreneurial career:					1.13	0.886
No – Yes	0.23199	0.247	0.2520	0.202		
Maybe – Yes	-0.22072	0.148	-0.1624	0.284		
Entrepreneurial preparation by HEI:					1.12	0.889
No – Yes	-0.11927	0.467	-0.1158	0.474		
Maybe – Yes	-0.06289	0.693	-0.0346	0.826		
Exposure to entrepreneurship education:					1.28	0.780
No – Yes	-0.30074	0.035	-0.2332	0.102		
Highest qualification:					1.12	0.897
Certificate – Course	0.12255	0.571	0.1053	0.622		
Diploma – Course	0.38348	0.154	0.3796	0.152		
Advanced diploma – Course	0.28208	0.473	0.3597	0.355		
Bachelor – Course	0.18385	0.395	0.2214	0.300		
Honours – Course	0.09023	0.738	0.1831	0.495		
Master's – Course	0.10651	0.722	0.2760	0.359		
Doctoral – Course	-0.89369	0.075	-0.6940	0.165		
Technical skills			0.1809	0.003	1.10	0.907
R^2	0.133		0.16			
Change in R^2			0.0269			
F-value	F(25,274)1.68, p=0.025		F(26,273)2, p=0.004			

In Model 1 (see Table 8.4), none of the demographic variables were statistically significant predictors of entrepreneurial readiness behaviour. However, in Model 2 (see Table 8.4), technical skills have a positive and statistically significant relationship with venture creation (β=0.1809, p=0.003), indicating that individuals with higher levels of technical skills are more likely to engage in venture creation.

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The change in R^2 from Model 1 to Model 2 (see Table 8.4) was 0.0269, indicating that the addition of technical skills as a predictor explained an additional 2.69% of the variance in venture creation. The overall R^2 for Model 2 was 0.16, indicating that the predictors included in the model explain 16% of the variance in venture creation. This finding supports evidence in literature suggesting that the possession of technical skills such as management skills and entrepreneurial skills tend to predict entrepreneurs' engagement in growth-orientated businesses (Cooney, 2012). This also supports the view that entrepreneurs need to combine technical skills such as entrepreneurial skills (Greblikaite et al., 2016; Ferreira et al., 2017; Solesvik, 2019) with intentions (Herrington and Kew, 2013) to make entrepreneurial pursuits possible. It is important to note that none of the demographic variables included in the analysis were statistically significant predictors of entrepreneurial readiness behaviour. Therefore, the relationship between technical skills and venture creation remains significant, even after controlling for demographic variables. These findings support Hypothesis 2a, which suggests that *there is a positive and significant relationship between technical skills and venture creation.*

8.3.5 Relationship between technical skills and innovative financing

Previous research shows that entrepreneurs with greater numeracy and financial literacy skills are more likely to engage in innovative financing (Almenberg & Dreber, 2012). As such the significance of technical skills in the formation of entrepreneurial readiness behaviour is hypothesised by predicting that technical skills have a direct impact on innovative financing (see H2b in Table 8.5). The study hypothesised that:
H2b*: There is a positive and statistically significant relationship between technical skills and innovative financing while controlling for demographic variables.*

The hierarchical regression analysis presented in Table 8.5 tests Hypothesis 2b, which predicts a positive and statistically significant relationship between technical skills and innovative financing while controlling for demographic variables.

The Shapiro-Wilk test indicates that the data is not normally distributed (SW statistic=0.955, $p < .001$). Furthermore, the Goldfeld-Quandt test does not provide evidence of heteroscedasticity (GQ statistic=0.877, p=0.766). Lastly, the Variance

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Inflation Factor (VIF) values are less than 1.5, which indicates that there is no evidence of multicollinearity among the predictors. The tolerance values were less than 1, which is also consistent with low multicollinearity.

Table 8. 5: Technical skills predicting innovative financing while controlling for demographic variables.

Predictor	Model 1		Model 2		Collinearity	
	Stand. Estimate	p	Stand. Estimate	p	VIF	Tolerance
Intercept [a]		< .001		< .001		
Age:					1.21	0.826
26-35 years – 18-25 years	0.3390	0.045	0.21900	0.195		
36-49 years – 18-25 years	0.0905	0.726	-0.06265	0.807		
50+ years – 18-25 years	-0.2784	0.562	-0.35148	0.455		
Gender:					1.13	0.883
Female – Male	0.0512	0.710	0.04348	0.747		
Other – Male	1.5926	0.109	1.14915	0.242		
Higher Education Institution (HEI):					1.28	0.779
UFS – CUT	0.0543	0.762	0.09622	0.585		
Other – CUT	0.0357	0.840	0.05654	0.745		
Field:					1.11	0.900
Economic and Management Sciences – Education	-0.0774	0.691	-0.06306	0.742		
Theology – Education	0.4335	0.213	0.49205	0.150		
Health Sciences – Education	-0.2792	0.232	-0.38784	0.094		
Natural and Agricultural Sciences – Education	0.3618	0.187	0.32811	0.223		
Humanities – Education	-0.3911	0.128	-0.46142	0.068		
Other – Education	-0.5388	0.042	-0.56659	0.030		
Considered an entrepreneurial career:					1.13	0.886
No – Yes	0.1922	0.330	0.21565	0.265		
Maybe – Yes	0.0810	0.590	0.14917	0.315		
Entrepreneurial preparation by HEI:					1.12	0.889

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No – Yes	-0.1929	0.233	-0.18887	0.233		
Maybe – Yes	0.0108	0.945	0.04388	0.776		
Exposure to entrepreneurship education:					1.28	0.780
No – Yes	-0.1918	0.173	-0.11284	0.418		
Highest qualification:					1.12	0.897
Certificate – Course	0.2024	0.343	0.18217	0.384		
Diploma – Course	0.1980	0.454	0.19347	0.456		
Advanced diploma – Course	0.5738	0.139	0.66453	0.082		
Bachelor – Course	0.0591	0.782	0.10300	0.622		
Honours – Course	0.0799	0.764	0.18840	0.473		
Master's – Course	-0.1952	0.509	0.00289	0.992		
Doctoral – Course	-1.0400	0.036	-0.80661	0.100		
Technical skills			0.21135	< .001	1.10	0.907
R^2	0.157		0.194			
Change in R^2			0.0367			
F-value	F(25,274)2.04, p=0.003		F(26,273)12.4, p<0.02			

The analysis includes two models, with Model 1 (see Table 8.5) considering only the demographic variables, and Model 2 (see Table 8.5) adding technical skills as a predictor.

The results indicate that the demographic variables in Model 1 (see Table 8.5) explain 15.7% of the variance in innovative financing, which is statistically significant [F(25, 274) =2.04, p=0.003]. However, when technical skills are added in Model 2 (see Table 8.5), the variance explained increases to 19.4%, which is also statistically significant [F(26, 273) =12.4, p < 0.02]. This suggests that technical skills have a significant positive relationship with innovative financing, even after controlling for demographic variables.

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The standardised estimate for technical skills in Model 2 (see Table 8.5) is 0.211, which indicates that a one-unit increase in technical skills is associated with a 0.211 unit increase in innovative financing. This relationship is statistically significant ($p < 0.001$).

Pu et al. (2021) indicates that ventures have been capitalising on skills and innovative financing to overcome unforeseen consequences such as the negative impact of Covid 19. While this finding is indicative of the joint effect of technical skills and innovative financing on business stability, the finding of this study suggests a positive and significant relationship between technical skills and innovative financing.

Overall, the results support Hypothesis 2b and suggest *that technical skills are an important predictor of innovative financing* among the study population, even after accounting for demographic variables such as age, gender, education, and exposure to entrepreneurship education.

8.3.6 Relationship between technical skills and venture growth

Previous research (Bruhn et al., 2010) argue that technical skills, such as business acumen and job-specific skills are drivers for venture growth. The current study tested the significance of technical skills in the formation of entrepreneurial readiness behaviour by hypothesising that technical skills have a direct impact on venture growth (see 2c in Table 8.6). The hypothesis was that:

H2c: *There is a positive and statistically significant relationship between technical skills and venture growth while controlling for demographic variables.*

The study, therefore, tested the hypothesis that technical skills are positively related to venture growth while controlling for demographic variables. The analysis employs hierarchical regression to investigate the unique contribution of technical skills to the variance in venture growth, after accounting for the effect of demographic variables. The demographic variables include age, gender, higher education institution, study field, considered an entrepreneurial career, entrepreneurial preparation by HEI, exposure to entrepreneurship education, and highest qualification. The dependent

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variable is venture growth, and the independent variable here is technical skills. The results of the hierarchical regression analysis are presented in Table 8.6.

The Shapiro-Wilk test indicates that the data is not normally distributed (SW statistic=0.968, $p < .001$). Furthermore, the Goldfeld-Quandt test does not provide evidence of heteroscedasticity (GQ statistic=0.786, p=0.908). Lastly, the Variance Inflation Factor (VIF) values are less than 1.5, which indicates that there is no evidence of multicollinearity among the predictors. The Tolerance values were less than 1, which is also consistent with low multicollinearity.

Table 8. 6: Technical skills predicting venture growth while controlling for demographic variables.

	Model 1		Model 2		Collinearity	
Predictor	Stand. Estimate	p-value	Stand. Estimate	p-value	VIF	Tolerance
Intercept [a]		< .001		< .001		
Age:					1.21	0.826
26-35 years – 18-25 years	0.33953	0.044	0.23852	0.160		
36-49 years – 18-25 years	0.07365	0.775	-0.05528	0.831		
50+ years – 18-25 years	-0.27768	0.562	-0.33918	0.474		
Gender:					1.13	0.883
Female – Male	-0.20085	0.145	-0.20734	0.127		
Other – Male	1.50671	0.129	1.13339	0.251		
Higher Education Institution (HEI):					1.28	0.779
UFS – CUT	-0.26471	0.140	-0.22938	0.196		
Other – CUT	0.00116	0.995	0.01869	0.915		
Field:					1.11	0.900
Economic and Management Sciences – Education	-0.04765	0.807	-0.03555	0.853		
Theology – Education	-0.49951	0.151	-0.45020	0.190		
Health Sciences – Education	-0.18140	0.437	-0.27285	0.240		
Natural and Agricultural Sciences – Education	-0.02588	0.925	-0.05425	0.841		
Humanities – Education	-0.52252	0.042	-0.58172	0.022		

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Other – Education	-0.20299	0.442	-0.22636	0.385		
Considered an entrepreneurial career:					1.13	0.886
No – Yes	0.54203	0.006	0.56174	0.004		
Maybe – Yes	0.01526	0.919	0.07261	0.627		
Entrepreneurial preparation by HEI:					1.28	0.780
No – Yes	-0.01302	0.936	-0.00960	0.952		
Maybe – Yes	0.05174	0.742	0.07959	0.608		
Exposure to entrepreneurship education:					1.12	0.889
No – Yes	-0.47028	< .001	-0.40383	0.004		
Highest qualification:					1.12	0.897
Certificate – Course	0.05198	0.807	0.03498	0.868		
Diploma – Course	-0.41984	0.113	-0.42369	0.105		
Advanced diploma – Course	0.31767	0.412	0.39402	0.304		
Bachelor – Course	-0.06973	0.743	-0.03276	0.876		
Honours – Course	0.01509	0.955	0.10642	0.687		
Master's – Course	-0.07619	0.796	0.09057	0.760		
Doctoral – Course	-0.73923	0.135	-0.54279	0.270		
Technical skills			0.17791	0.003	1.10	0.907
R^2	0.159		0.185			
Change in R^2			0.026			
F-value	F(25,274)2.07, p=0.003		F(26,273)2.38, p<0.001			

In Model 1 (see Table 8.6), the demographic variables explain 15.9% of the variance in venture growth, [F(25, 274) =2.07, p=0.003]. Among the demographic variables, only those in the humanities field were significantly associated with lower levels of venture growth (β=-0.52, p=0.042). Traditionally, this discipline has no business-related course and therefore, students in this field may not know how to capitalise on opportunities to create growth for their ventures (Walker, 2023).

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In Model 2 (see Table 8.6), technical skills were added to the regression equation. The results show that technical skills are a significant predictor of venture growth, even after controlling for demographic variables (β=0.18, p=0.003). The addition of technical skills significantly improved the model's predictive power, as indicated by the change in R^2 (ΔR2 =0.026) and the F-value [F(26, 273) =2.38, p < 0.001]. The positive connection between technical skills and venture growth is not supported by literature. For instance, Agénor and Canuto (2017) argue that ventures depend on innovation to survive, compete and expand and not necessarily on the accumulation of technical skills by their owners. Therefore, since technical skills were just as important, entrepreneurs should acquire not only technical skills, but also innovation capabilities.

The findings support Hypothesis 2c, suggesting that *technical skills are positively related to venture growth*, despite demographic variables. Therefore, enhancing technical skills can be a valuable strategy in promoting entrepreneurial readiness behaviours and fostering venture growth.

8.3.7 Relationship between entrepreneurial skills and venture creation

The significance of entrepreneurial skills in the formation of entrepreneurial readiness behaviour is hypothesised by predicting that entrepreneurial skills have a direct impact on venture creation (see H3a in Table 8.7). It was hypothesised that *there is a positive and statistically significant relationship between entrepreneurial skills and venture creation while controlling for demographic variables.*

Table 8.7 presents the results of a hierarchical regression analysis examining the relationship between entrepreneurial skills and venture creation while controlling for demographic variables. The analysis includes two models: Model 1 (see Table 8.7) with demographic variables as predictors, and Model 2 (see Table 8.7) with entrepreneurial skills as an additional predictor. The collinearity statistics, Variance Inflation Factor (VIF) and Tolerance, are also reported to check for multicollinearity between the predictors.

The Shapiro-Wilk test indicates that the data is not normally distributed (SW statistic=0.968, p < .001). Furthermore, the Goldfeld-Quandt test does not provide

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evidence of heteroscedasticity (GQ statistic=0.732, p=0.962). Lastly, the Variance Inflation Factor (VIF) values are less than 1.5, which indicates that there is no evidence of multicollinearity among the predictors. The Tolerance values were less than 1, which is also consistent with low multicollinearity.

Table 8. 7: Entrepreneurial skills predicting venture creation while controlling for demographic variables

Predictor	Model 1		Model 2		Collinearity	
	Stand. Estimate	p-value	Stand. Estimate	p-value	VIF	Tolerance
Intercept [a]		< .001		< .001		
Age:					1.07	0.936
26-35 years – 18-25 years	0.0513	0.728	0.04318	0.767		
36-49 years – 18-25 years	-0.1003	0.638	-0.06802	0.747		
50+ years – 18-25 years	-0.8313	0.051	-0.78950	0.061		
Gender:					1.12	0.890
Female – Male	0.0961	0.490	0.05189	0.707		
Other – Male	1.6905	0.091	1.48180	0.134		
Higher Education Institution (HEI):					1.23	0.813
UFS – CUT	-0.0923	0.584	-0.00108	0.995		
Other – CUT	0.0367	0.829	0.05844	0.727		
Field of study:					1.09	0.918
Economic and Management Sciences – Education	-0.2346	0.225	-0.22754	0.233		
Theology – Education	-0.7596	0.026	-0.91788	0.007		
Health Sciences – Education	-0.3670	0.116	-0.34085	0.139		
Natural and Agricultural Sciences – Education	-0.6278	0.023	-0.70422	0.010		
Humanities – Education	-0.3196	0.216	-0.36586	0.152		
Other – Education	-0.4063	0.128	-0.29523	0.267		
Considered an entrepreneurial career:					1.09	0.914
No – Yes	0.1319	0.497	0.13985	0.466		
Maybe – Yes	-0.2215	0.139	-0.22285	0.131		
Entrepreneurial preparation by HEI:					1.11	0.903
No – Yes	-0.1116	0.487	-0.13375	0.399		

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Maybe – Yes	-0.0292	0.854	-0.05658	0.718		
Exposure to entrepreneurship education:					1.24	0.808
No – Yes	-0.2784	0.045	-0.23107	0.094		
Entrepreneurial skills			0.17179	0.004	1.06	0.946
R^2	0.109		0.135			
Change in R^2			0.0264			
F-value	F(18,281)1.90, p=0.016		F(19,280)2.30, p=0.002			

According to Dada et al. (2023), venture creation is a complex process that requires skills. Meyer and Synodinos (2019) suggests that individuals should possess a certain level of entrepreneurial skills in order to create a new venture. In addition, entrepreneurial skills are a specific expertise that is necessary to create and maintain a new venture (Pyysiainen et al., 2006; Balmaceda, 2018). Entrepreneurial skills, such as risk-taking could help undergraduate students to navigate uncertainties and challenges associated with creating a new venture (Al-Mamary & Alshallaqi, 2022). Drewery et al. (2020) suggest that persistence and resilience could assist undergraduate students who aspire to create new ventures and to overcome setbacks. These entrepreneurial skills are critical when creating a new venture, as this is an unpredictable and challenging process. Therefore, in view of the previous literature, the study tested the significance of entrepreneurial skills in the formation of entrepreneurial readiness behaviour (see H3a in Table 8.7).

The demographic variables included in the analysis are age, gender, higher education institution, field of study, consideration of an entrepreneurial career, entrepreneurial preparation by HEI, and exposure to entrepreneurship education. The intercept value is not reported in Model 1 (see Table 8.7), and the p-value is < .001, indicating that the model is statistically significant.

Among the demographic variables, only the field of study shows statistically significant but negative relationship with entrepreneurial readiness behaviour in Model 1. The coefficients for all other variables are not statistically significant. This contradicts literature which suggests mixed results on the connection between field of study

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(especially entrepreneurship-related study fields) and expression of entrepreneurial intention through venture creation (Fatoki, 2014b; Malabena & Swanepoel, 2015). For instance, Ho et al. (2014) confirm a positive relationship between intention and entrepreneurial education, implying that these students have a better understanding of the skills required in the process of venture creation.

In Model 2 (see Table 8.7), after controlling for demographic variables, entrepreneurial skills have a positive and statistically significant relationship with venture creation (β=0.17179, p=0.004). This coheres with Gieure et al. (2020), who suggest that participants with higher levels of entrepreneurial skills (e.g., attained through participation in entrepreneurial programmes) were more likely to engage in entrepreneurial activities. The change in R-squared between Model 1 and Model 2 (see Table 8.7) is statistically significant (ΔR^2 =0.0264, F(1, 280) =6.42, p=0.012), indicating that the addition of entrepreneurial skills (β=0.17179, p=0.004) as a predictor improves the predictive accuracy of venture creation.

The results provide support for Hypothesis 3a, which posits that *there is a positive and statistically significant relationship between entrepreneurial skills and venture creation* while controlling for demographic variables. The findings suggest that developing entrepreneurial skills may be an effective way for promoting entrepreneurial readiness behaviour among individuals, regardless of their demographic characteristics.

8.3.8 Relationship between entrepreneurial skills and innovative financing

Previous literature has analysed the relationship between entrepreneurial skills and innovation (Ullah, 2019). Evidence suggests that the possession of entrepreneurial skills has potential to improve financial bootstrapping strategy of the founder in ways that sustain the growth of a venture (Block et al., 2021). Motivated by this literature, the current study investigated the importance of developing entrepreneurial skills in generating innovative financing behaviours by surmising that entrepreneurial skills have a direct impact on innovative financing (see H3b in Table 8.8). The study hypothesised that:

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H3b: *There is a positive and statistically significant relationship between entrepreneurial skills and innovative financing while controlling for demographic variables.*

The objective of the hierarchical regression analysis was to test the relationship between entrepreneurial skills and entrepreneurial readiness behaviours, specifically innovative financing, while controlling for demographic variables. The analysis strove to determine whether there was a statistically significant positive relationship between the two variables.

Table 8.8 presents the results of the hierarchical regression analysis. Model 1 catered for the demographic variables, including age, gender, HEI, field, having considered an entrepreneurial career, entrepreneurial preparation by HEI, exposure to entrepreneurship education, and highest qualification. Model 2 included entrepreneurial skills as an additional predictor variable.

The Shapiro-Wilk test indicates that the data is not normally distributed (SW statistic=0.942, p < .001). Furthermore, the Goldfeld-Quandt test does not provide evidence of heteroscedasticity (GQ statistic=0.756, p=0.804). Lastly, the Variance Inflation Factor (VIF) values are less than 1.5, which indicates that there is no evidence of multicollinearity among the predictors. The Tolerance values were less than 1, which is also consistent with low multicollinearity.

Table 8. 8: Entrepreneurial skills predicting innovative financing while controlling for demographic variables

Predictor	Model 1		Model 2		Collinearity	
	Stand. Estimate	p-value	Stand. Estimate	p-value	VIF	Tolerance
Intercept [a]		< .001		< .001		
Age:					1.20	0.832
26-35 years – 18-25 years	0.3390	0.045	0.2635	0.101		
36-49 years – 18-25 years	0.0905	0.726	0.0232	0.925		

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50+ years – 18-25 years	-0.2784	0.562	-0.3543	0.437		
Gender:					1.13	0.884
Female – Male	0.0512	0.710	-0.0196	0.881		
Other – Male	1.5926	0.109	1.2672	0.180		
Higher Education Institution (HEI):					1.29	0.776
UFS – CUT	0.0543	0.762	0.1678	0.328		
Other – CUT	0.0357	0.840	0.0245	0.884		
Field:					1.11	0.899
Economic and Management Sciences – Education	-0.0774	0.691	-0.0821	0.658		
Theology – Education	0.4335	0.213	0.2298	0.489		
Health Sciences – Education	-0.2792	0.232	-0.2360	0.287		
Natural and Agricultural Sciences – Education	0.3618	0.187	0.2616	0.316		
Humanities – Education	-0.3911	0.128	-0.4584	0.061		
Other – Education	-0.5388	0.042	-0.3399	0.181		
Considered an entrepreneurial career:					1.12	0.890
No – Yes	0.1922	0.330	0.2180	0.245		
Maybe – Yes	0.0810	0.590	0.1124	0.431		
Entrepreneurial preparation by HEI:					1.12	0.889
No – Yes	-0.1929	0.233	-0.2356	0.126		
Maybe – Yes	0.0108	0.945	-0.0446	0.766		
Exposure to entrepreneurship education:					1.27	0.785
No – Yes	-0.1918	0.173	-0.1070	0.425		
Highest qualification:					1.12	0.897
Certificate – Course	0.2024	0.343	0.1928	0.341		
Diploma – Course	0.1980	0.454	0.2733	0.278		
Advanced diploma – Course	0.5738	0.139	0.4875	0.186		
Bachelor – Course	0.0591	0.782	0.2211	0.280		
Honours – Course	0.0799	0.764	0.1809	0.475		
Master's – Course	-0.1952	0.509	0.0457	0.872		
Doctoral – Course	-1.0400	0.036	-0.8044	0.088		

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Entrepreneurial skills			0.3200	< .001	1.09	0.917
R^2		0.157		0.243		
Change in R^2				0.086		
F-value	F(25,274)2.04,p=0.003		F(26,273)3.374, p<0.001			

The results indicate that there was a statistically significant positive relationship between entrepreneurial skills and innovative financing behaviours (β=0.32, p < 0.001), even after controlling for demographic variables. The change in R^2 between Model 1 and Model 2 (see Table 8.8) was significant (ΔR^2 =0.086, p < 0.001), indicating that the addition of entrepreneurial skills as a predictor variable significantly improved the predictive power of the model.

Among the demographic variables, only age has a statistically significant relationship with innovative financing behaviours. These results indicate that participants aged between 26-35 years were more likely to exhibit innovative financing behaviours compared to those aged 18-25 years (β=0.339, p=0.045). This study suggests that young adults tend to have a greater proclivity to exhibit innovative financial behaviours by virtue of their increased access to emerging technologies compared to older people. This finding contradicts the narrative that mature people tend to be more successful entrepreneurs as they tend to have more access to financial capital, value-based social networks and would have accumulated more human capital (Maritz et al., 2021). This supports the view that empirical literature on the characteristics of predominantly highly successful entrepreneurs contradicts results concerning the age of entrepreneurs as a predictive factor (Azoulay et al., 2020).

In conclusion**,** the results provide support for Hypothesis 3b, which predicted *a positive and statistically significant relationship between entrepreneurial skills and innovative financing behaviours* while controlling for demographic variables.

8.3.9 Relationship between entrepreneurial skills and venture growth

Although there is an increase in studies on entrepreneurial skills (Loué & Baronet, 2012; Deakins et al., 2016; Shabbir et al., 2016), there is not much literature on

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entrepreneurial skills necessary for entrepreneurs in South Africa for growing successful ventures (Mamabolo et al., 2017a). Therefore, measuring the relationship between entrepreneurial skills and venture growth is critical. In pursuit of this, the study sought to investigate the significance of entrepreneurial skills in the formation of entrepreneurial readiness behaviour by predicting that entrepreneurial skills have a direct impact on venture growth (see H3c in Table 8.9).

The study hypothesised that H3c: *There is a positive and statistically significant relationship between entrepreneurial skills and venture growth while controlling for demographic variables.*

The hypothesis tested in this hierarchical regression analysis is whether there is a positive and statistically significant relationship between entrepreneurial skills and venture growth while controlling for demographic variables. The analysis caters for several demographic variables as control variables, including age, gender, higher education institution (HEI), field of study, whether the participant has considered an entrepreneurial career, whether the participant has received entrepreneurial preparation from an HEI, exposure to entrepreneurship education, and highest qualification.

Model 1 (see Table 8.9) includes only the demographic control variables, while Model 2 includes the entrepreneurial skills predictor. The Shapiro-Wilk test indicates that the data is not normally distributed (SW statistic=0.962, $p < .001$). Furthermore, the Goldfeld-Quandt test does not provide evidence of heteroscedasticity (GQ statistic=0.818, p=0.866). Lastly, the Variance Inflation Factor (VIF) values are less than 1.5, which indicates that there is no evidence of multicollinearity among the predictors. The Tolerance values were less than 1, which is also consistent with low multicollinearity. The results are summarised in Table 8.9.

Table 8. 9: Entrepreneurial skills predicting venture growth while controlling for demographic variables

Predictor	Model 1		Model 2		Collinearity	
	Stand. Estimate	p-value	Stand. Estimate	p-value	VIF	Tolerance

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Intercept [a]		< .001		< .001		
Age:					1.20	0.832
26-35 years – 18-25 years	0.33953	0.044	0.28426	0.085		
36-49 years – 18-25 years	0.07365	0.775	0.02433	0.923		
50+ years – 18-25 years	-0.27768	0.562	-0.33328	0.476		
Gender:					1.13	0.884
Female – Male	-0.20085	0.145	-0.25272	0.061		
Other – Male	1.50671	0.129	1.26829	0.190		
Higher Education Institution (HEI):					1.29	0.776
UFS – CUT	-0.26471	0.140	-0.18153	0.302		
Other – CUT	0.00116	0.995	-0.00705	0.967		
Field:					1.11	0.899
Economic and Management Sciences – Education	-0.04765	0.807	-0.05109	0.788		
Theology – Education	-0.49951	0.151	-0.64875	0.057		
Health Sciences – Education	-0.18140	0.437	-0.14976	0.510		
Natural and Agricultural Sciences – Education	-0.02588	0.925	-0.09933	0.710		
Humanities – Education	-0.52252	0.042	-0.57184	0.023		
Other – Education	-0.20299	0.442	-0.05726	0.826		
Considered an entrepreneurial career:					1.12	0.890
No – Yes	0.54203	0.006	0.56089	0.004		
Maybe – Yes	0.01526	0.919	0.03825	0.794		
Entrepreneurial preparation by HEI:					1.12	0.889
No – Yes	-0.01302	0.936	-0.04431	0.778		
Maybe – Yes	0.05174	0.742	0.01119	0.942		
Exposure to entrepreneurship education:					1.27	0.785
No – Yes	-0.47028	< .001	-0.40816	0.003		
Highest qualification:					1.12	0.897
Certificate – Course	0.05198	0.807	0.04494	0.829		
Diploma – Course	-0.41984	0.113	-0.36467	0.158		
Advanced diploma – Course	0.31767	0.412	0.25443	0.500		
Bachelor – Course	-0.06973	0.743	0.04897	0.815		
Honours – Course	0.01509	0.955	0.08907	0.731		

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Master's – Course	-0.07619	0.796	0.10033	0.730		
Doctoral – Course	-0.73923	0.135	-0.56664	0.241		
Entrepreneurial skills			0.23445	< .001	1.09	0.917
R^2	0.159		0.205			
Change in R^2			0.0462			
F-value	F(25,247) 2.07, p=0.003		F(26,273)2.71, p<0.001			

The results indicate that, in Model 1 (see Table 8.9), only one demographic variable is statistically significant. Participants aged 26-35 years old are more likely to exhibit venture growth compared to those aged 18-25 years old. This result supports Strydom et al.'s (2020) study that found that the age group of 26-35 years old demonstrates more entrepreneurial intention to grow a venture than any other age group. Sahinidis et al., (2021) propose that students (in the age group 26-34 years), with prior work experience demonstrate a higher level of entrepreneurial intention than students in the younger age group of 18-25 years without work experience.

In Model 2 (see Table 8.9), the entrepreneurial skills predictor is statistically significant, indicating that higher levels of entrepreneurial skills are associated with equally higher levels of venture growth. The change in R^2 between Model 1 and Model 2 (see Table 8.9) indicates that adding the entrepreneurial skills predictor significantly improves the model's ability to explain the variance in venture growth. These findings support Joshi (2017) who states that there is a positive relationship between entrepreneurship and growth, and one would assume that possession of entrepreneurship skills would predate one's engagement in specific entrepreneurial behaviours.

The results support the hypothesis that *there is a positive and statistically significant relationship between entrepreneurial skills and venture growth* while controlling for demographic variables.

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8.4 MEDIATION ANALYSIS

In this section, three sets of mediation analyses were conducted with the subdimensions of the entrepreneurial process (opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation) mediating the effects of the sub-dimensions of 4IR skills (soft skills, technical skills and entrepreneurial skills) on the sub-dimensions of entrepreneurial readiness behaviours (venture creation, innovating financing, and venture growth) to test the following hypotheses:

H4: *The effect of 4IR skills on venture creation is mediated by the entrepreneurial process.*
H5: *The effect of 4IR skills on innovative financing is mediated by the entrepreneurial process.*
H6: *The effect of 4IR skills on venture growth is mediated by the entrepreneurial process.*

8.4.1 The entrepreneurial process mediating the effects of the selected 4IR skills on venture creation

It is not possible to test H4 before establishing the relationship between 4IR skills and the entrepreneurial readiness behaviour. Thereafter, the mediation of the entrepreneurial process can be explained. Consistent with the Theory of Planned Behaviour (TPB) that links possession of entrepreneurial traits (e.g., entrepreneurial intentions, entrepreneurial skills) to engagement in specific entrepreneurial behaviours (Ferreira et al., 2012), one would assume that once an entrepreneur has identified an opportunity and acquired the necessary skills to create a venture, the intention of starting the entrepreneurial journey must be established. Therefore, possession of entrepreneurial skills could trigger the entrepreneurial process (e.g., identification of opportunities) and hence the significant correlation of entrepreneurial intention and venture creation (Herrington & Kew 2013; Herrington et al., 2015). Drawing on this narrative, we postulated that the relationship between 4IR skills and venture creation is mediated by the entrepreneurial process.

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The significance of 4IR skills in the formation of venture creation is hypothesised in H4 in Table 8.10, which predicts that the entrepreneurial process fully mediates the effect of 4IR skills on venture creation.

H4: *The effect of 4IR skills on venture creation is mediated by the entrepreneurial process.*

The results of a Generalized Linear Model (GLM) mediation test which explored the mediating effect of aspects of the entrepreneurship process on the relationship between 4IR skills and entrepreneurship readiness behaviour (new venture creation) are presented in Table 8.10. A GLM mediation analysis establishes the statistical significance of the indirect (mediated) effect of a predictor(independent) variable on an outcome (dependent) variable via one or more mediator variables (Barrett, 2018). Serang et al. (2017) assert that mediation arises when the influence of the independent variable(s) on the dependent variable is transmitted through a third variable (the mediator).

According to the mediation analysis method developed by Baron and Kenny (1986), there are three steps to test whether a variable M mediates the effect of X on Y:
1. Regress Y on X and check if X is a significant predictor of Y.
2. Regress M on X and check if X is a significant predictor of M.
3. Regress Y on both X and M and check if M is a significant predictor of Y and if the effect of X on Y is reduced or eliminated.

In this test, there were three independent variables (soft skills, technical skills, and entrepreneurial skills), four mediators (opportunity identification, opportunity validation, opportunity exploitation, and resource mobilisation), and one dependent variable (venture creation). The results in Table 8.10 show the direct effects of each independent variable on the dependent variable, the indirect effects of each independent variable on the dependent variable through each mediator, and the total effects of each independent variable on the dependent variable.

To interpret whether each of the mediators partially or fully mediates the effect of each independent variable on the dependent variable, the direct effects are compared with

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the total effects. If the direct effect is smaller than the total effect, it means that there is some mediation happening. If the direct effect is zero or non-significant, it means that there is full mediation happening. If the direct effect is equal to or larger than the total effect, it means that there is no mediation happening (Agler & De Boeck, 2017).

Table 8. 10: Entrepreneurship process mediating the relationship between the selected 4IR skills and venture creation

				95% C.I. (a)				
Type	Effect	Estimate	SE	Lower	Upper	β	z	p-values
Direct effects	Soft skills ⇒ Venture creation	-0.02464	0.08684	-0.19485	0.14556	-0.02595	-0.2838	0.777
	Technical skills ⇒ Venture creation	0.15319	0.04741	0.06026	0.24611	0.18965	3.2310	0.001
	Entrepreneurial skills ⇒ Venture creation	-0.06789	0.08333	-0.23122	0.09544	-0.07776	-0.8146	0.415
Indirect effects	Soft skills ⇒ Opportunity identification ⇒ Venture creation	-0.00633	0.01470	-0.03515	0.02248	-0.00667	-0.4306	0.667
	Soft skills ⇒ Opportunity validation ⇒ Venture creation	-0.00366	0.00986	-0.02299	0.01567	-0.00386	-0.3713	0.710
	Soft skills ⇒ Opportunity exploitation ⇒ Venture creation	0.00432	0.00964	-0.01456	0.02321	0.00455	0.4486	0.654
	Soft skills ⇒ Resource mobilisation ⇒ Venture creation	-0.00527	0.02871	-0.06153	0.05099	-0.00555	-0.1836	0.854
	Technical skills ⇒ Opportunity identification ⇒ Venture creation	0.00313	0.00799	-0.01254	0.01879	0.00387	0.3914	0.695
	Technical skills ⇒ Opportunity validation ⇒ Venture creation	-0.00103	0.00530	-0.01142	0.00935	-0.00128	-0.1951	0.845
	Technical skills ⇒ Opportunity exploitation ⇒ Venture creation	-0.00672	0.00624	-0.01894	0.00551	-0.00832	-1.0771	0.281
	Technical skills ⇒ Resource mobilisation ⇒ Venture creation	5.65e-4	0.01563	-0.03007	0.03120	6.99e-4	0.0361	0.971
	Entrepreneurial skills ⇒ Opportunity identification ⇒ Venture creation	0.05520	0.02309	0.00995	0.10045	0.06323	2.3912	0.017
	Entrepreneurial skills ⇒ Opportunity validation ⇒ Venture creation	0.02844	0.01710	-0.00508	0.06196	0.03257	1.6628	0.096
	Entrepreneurial skills ⇒ Opportunity exploitation ⇒ Venture creation	0.01399	0.01127	-0.00810	0.03608	0.01602	1.2412	0.215
	Entrepreneurial skills ⇒ Resource mobilisation ⇒ Venture creation	0.08321	0.02963	0.02514	0.14129	0.09532	2.8083	0.005
Total effects	Soft skills ⇒ Venture creation	-0.03558	0.10110	-0.23373	0.16256	-0.03485	-0.3520	0.725
	Technical skills ⇒ Venture creation	0.14913	0.05507	0.04119	0.25707	0.17174	2.7079	0.007
	Entrepreneurial skills ⇒ Venture creation	0.11296	0.09100	-0.06541	0.29132	0.12036	1.2412	0.215

β means beta (standardised regression estimate)

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In the case of soft skills, the direct effect was β=-0.02595 (p=0.777) and total effect was β=-0.03485 (p=0.725). The direct effect is smaller than the total effect, but both are non-significant. This means that there is no evidence that soft skills have any effect on venture creation, either directly or indirectly through any of the mediators. These findings are contradictory to other research that consider soft skills as essential in the opportunity identification process (Mamabolo & Myres, 2020). Rosique-Blasco et al. (2016) further consider soft skills as indispensable for entrepreneurs when creating new ventures. One would assume that entrepreneurial education attained was not efficacious enough to trigger the right quality of soft skills that would directly or indirectly impact venture creation. This is because Cambronero-Alonso (2021), contends that soft skills of an entrepreneur have greater importance than technical skills, and hence education programmes must emphasise the imparting of soft skills during the training.

For technical skills, the direct effect was β=0.18965 (p=0.001) and total effect was β=0.17174 (p=0.001). The direct effect is slightly larger than the total effect, but both are significant. This means that technical skills have a positive and significant effect on venture creation, and that there is no mediation happening through any of the mediators. Although the findings of this study show that there is no mediation from the entrepreneurial process, research exists on the relevance of technical skills in each stage of the entrepreneurial process (Cambronero-Alonso, 2021) and this points to our findings' contradiction of extant literature. This current finding also contradicts the body of literature. For instance, Unger et al. (2011) insists that different skills especially technical skills, are important in venture creation.

Lastly, for entrepreneurial skills, the direct effect was β=-0.06789 (p=0.415) and total effect was β=0.11200 (p=0.001). The direct effect is negative and non-significant, while the total effect is positive and significant. This means that entrepreneurial skills have a positive relationship, yet statistically a non-significant direct and total effect on venture creation. However, there are statistically significant indirect effects through some of the mediators (opportunity identification and resource mobilisation). This would support the finding of the effect of 4IR skills on entrepreneurial readiness behaviours such as venture creation, remains largely debatable (Raza et al., 2019).

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To identify which mediators are responsible for the full mediation of entrepreneurial skills, the indirect effects of entrepreneurial skills are examined through each mediator and the results are as follows:

- Opportunity identification: β=0.06323(p=0.017)
- Opportunity validation: β=0.03257 (p=0.096)
- Opportunity exploitation: β=0.01602 (p=0.215)
- Resource mobilisation: β=0.09532 (p=0.005)

The indirect effects through opportunity identification and resource mobilisation are positive and significant, while the indirect effects through opportunity validation and opportunity exploitation are positive but non-significant. This means that opportunity identification and resource mobilisation are the mediators that fully mediate the positive effect of entrepreneurial skills on venture creation. This also means that for entrepreneurial skills to trigger entrepreneurial behaviours such as venture creation outcomes, students need to be capable of identifying opportunities and mobilising them to generate desirable economic ends. In other words, they need to put into action some of the entrepreneurial processes. As such, the development and exploitation of the entrepreneurial process is fundamental to future success of ventures (Jones et al., 2018). It is evident from the results that opportunity identification and resource mobilisation can mediate the effect of entrepreneurial skills on venture creation.

Table 8. 11: Sub-hypotheses of H4

Sub-hypotheses	**The effect of 4IR skills on venture creation**	**Hypothesis Accepted or Rejected**
H4a	Soft skills ⇒ Opportunity identification ⇒ Venture creation	Rejected
H4b	Soft skills ⇒ Opportunity validation ⇒ Venture creation	Rejected
H4c	Soft skills ⇒ Opportunity exploitation ⇒ Venture creation	Rejected
H4d	Soft skills ⇒ Resource mobilisation ⇒ Venture creation	Rejected
H4e	Technical skills ⇒ Opportunity identification ⇒ Venture creation	Rejected
H4f	Technical skills ⇒ Opportunity validation ⇒ Venture creation	Rejected
H4g	Technical skills ⇒ Opportunity exploitation ⇒ Venture creation	Rejected
H4h	Technical skills ⇒ Resource mobilisation ⇒ Venture creation	Rejected
H4i	Entrepreneurial skills ⇒ Opportunity identification ⇒ Venture creation	Accepted

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H4j	Entrepreneurial skills ⇒ Opportunity validation ⇒ Venture creation	Rejected
H4k	Entrepreneurial skills ⇒ Opportunity exploitation ⇒ Venture creation	Rejected
H4l	Entrepreneurial skills ⇒ Resource mobilisation ⇒ Venture creation	Accepted

8.4.2 The entrepreneurial process mediating the effects of the selected 4IR skills on innovative financing

The literature that exists seems to counter the propositions made in this study. For instance, while it was assumed that the entrepreneurial process (e.g., opportunity identification) shapes the conditions under which venture funding is provided, Celliers et al. (2021), proposes a reverse relationship by suggesting that venture capital (VC) funding is fundamental for entrepreneurs to create opportunities for venture creation. VC is further described as equity funding used to establish new entrepreneurial ventures (Correia et al., 2011; Mbhele, 2012; Portmann & Mlambo, 2013; Els et al., 2014; SAVCA, 2015) and includes start-up capital, growth capital, later-stage financing, rescue capital, replacement capital and buyout-capital (SAVCA, 2019), although entrepreneurs still find it difficult to secure funding (Celliers et al., 2021).

The significance of 4IR skills in the formation of innovative financing is hypothesised in H5, which predicts that the entrepreneurial process fully mediates the effect of 4IR skills on innovative financing (see Table 8.12). The study hypothesised that:

H5: *The effect of 4IR skills on innovative financing is mediated by the entrepreneurial process*

The results of a Generalized Linear Model (GLM) mediation test which explored the mediating effect of aspects of the entrepreneurship process on the relationship between 4IR skills and innovative financing are presented in Table 8.12. The table provides estimates of the direct and indirect effects of soft skills, technical skills, and entrepreneurial skills on innovative financing, through four potential mediators: opportunity identification, opportunity validation, opportunity exploitation, and resource mobilisation.

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Table 8. 12: Entrepreneurship process mediating the relationship between 4IR skills and innovative financing

				95% C.I. (a)				
Type	Relationship path	Estimate	SE	Lower	Upper	β	z	p-value
Direct effects	Soft skills ⇒ Innovative financing	0.13201	0.06829	-0.00183	0.26585	0.15913	1.9331	0.053
	Technical skills ⇒ Innovative financing	0.03848	0.03728	-0.03459	0.11155	0.05454	1.0322	0.302
	Entrepreneurial skills ⇒ Innovative financing	0.01429	0.06553	-0.11414	0.14272	0.01874	0.2181	0.827
Indirect effects	Soft skills ⇒ Opportunity identification ⇒ Innovative financing	-0.00484	0.01125	-0.02689	0.01721	-0.00584	-0.4303	0.667
	Soft skills ⇒ Opportunity validation ⇒ Innovative financing	-0.00500	0.01329	-0.03105	0.02106	-0.00602	-0.3759	0.707
	Soft skills ⇒ Opportunity exploitation ⇒ Innovative financing	0.01064	0.02309	-0.03462	0.05590	0.01283	0.4607	0.645
	Soft skills ⇒ Resource mobilisation ⇒ Innovative financing	-0.00388	0.02112	-0.04527	0.03752	-0.00468	-0.1837	0.854
	Technical skills ⇒ Opportunity identification ⇒ Innovative financing	0.00239	0.00612	-0.00960	0.01438	0.00339	0.3912	0.696
	Technical skills ⇒ Opportunity validation ⇒ Innovative financing	-0.00141	0.00721	-0.01554	0.01272	-0.00200	-0.1958	0.845
	Technical skills ⇒ Opportunity exploitation ⇒ Innovative financing	-0.01653	0.01286	-0.04173	0.00866	-0.02343	-1.2862	0.198
	Technical skills ⇒ Resource mobilisation ⇒ Innovative financing	4.15e-4	0.01150	-0.02212	0.02295	5.89e-4	0.0361	0.971
	Entrepreneurial skills ⇒ Opportunity identification ⇒ Innovative financing	0.04222	0.01800	0.00695	0.07749	0.05537	2.3462	0.019
	Entrepreneurial skills ⇒ Opportunity validation ⇒ Innovative financing	0.03881	0.01659	0.00629	0.07133	0.05089	2.3390	0.019
	Entrepreneurial skills ⇒ Opportunity exploitation ⇒ Innovative financing	0.03443	0.02154	-0.00780	0.07665	0.04515	1.5980	0.110
	Entrepreneurial skills ⇒ Resource mobilisation ⇒ Innovative financing	0.06122	0.02217	0.01777	0.10467	0.08029	2.7614	0.006
Total effects	Soft skills ⇒ Innovative financing	0.12892	0.08806	-0.04367	0.30152	0.13876	1.4640	0.143
	Technical skills ⇒ Innovative financing	0.02335	0.04797	-0.07067	0.11737	0.02954	0.4867	0.626
	Entrepreneurial skills ⇒ Innovative financing	0.19097	0.07927	0.03560	0.34634	0.22360	2.4091	0.016

In the current study, for soft skills:

- Direct effect: β=0.15913 (p=0.053)
- Total effect: β=0.138 (p=0.143)

The direct effect is slightly larger than the total effect, but both are non-significant. This means that there is no evidence that soft skills have any effect on innovative financing, either directly or indirectly through any of the mediators. This corroborates Rebele and Pierre's (2019) view that innovative financing is hard to achieve or improve drawing on the development of soft skills.

For technical skills, the results show:

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- Direct effect: β=0.055 (p=0.302)
- Total effect: β=0.0295 (p=0.626)

The direct effect is larger than the total effect, but both are non-significant. This means that there is no evidence that technical skills have any effect on innovative financing, either directly or indirectly through any of the mediators. It is important to understand that the respondents of this study are students who did not have work experience, especially in the financial field and hence might not have sufficiently developed task-oriented skills such as technical skills. This finding is inconsistent with the general narrative that technical skills are perceived as important to complete job-specific tasks in the financial management of ventures (Deloitte, 2018b).

For entrepreneurial skills, the results show that:
- Direct effect: β=0.01874 (p=0.827)
- Total effect: β=0.2236 (p < 0.001)

The direct effect is positive and non-significant, while the total effect is positive and significant. This means that entrepreneurial skills have a positive and significant effect on innovative financing through some of the mediators, and that there is full mediation happening. This finding somewhat does cohere with the reverse relationship between entrepreneurial skills and innovative financing. For instance, Sariwulan et al. (2020) contend that there is a positive and significant influence of innovative financing on entrepreneurial skills. Therefore, a higher knowledge of innovative financing leads to an increase in entrepreneurial skills.

To identify which mediators are responsible for the full mediation of entrepreneurial skills, the indirect effects of entrepreneurial skills are examined through each mediator below:
- Opportunity identification: β=0.05537 (p=0.019)
- Opportunity validation: β=0.05089 (p=0.019)
- Opportunity exploitation: β=0.04515 (p=0.110)
- Resource mobilisation: β=0.08029 (p < 0.006)

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The indirect effects through opportunity identification, opportunity validation, and resource mobilisation are positive and significant, while the indirect effect through opportunity exploitation is positive but non-significant. This means that opportunity identification, opportunity validation, and resource mobilisation fully mediate the positive effect of entrepreneurial skills on innovative financing. Since full mediation implies the relationship between the antecedent and outcome variables becomes significant and positive only upon the inclusion of the mediator in the model, this means that without the mediator, the antecedent-outcome relationship would not be significant. The finding on full mediation, therefore, does not seem to support Mamabolo and Myres's (2020) claim that certain skills are needed for each stage of the entrepreneurial process and entrepreneurial activities in each stage determine the type of skill required. The full mediation does not seem to give credence to the view that certain entrepreneurial skills, such as creativity and risk-taking are important in the opportunity identification stage, while technical skills such as analytical skills and rational thinking are considered more important in the opportunity validation stage (Rosique-Blasco et al., 2016). Although the results for the relationship between entrepreneurial skills and innovative financing mediated by resource mobilisation are endorsed in this study, literature suggests that there is still a lack of understanding of resource mobilisation processes (Clough, 2019).

Table 8. 13: Sub-hypotheses of H5

Sub-hypotheses	The effect of 4IR skills on innovative financing	Hypothesis Accepted or Rejected
H5a	Soft skills ⇒ Opportunity identification ⇒ Innovative financing	Rejected
H5b	Soft skills ⇒ Opportunity validation ⇒ Innovative financing	Rejected
H5c	Soft skills ⇒ Opportunity exploitation ⇒ Innovative financing	Rejected
H5d	Soft skills ⇒ Resource mobilisation ⇒ Innovative financing	Rejected
H5e	Technical skills ⇒ Opportunity identification ⇒ Innovative financing	Rejected
H5f	Technical skills ⇒ Opportunity validation ⇒ Innovative financing	Rejected
H5g	Technical skills ⇒ Opportunity exploitation ⇒ Innovative financing	Rejected
H5h	Technical skills ⇒ Resource mobilisation ⇒ Innovative financing	Rejected
H5i	Entrepreneurial skills ⇒ Opportunity identification ⇒ Innovative financing	Accepted
H5j	Entrepreneurial skills ⇒ Opportunity validation ⇒ Innovative financing	Accepted

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H5k	Entrepreneurial skills ⇒ Opportunity exploitation ⇒ Innovative financing	Rejected
H5l	Entrepreneurial skills ⇒ Resource mobilisation ⇒ Innovative financing	Accepted

8.4.3 The entrepreneurial process mediating the effects of the selected 4IR skills on venture growth

Since the mediating role of the entrepreneurial process is discussed, one needs to explain entrepreneurship first before deliberating on this process. In literature, entrepreneurship is defined as how individuals use resources and positive opportunities in the process of creating and growing new ventures (Gries & Naudé, 2011). A number of researchers (Venkataraman, 1997; Shane & Venkataraman, 2000), share the view and describe entrepreneurship as activities that include innovation, discovery, exploitation and evaluation of opportunities to improve the development of processes, markets, services and resources through procedures that have not previously existed. An entrepreneur is thus primarily seen as a venture innovator who identifies, exploits and develops opportunities into practical ideas by adding value in the form of skills (Meyer & Synodinos, 2019).

The study predicted entrepreneurial process to fully mediate the effect of 4IR skills on venture growth (see H4 in Table 8.14). The study hypothesised that:

H6: *The effect of 4IR skills on venture growth is mediated by the entrepreneurial process*

Table 8.14 presents the results of the mediating effects of opportunity identification, opportunity validation, opportunity exploitation, and resource mobilisation on the relationship between soft skills, technical skills, and entrepreneurial skills and venture growth. The analysis includes direct effects, indirect effects, and total effects, along with their standard errors and 95% confidence intervals.

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Table 8. 14: Entrepreneurial process mediating the effects of the 4IR skills on venture growth

				95% C.I.				
Type	Relationship path		SE	Lower	Upper	B	z-score	p-value
Direct effects	Soft skills ⇒ Venture growth		0.06772	-0.15941	0.10606	-0.03281	-0.3939	0.694
	Technical skills ⇒ Venture growth		0.03697	0.04084	0.18578	0.16386	3.0646	0.002
	Entrepreneurial skills ⇒ Venture growth		0.06499	-0.11788	0.13687	0.01270	0.1461	0.884
Indirect effects	Soft skills ⇒ Opportunity identification ⇒ Venture growth		0.00607	-0.01444	0.00936	-0.00312	-0.4180	0.676
	Soft skills ⇒ Opportunity validation ⇒ Venture growth		0.00726	-0.01692	0.01154	-0.00331	-0.3704	0.711
	Soft skills ⇒ Opportunity exploitation ⇒ Venture growth		0.03365	-0.05043	0.08149	0.01910	0.4615	0.644
	Soft skills ⇒ Resource mobilisation ⇒ Venture growth		0.02177	-0.04668	0.03868	-0.00492	-0.1837	0.854
	Technical skills ⇒ Opportunity identification ⇒ Venture growth		0.00328	-0.00518	0.00769	0.00181	0.3818	0.703
	Technical skills ⇒ Opportunity validation ⇒ Venture growth		0.00389	-0.00839	0.00687	-0.00110	-0.1950	0.845
	Technical skills ⇒ Opportunity exploitation ⇒ Venture growth		0.01852	-0.06043	0.01216	-0.03490	-1.3033	0.192
	Technical skills ⇒ Resource mobilisation ⇒ Venture growth		0.01186	-0.02281	0.02366	6.20e-4	0.0361	0.971
	Entrepreneurial skills ⇒ Opportunity identification ⇒ Venture growth		0.01573	-0.00871	0.05296	0.02961	1.4065	0.160
	Entrepreneurial skills ⇒ Opportunity validation ⇒ Venture growth		0.01314	-0.00487	0.04663	0.02794	1.5891	0.112
	Entrepreneurial skills ⇒ Opportunity exploitation ⇒ Venture growth		0.03081	-0.01013	0.11064	0.06724	1.6312	0.103
	Entrepreneurial skills ⇒ Resource mobilisation ⇒ Venture growth		0.02263	0.01877	0.10748	0.08446	2.7892	0.005
Total effects	Soft skills ⇒ Venture growth		0.08878	-0.19438	0.15364	-0.02256	-0.2294	0.819
	Technical skills ⇒ Venture growth		0.04836	-0.00469	0.18489	0.11730	1.8630	0.062
	Entrepreneurial skills ⇒ Venture growth		0.07992	0.00924	0.32252	0.19980	2.0756	0.038

β means beta (standardised regression estimate)

For example, for soft skills

- Direct effect: β=-0.03281 (p=0.694)
- Total effect: β=-0.02256 (p=0.819)

The direct effect is smaller than the total effect, but both are non-significant. This means that there is no evidence that soft skills have any effect on venture growth, either directly or indirectly through any of the mediators. In contrast, Tripathy (2020) argues that selected soft skills, such as leadership, teamwork, communication and emotional intelligence, are significant for successful venture growth.

For technical skills:

- Direct effect: β=-0.03281 (p=0.302)
- Total effect: β=0.11730 (p=0.062)

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The direct effect is smaller than the total effect, but both are non-significant. This means that there is no evidence that technical skills have any effect on venture growth, either directly or indirectly through any of the mediators. This negative finding supports Ali's (2018) view that if an entrepreneur possesses a limited level of technical skills, a negative growth can be expected within ventures.

For entrepreneurial skills, the results show that:
- Direct effect: β=0.01270 (p=0.884)
- Total effect: β=0.19980 (p < 0.001)

The direct effect is positive and non-significant, while the total effect is positive and significant. This means that entrepreneurial skills have a positive and significant effect on venture growth through some of the mediators, and that there is full mediation happening. The positive effect of entrepreneurial skill on venture creation is also supported in literature, for instance, this skill is deemed critical to the discovery of new methods linked to the development of markets and the creation of new opportunities (Rwigema & Venter, 2005; Eckhardt et al., 2018; Nagy et al., 2018). Therefore, Naudé (2013) supports the notion that entrepreneurship skill is a facilitator for venture growth and structural change.

To identify which mediators are responsible for the full mediation of entrepreneurial skills, the indirect effects of entrepreneurial skills must be examined through each mediator:
- Opportunity identification: β=0.02961 (p=0.160)
- Opportunity validation: β=0.02794(p=0.112)
- Opportunity exploitation: β=0.06724(p=0.103)
- Resource mobilisation: β=0.08446(p < 0.001)

The indirect effects through resource mobilisation are positive and significant, while the indirect effects through opportunity identification, opportunity validation, and opportunity exploitation are positive but non-significant. Pinelli (2015) contends that entrepreneurs who direct their entrepreneurial skills to maintain and sustain their venture, for instance though continual mobilisation of resources, contribute to the growth of their ventures and create new jobs. This means that resource mobilisation

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fully mediates the positive effect of entrepreneurial skills on venture growth. Moreover, entrepreneurial skills, such as creativity and innovation that were crucial in earlier stages, resurface during the phase of resource mobilisation, allowing entrepreneurs to fully develop their ventures (Chell, 2013; Leyden & Link, 2015). This is visible in Table 8.15, where most sub-hypotheses were rejected except for resource mobilisation mediating the effects of entrepreneurial skills on venture growth.

Table 8. 15: Sub-hypotheses of H6

Sub-hypotheses	The effect of 4IR skills on venture growth	Accepted or Rejected Hypothesis
H6a	Soft skills ⇒ Opportunity identification ⇒ Venture growth	Rejected
H6b	Soft skills ⇒ Opportunity validation ⇒ Venture growth	Rejected
H6c	Soft skills ⇒ Opportunity exploitation ⇒ Venture growth	Rejected
H6d	Soft skills ⇒ Resource mobilisation ⇒ Venture growth	Rejected
H6e	Technical skills ⇒ Opportunity identification ⇒ Venture growth	Rejected
H6f	Technical skills ⇒ Opportunity validation ⇒ Venture growth	Rejected
H6g	Technical skills ⇒ Opportunity exploitation ⇒ Venture growth	Rejected
H6h	Technical skills ⇒ Resource mobilisation ⇒ Venture growth	Rejected
H6i	Entrepreneurial skills ⇒ Opportunity identification ⇒ Venture growth	Rejected
H6j	Entrepreneurial skills ⇒ Opportunity validation ⇒ Venture growth	Rejected
H6k	Entrepreneurial skills ⇒ Opportunity exploitation ⇒ Venture growth	Rejected
H6l	Entrepreneurial skills ⇒ Resource mobilisation ⇒ Venture growth	Accepted

8.5 SUMMARY TABLE OF HYPOTHESES

The results of the mediation roles of the entrepreneurial process variables and the relationship between 4IR skills and the entrepreneurial readiness behaviour variables are summarised in Table 8.16.

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As shown in Table 8.16, of the forty-five hypotheses tested in this research study, only fifteen were accepted. All forty-five hypotheses were previously tabulated (Table 8.1, Table 8.2, Table 8.3, Table 8.4, Table 8.5, Table 8.6, Table 8.7, Table 8.8, Table 8.9, Table 8.10, Table 8.12 and Table 8.14) and mentioned, however the fifteen accepted hypotheses are presented in Table 8.16.

Table 8. 16: Summary of objectives, hypothesis testing and analysis

Objectives	**Hypothesis/ Control variables**	**Evidence/ Significance at 5% level**	**Results**	**Remarks**
Relationship between soft skills and entrepreneurial readiness behaviours	*H1a: There is a positive and statistically significant relationship between soft skills and venture creation while controlling for demographic variables.*	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
	H1b: There is a positive and statistically significant relationship between soft skills and innovative financing while controlling for demographic variables.	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
	H1c: There is a positive and statistically significant relationship between soft skills and venture growth while controlling for demographic variables.	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
Relationship between technical skills and entrepreneurial readiness behaviours	*H2a: There is a positive and statistically significant relationship between technical skills and venture creation while controlling for demographic variables.*	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
	H2b: There is a positive and statistically significant relationship between technical skills and	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data

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	innovative financing while controlling for demographic variables.			
	H2c: There is a positive and statistically significant relationship between technical skills and venture growth while controlling for demographic variables.	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
Relationship between entrepreneurial skills and entrepreneurial readiness behaviours	*H3a: There is a positive and statistically significant relationship between entrepreneurial skills and venture creation while controlling for demographic variables.*	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
	H3b: There is a positive and statistically significant relationship between entrepreneurial skills and innovative financing while controlling for demographic variables.	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
	H3c: There is a positive and statistically significant relationship between entrepreneurial skills and venture growth while controlling for demographic variables.	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
The entrepreneurial process mediating the effects of the 4IR skills on venture creation	*H4i: Opportunity identification fully mediates the relationship between entrepreneurial skills and venture creation.*	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
The entrepreneurial process mediating the effects of the 4IR skills on venture creation	*H4l: Resource mobilisation fully mediates the relationship between entrepreneurial skills and venture creation.*	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data

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The entrepreneurial process mediating the effects of the 4IR skills on innovative financing.	*H5i: Opportunity identification fully mediates the relationship between entrepreneurial skills and innovation financing.*	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
The entrepreneurial process mediating the effects of the 4IR skills on innovative financing.	*H5j: Opportunity validation fully mediates the relationship between entrepreneurial skills and innovation financing.*	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
The entrepreneurial process mediating the effects of the 4IR skills on innovative financing.	*H5l: Resource mobilisation fully mediates the relationship between technical skills and innovation financing.*	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
The entrepreneurial process mediating the effects of the 4IR skills on venture growth.	*H6l: Resource mobilisation fully mediates the relationship between entrepreneurial skills and venture growth.*	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data

8.6 CHAPTER SUMMARY

The chapter focused on the extent to which the entrepreneurial process (i.e., opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation) mediated the effect of soft skills, technical skills and entrepreneurial skills on venture creation, venture growth and innovative financing.

Next, the internal consistency approach was followed to measure the reliability and validity of the independent variables (soft skills, technical skills and entrepreneurial skills), the dependent variables (venture creatin, innovative financing and venture growth), and the mediators (opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation). Soft skills and entrepreneurial skills were highly reliable and valid, while technical skills indicated satisfactory reliability and validity. All the dimensions of the entrepreneurial readiness behaviour, namely venture creation, innovative financing and venture growth were highly reliable and valid. All the dimensions of the entrepreneurial process, namely opportunity

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identification, opportunity validation, opportunity exploitation and resource mobilisation were highly reliable and valid.

The results of the GLM mediation test were presented in Table 8.10, Table 8.12 and Table 8.14. These tables confirm the mediating effect of the dimensions of the entrepreneurial process on the relationship between 4IR skills and the dimensions of entrepreneurial readiness behaviour. Based on the results, H1a, H1b, H1c, H2a, H2b, H2c, H3a, H3b, H3c, H4i, H4l, H5i, H5j, H5l and H6l are accepted while H4a, H4b, H4c, H4d, H4e, H4f, H4g, H4h, H4j, H4k, H5a, H5b, H5c, H5d, H5e, H5f, H5g, H5h, H5k, H6a, H6b, H6c, H6d, H6e, H6f, H6g, H6h, H6i, H6j and H6k are rejected. The next chapter presents the conclusions and recommendations for this study.

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CHAPTER 9 CONCLUSION AND RECOMMENDATIONS

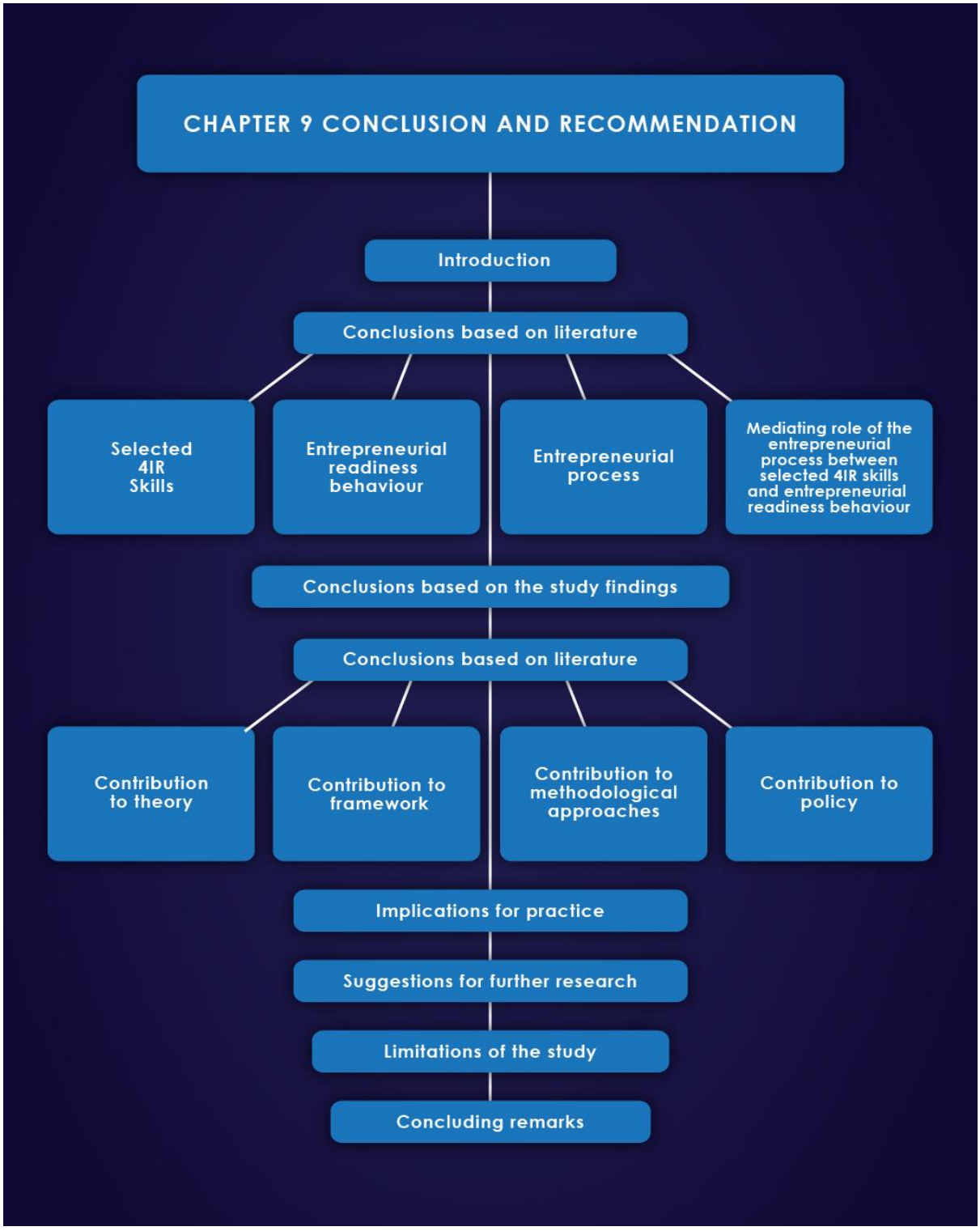

Figure 9. 1: Flow diagram indicating the structure of Chapter 9

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9.1 INTRODUCTION

The previous chapter presented findings of hypotheses testing and the entrepreneurial process' mediation of the relationship between 4IR skills and entrepreneurial readiness behaviour. The data set was extracted from research conducted on two selected higher education institutions (HEIs) in South Africa, namely the Central University of Technology (CUT) and the University of the Free State (UFS). The findings proved the predictive effect of selected 4IR skills on students' entrepreneurial readiness behaviour. The study also drew on the Human Capital Theory as a theoretical lens to explain how entrepreneurship training and education, especially the acquisition of specific skills, are instrumental in shaping entrepreneurial outcomes (Martin et al., 2013), especially entrepreneurial readiness behaviours. The current chapter builds on these insights to provide some conclusions and recommendations, based on the objectives of this research study. It is structured to synthesise conclusions based on extant literature. Secondly, conclusions based on the empirical findings are recapped, drawing on research questions. Thirdly, the contributions of this study to theory, framework, methodology, policy and practice are rendered. Then, the suggestions for future research are articulated. Thereafter, the limitations of the study are stated, leading to the concluding remarks.

9.2 CONCLUSIONS BASED ON LITERATURE

The purpose of this research study is to contribute to entrepreneurial research by explaining the processes under which selected 4IR skills interact with specific forms of entrepreneurial outcomes, especially entrepreneurial readiness behaviours. Drawing on literature (Rwigema & Venter, 2004; Cardone & Fonseca, 2006; Prelipcean et al., 2014; Kirkley, 2016; Mamabolo et al., 2017a), the study presented the entrepreneurial process comprising venture creation, innovative financing and venture growth as principal mechanisms through which 4IR skills generate entrepreneurial readiness behaviours in the unique context of a developing country. To synthesise this relationship, the broad literature on entrepreneurship explored the individual concepts and their constitutive dimensions including how these relationships have been discussed in literature. Therefore, the next section explores the highlights of each concept, including their relationships with other constructs as postulated in literature.

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9.2.1 Selected 4IR skills

Given the growing body of literature on the range of 4IR skills (World Economic Forum, 2016; Eberhard et al., 2017; Deloitte, 2018b; Panah & Rusman, 2018), the research investigated which of these skills are fundamental in higher education curricula with a view to shaping students' nascent entrepreneurial behaviours within and beyond their university education. Literature characterises such entrepreneurial behaviours as comprising student capacity to engage in new venture creation (Shah et al., 2020), their ability to be innovative in their finance ventures (Bonini & Capizzi, 2019) and developing their venture growth (Palma et al., 2009; McAdam & Cunningham, 2019).

Evidence from the literature suggests that of the wide range of 4IR skills spanning soft skills (Van Laar et al., 2017), human skills (Ra, 2018), methodological skills (Ivaldi et al., 2021), social skills, personal skills and technical skills (Saniuk et al., 2022), the most germane to the higher educational context of South Africa are soft skills (Mabe & Bwalya, 2022), technical skills (Gudanowska et al., 2018) and entrepreneurial skills (Olumuyiwa et al., 2023). In higher educational contexts, soft skills enable students to communicate verbally and non-verbally (Mwita et al., 2023), work effectively in teams (Succi, 2019) and to acquire problem solving skills (Rahman, 2019), while technical skills promote time management, connectivity, organisation and information management (Rodrigues et al., 2021). In tandem, entrepreneurial skills enable graduates to think constructively, communicate effectively and solve problems creatively to succeed in the job market (Sansone et al., 2021). The dimensions of 4IR skills, considered fundamental in this research study, are therefore soft skills, technical skills and entrepreneurial skills (Deloitte, 2018b).

Having identified the range of 4IR skills germane for the context of this investigation, the next step was to assess the possible connection between students' 4IR skills and entrepreneurial readiness behaviours as a basis for determining if such skills are worthy of inclusion or incorporating into specific programmes at HEIs to nurture such behaviours. Evidence from literature suggests that the acquirement of 4IR skills contributes directly to the manifestation of entrepreneurial readiness behaviours (Reddy et al., 2016; Xu et al., 2018; Raza et al., 2019). This postulation is consistent with the widely held notion at South African HEIs that adapting to the volatile changes

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brought about by 4IR means that students deploy their 4IR skills in ways that generate and sustain specific forms of entrepreneurial behaviours and attitudes that should sustain their careers (Collins & Halverson, 2009; Grand-Clement, 2017; Naidu, 2018).

While integrating all the 4IR skills was deemed useful to understand their collective impact on entrepreneurial readiness behaviours (Chauke, 2018), such an approach forecloses an understanding of the individual effect of each dimension of the selected 4IR skills. There is growing literature (Farooq, 2018; Akter & Iqbal, 2022) that calls for an investigation into the specific dimensions of 4IR skills to correctly gauge their impact on entrepreneurial processes, activities and behaviours.

9.2.1.1 Soft skills

As discussed in the literature review (see section 2.4.1), soft skills include personality traits, personal habits, language, communication and social relationships. Although soft skills are difficult to acquire, these skills can be taught (UPV, 2019) to university students to develop their entrepreneurial readiness behaviours. Soft skills, such as leadership, creative thinking, critical thinking, social emotional learning, communication, teamwork, collaboration, initiative, adaptability, growth mind-set, self-confidence, cultural awareness and empathy (Deloitte, 2018b) have been reported as fundamental to the development of entrepreneurial behaviours in business environment (Youth Business International, 2019).

9.2.1.2 Technical skills

Literature states that technical skills are a requirement for any entrepreneur to perform job-specific activities and thereby ensure the success of a venture (Gonçalves et al., 2017). There is general consensus that students should be motivated to acquire technical skills, such as coding, computer programming, scientific tasks, mechanical functions and other job-specific skills (Deloitte, 2018b) to improve entrepreneurial readiness behaviour. However, contradicting research (Andrews & Higson, 2008; Gonçalves et al., 2017; Deloitte, 2018a) point to the difficulty of aligning these technical skills to the advantage of student entrepreneurs. Overall, however, considering that technological transformation demands enhanced technical knowledge (Trivedi, 2019), students are expected to develop their technical skills in ways that contribute to higher

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levels of entrepreneurial readiness behaviour (Deloitte Global & the Global Business Coalition for Education, 2018; Petrillo et al., 2018).

9.2.1.3 Entrepreneurial skills

Recent literature identifies low levels of entrepreneurial skills as potentially undermining student engagement in entrepreneurial activity (Adendorff et al., 2013; Mamabolo et al., 2017a). Conversely, research (Letaifa & Goglio-Primard, 2016) also provides evidence that having entrepreneurial skills among students is instrumental in better positioning them to establish new ventures. Entrepreneurial skills could assist student entrepreneurs to adapt to changes and improve their skill set for future opportunities (Deloitte, 2018a). Entrepreneurial skills, such as creativity, innovation, resourcefulness, business execution, business acumen, courage, risk-taking, initiative, industriousness, ingenuity, optimism, resilience and curiosity (Deloitte, 2018b) have the potential to improve student entrepreneurship activity (Mamabolo et al., 2017a).

9.2.2 Entrepreneurial readiness behaviour

Entrepreneurial readiness can be defined as specific behaviours that orient an individual for the execution of entrepreneurial actions, activities and practices. A competent entrepreneur who observes their environment and channel their productive and creative potential in such a manner, has the capacity to reach self-actualisation and survive challenges (Coduras et al., 2016; Ruiz et al., 2016). Entrepreneurial behaviour, therefore, denotes an entrepreneur's actions engaged in the execution of the entrepreneurial process. An entrepreneur's actions set them apart from non-entrepreneurs (Ndofirepi, 2016) as such behaviour is oriented towards the creation and growth of ventures. Entrepreneurial behaviour improves survival and the margin of success of ventures during transformation (McAdam & Cunningham, 2019) through the interrelated processes of dream, business idea and venture creation (Metallo et al., 2021).

Previous studies have focused on various entrepreneurial behaviours such as entrepreneurial intentions to behaviour (Neneh, 2019), entrepreneurial behaviour and startups (Richter et al., 2018), and cultural differences relative to entrepreneurial

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behaviour (Covin et al., 2020). Encouraging entrepreneurial behaviour has been presented as a major objective in entrepreneurship (Wang et al., 2022), despite the controversies on the dimensions of entrepreneurial behaviour. Consistent with past literature (Rwigema & Venter, 2004; Cardone & Fonseca, 2006; Prelipcean et al., 2014; Kirkley, 2016; Mamabolo et al., 2017a), the current study identified venture creation, innovative financing and venture growth as the main dimensions of entrepreneurial readiness behaviour. The study builds on this characterisation, because it sufficiently captures what goes into the directing of behaviour to create a positive mindset towards entrepreneurial activities in an entrepreneurial environment. Entrepreneurship becomes incomprehensible without considering the new economic value added to communities through venture creation, innovative financing and venture growth. For clarity, the three dimensions of entrepreneurial readiness behaviour are further elaborated on.

9.2.2.1 Venture creation

Venture creation is established when the pursuit of opportunities has been identified (Kirzner, 1973; Dess et al., 1999; Shane & Venkataraman, 2000; Fox, 2004; Rusu et al., 2012; Bernoste et al., 2019). Successful new ventures adapt their entrepreneurial behaviours to keep pace with changing opportunities (Sackett et al., 2003; Rwigema & Venter, 2004; Thrassou et al., 2018). There is compelling evidence found in literature that soft skills such as communication skills, technical skills such as digital skills and entrepreneurial skills affect venture creation (Fadzil et al., 2017). From a practical perspective, the current study associates venture creation with the entrepreneur's technical skills such as engagement in establishing departments for a business (Cooper, 2017), filing for corporate tax (Nieuwenhuizen, 2019), establishing an office for operations (Reymen et al., 2015) and marketing operations of a business (Antonioli et al., 2016; Barba-Sánchez & Atienza-Sahuquillo, 2018). Yet, whether selected 4IR skills, especially technical skills, really predict venture creation is still debatable. For instance, a study that investigated this relationship, (Chalmers et al., 2020) proposes that emerging forms of automation in 4I, shift the foundations on which existing assumptions and conceptualisations about entrepreneurship per se, rest.

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9.2.2.2 Innovative financing

Even though the development of ventures is often restricted by financial constraints in the complex world of business (Carpenter & Petersen, 2002; Cosh et al., 2009; Brown & Earle, 2015; Herawati et al., 2018), the growth of ventures is sustained by a significant amount of financial capital, as cash is the lifeblood of all firms. Despite the importance of venture capital and the emergence of new financial sources (Bruton et al., 2015), there are incessant calls to pay special attention to the contributions of venture capital (Bellavitis et al., 2017). In view of the growing sources of financing for entrepreneurial ventures such as angel finance, lease finance, bank finance, supplier finance, crowdfunding and private equity (Hanssens et al., 2015), more attention could be devoted to which of these funding sources have greater potential to sustain the growth of new ventures than the rest. This study drew on literature that identified innovative financing as potentially facilitating the flow of cash and finances within new firms (Hall & Lerner, 2010), influencing productivity growth (Block et al., 2016), involving tapping into the capabilities of human resources which increase the growth of new ventures (Cooper et al., 1994) and contributing to increases in turnover (Nieman, 2006).

9.2.2.3 Venture growth

Venture growth has become critical for successful entrepreneurship, as it indicates the outcome of engagement in entrepreneurial behaviour (Venkataraman, 1997; Carton & Hofer, 2006). Identifying and exploiting opportunities are vital to venture growth and crucial traits will be influenced as much as entrepreneurs with higher growth aspirations are more likely to create and grow successful ventures (Župič & Giudici, 2017). This study drew on extant literature to support the findings of the survey, where venture growth may not only be supported by firms' use of technology and adaption to change (Morris & Zahra, 2000), but would require firms to exploit new products and markets to sustain strategic change, use the venture's internal systems to promote structural change and using managerial processes that sustain organisational change (Rwigema, 2004; Nieman, 2006).

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9.2.3 Entrepreneurial process

The entrepreneurial process consists of entrepreneurial individuals who activate, engage in and sustain the occurrence of opportunities (Venkataraman, 1997; Odongo, 2021). These opportunities that support entrepreneurship are further developed through innovation and evaluated by entrepreneurs in support of new venture creation (Shane, 2003; Stevenson & Jarillo, 2007; Rwigema et al., 2008; Kuratko et al., 2011; Venter et al., 2015; Maritz et al., 2020). The unification of an entrepreneurial approach is currently not available in the entrepreneurial field (Gartner, 1990; Brazeal & Herbert, 1999; Bruyat & Julien, 2001; Shane, 2012; Kuckertz et al., 2017), hence the importance of exploring mechanisms under which entrepreneurial readiness behaviours unfold. For this study, the entrepreneurial process is identified as the main conduit through which students as prospective entrepreneurs harness entrepreneurial education, especially the development of their 4IR skills to facilitate the realisation of specific entrepreneurial behaviours.

Despite the importance of the entrepreneurial process as a theoretical construct in fully understanding entrepreneurship, extant literature lacks consensus as to how the entrepreneurial processes develop in different environments. The Global Entrepreneurship Monitor (GEM) uses a socioeconomic approach (Bosma et al., 2012b) where four phases are identified in the form of intentions, early-stage entrepreneurial activity, established business and discontinuation, if the early stages or established business fail (Galanakis & Giourka, 2017). Authors following the process approach, however, have used the opportunity perspective of discovery, evaluation and opportunity exploitation (Shane & Venkataraman, 2000; Fayolle, 2007) as an alternative to understanding entrepreneurship behaviours.

Following the definitions raised by Shane and Venkataraman (2000) and Clough et al. (2019), the study identified the dimensions of the entrepreneurial process as opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation (see Figure 3.2). This characterisation of the entrepreneurial process sufficiently captures the complex process of engagement in entrepreneur' behaviour as deeply intertwined with opportunities (Markowska, 2018; Pathak & Goltz, 2021). Building on the characterisation that the entrepreneurial process is observable and

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action-orientated, entrepreneurship education as context is considered an environment where students can be equipped with selected 4IR skills required to successfully interact in entrepreneurial actions in this study. Consistent with this characterisation, each of these dimensions are explicated in subsequent sections.

9.2.3.1 Opportunity identification

Identifying opportunities that are palpable in the market is the first stage of the entrepreneurial process (Bhave, 1994; Timmons, 1999; Kuratko, 2001; Baron 2004b; Amorós & Bosma, 2014; Yu et al., 2020). Stages within opportunity identification include utilising the changing information sufficiently from the transformed external environments, scanning the environment for new information (Markman & Baron, 2003; Du Toit, 2016), adapting an opportunity to suit the market need (Morris & Zahra, 2000) and conducting systematic research to cultivate an idea into a high potential opportunity that transmutes into marketable items (Markman & Baron, 2003; Hampel et al., 2020).

9.2.3.2 Opportunity validation

Opportunity validation involves comparing and testing innovative ideas to determine their market value. Testing market research and learning through the experience are components of opportunity validation (Musteen et al., 2018). Wood and McKelvie (2015) highlight that opportunity validation has received less focus than other dimensions of the entrepreneurial process. For instance, scales that measure opportunities in an entrepreneurial environment of technological change have not been validated. Validated instruments on perceived opportunities related to entrepreneurial innovation are still underdeveloped (Robbins, 2014). However, Carter et al. (1996), Gartner et al. (1999), Timmons (1999) and Rwigema and Venter (2004) suggested that opportunity validation can be broken up into eleven statements that involve the competitive advantage of a product/service, ascertaining the required customer of a product/service, determining the size of market demand, locating the target market, determining the market share, ascertaining the level of competition in the market, determining the cost of product development, comparing the prices of products/services with those of competitors, determining the gross margins of the venture, determining the capital required to create a new venture and establishing the risks inherent with the product/service.

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9.2.3.3 Opportunity exploitation

Opportunity exploitation utilises external knowledge sources to appreciate identified opportunities through investments, actions and the deployment of resources (Foss & Klein, 2012; Clough et al., 2019). The ability of entrepreneurs to exploit an unidentified opportunity contributes to the essence of entrepreneurial alertness (Kirzner, 1973; Park et al., 2017) as it allows them to make effective use of identified opportunities by changing their external environment through resource orchestration. Opportunity exploitation involves developing a good business plan, successfully managing a venture, obtaining the appropriate resources (Hisrich, 2005; Nieman, 2006) and dealing with competition (Kunene, 2008).

9.2.3.4 Resource mobilisation

Entrepreneurial resource mobilisation is characterised as the execution of opportunities by entrepreneurs (Marquis & Tilcsik, 2013). Resource mobilisation includes acts of resource management that enable entrepreneurs to manage limitations that are resource-related (Armstrong, 2015). Resource mobilisation involves combining different resources to pursue market opportunities, making strategic decisions when allocating scarce resources (Kodithuwakhu & Rosa, 2002), determining how an entrepreneur secures resources (Bradley, 2002) and impacting employees through training (Densford et al., 2018).

9.2.4 Entrepreneurial process' mediation of the selected 4IR skills-entrepreneurial readiness behaviours relationship

This study extends the discourse on the entrepreneurship field by introducing the entrepreneurial process' mediation of 4IR skills – entrepreneurial readiness behaviour relationship. By doing this, this study extends existing knowledge on the 4IR skills – entrepreneurial readiness behaviour relationship to include the mediating role of the entrepreneurial process.

The arguments of this research study hinge on two foundations. The first foundation is the relationship between the predictor variable (4IR skills) and entrepreneurial readiness behaviour. The second foundation explains the mediator, the

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entrepreneurial process. As an entrepreneurial education outcome, 4IR skills can be viewed as a generator of knowledge of the entrepreneurial process within an entrepreneurial environment, which has potential to shape students' entrepreneurial readiness behaviour.

There is agreement among researchers on what constitutes entrepreneurial readiness behaviour (Kuratko et al, 2015; Seun & Kalsom, 2015). Entrepreneurial readiness behaviour involves entrepreneurial activities dealing with predicting, understanding and influencing an entrepreneur's behaviour in an entrepreneurial environment. An individuals' intentions to create new ventures have been identified as crucial to an emerging economy because new ventures foster growth and job creation (Maresh et al., 2016). According to McAdam & Cunningham, (2019) entrepreneurial behaviour is the outcome of skills, knowledge, experience, motivation and personality of entrepreneurs, externalised through action. The acquisition of skills, in essence, is also a requirement of the entrepreneurial process (Kunene, 2009), although the types of skills will vary according to the different dimensions of the entrepreneurial process (McMahon, 2001).

The first dimension of the entrepreneurial process is opportunity identification. Extant literature confirms that there exists a relationship between opportunity identification and 4IR skills (Mamabolo & Myers, 2020). Entrepreneurs must utilise selected 4IR skills to assist them in the decision-making stage necessary to create a successful venture (Ozdemir et al. 2014). Shah et al. (2020) agree and conclude that EE provides students with knowledge and skills to ensure successful venture creation. Amorós and Bosma (2014) consider the first stage of the entrepreneurial process as the identification of a viable opportunity in the market, whereby opportunity identification logically affects venture creation (Lundberg & Rehnfors, 2018).

The second dimension is opportunity validation. The ability to evaluate and validate opportunities is an important component in determining the entrepreneurial activity. The actions of entrepreneurs engaged in this stage of the entrepreneurial process affect the entrepreneur's entrepreneurial behaviour. McAdam and Cunningham (2019) further postulate that these actions that create more value to ventures are directed by experience, prior knowledge, and education.

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The third dimension is opportunity exploitation. Opportunity exploitation differentiates an entrepreneur's entrepreneurial behaviour by acting on opportunities (Maritz & Amarsadi, 2015). Letaifa and Goglio-Primard (2016) concur that students who possess entrepreneurial skills are in a better position to exploit opportunities by creating ventures as evidence of the triggering of entrepreneurial behaviours. An understanding of this stage of the entrepreneurial process can mediate entrepreneurial skills and entrepreneurial behaviours in the form of venture creation.

The last dimension is resource mobilisation. Resource mobilisation comprises activities such as identification, collection and utilisation of resources (Fiet et al., 2013) and are vital in creating a venture (Kanchana et al., 2013). Resource mobilisation can take the form of an entrepreneur benefiting from the exploitation of technological changes by engaging in creative decision-making and innovation, resulting in venture creation (Gerschewski & Xiao, 2015).

9.3 CONCLUSIONS BASED ON THE STUDY FINDINGS

The next section provides conclusions based on the empirical findings responding to the research questions and objectives of this study. To show how each research question was addressed, each research question is first presented, and a short discussion of the answer is presented and then a conclusion is derived. The next section presents the answer to research question 1.

9.3.1 Research question 1

The first research question asked: What is the effect of soft skills on entrepreneurial readiness behaviours? To address this empirical question, three hypotheses were postulated, namely:

H1a: *There is a positive and statistically significant relationship between soft skills and venture creation while controlling for demographic variables.*
H1b: *There is a positive and statistically significant relationship between soft skills and innovative financing while controlling for demographic variables.*

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H1c: *There is a positive and statistically significant relationship between soft skills and venture growth while controlling for demographic variables.*

It can be inferred that, to address research question 1, the three hypotheses sought to determine the effect of soft skills on entrepreneurial readiness behaviour, namely the dimensions of venture creation, innovative financing and venture growth. The results of the hierarchical regression analysis suggested a positive and statistically significant relationship between soft skills and entrepreneurial readiness behaviour. The results further indicate that soft skills are a significant predictor of venture creation ($p=0.005$), innovative financing ($p < 0.001$) and venture growth ($p < 0.002$). The results are outlined in Chapter 8 (see Table 8.1, Table 8.2 and Table 8.3). This concurs with the findings of NACE (2021), which considered entrepreneurial readiness behaviour as positively impacted by soft skills. The findings of this study therefore confirm previous research, that soft skills have a positive effect on the dimensions of entrepreneurial readiness behaviour such as venture creation (Kumar & Shukla, 2022), innovative financing (Block et al., 2016) and venture growth (Murnieks et al., 2020).

Since literature identifies personal demographic factors such as age, gender and qualifications as potential predictors of entrepreneurial readiness behaviour (Paray & Kumar, 2020), the effect of these on this outcome variable must be controlled, so that the effect of soft skills on entrepreneurial readiness behaviour could be independently determined. None of the demographic variables were significant predictors, except age that was found to be a significant predictor of innovative financing. From the results, participants aged 26-35 years were more inclined to exhibit innovative financing behaviour. The strong and statistically significant relationship between age and innovative financing suggests that age was a significant predictor of innovative financing avenues (Silinskas et al., 2021). Despite the lack of consensus on which soft skills affect entrepreneurial readiness behaviour, the finding on soft skills being a significant predictor of entrepreneurial readiness behaviour, especially venture creation, bodes well with literature that considers soft skills, such as creative thinking and critical thinking as influencing entrepreneurial intent to create new ventures (Al-Shehab et al., 2021; Kumar & Shukla, 2022).

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9.3.2 Research question 2

Since technical skills were identified as a constituent of 4IR skills set**,** the study sought to determine the effects of technical skills on entrepreneurial readiness behaviours**.** The second research question was the following: What is the effect of technical skills on entrepreneurial readiness behaviours? To address this question, three hypotheses were postulated, namely:

H2a: *There is a positive and statistically significant relationship between technical skills and venture creation while controlling for demographic variables.*

H2b: *There is a positive and statistically significant relationship between technical skills and innovative financing while controlling for demographic variables.*

H2c: *There is a positive and statistically significant relationship between technical skills and venture growth while controlling for demographic variables.*

Evidence from this study suggests that there is a positive and statistically significant relationship between technical skills and entrepreneurial readiness behaviour. The results further indicate that technical skills are a significant predictor of venture creation ($p=0.004$), innovative financing ($p < 0.02$) and venture growth ($p < 0.001$). These results are detailed in Chapter 8 (see Table 8.4, Table 8.5 and Table 8.6), corroborating previous literature and confirming that technical skills have a positive relationship with venture creation (Ruiz-Dotras & Llados-Masllorens, 2022), innovative financing (Moll & Yigitbasioglu, 2019) and venture growth (Bruhn et al., 2010).

9.3.3 Research question 3

Since the other dimension of 4IR skills was identified in literature as entrepreneurial skills**,** the study sought to determine the effects of these skills on entrepreneurial readiness behaviours. The study, therefore, posed the following question: What is the effect of entrepreneurial skills on entrepreneurial readiness behaviours? Once again, it was important to investigate entrepreneurial readiness behaviours and break it down into its constituent parts to evaluate the significance of entrepreneurial skills in shaping such behaviours. In this direction, the following three hypotheses were postulated:

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H3a: *There is a positive and statistically significant relationship between entrepreneurial skills and venture creation while controlling for demographic variables.*

H3b: *There is a positive and statistically significant relationship between entrepreneurial skills and innovative financing while controlling for demographic variables.*

H3c: *There is a positive and statistically significant relationship between entrepreneurial skills and venture growth while controlling for demographic variables.*

The empirical results indicate that there is a positive and statistically significant relationship between entrepreneurial skills and entrepreneurial readiness behaviour. The results further indicate that entrepreneurial skills are a significant predictor of venture creation ($p=0.002$), innovative financing ($p < 0.001$) and venture growth ($p < 0.001$). These results are detailed in Chapter 8 (see Table 8.7, Table 8.8 and Table 8.9), confirming previous research that suggests that there could be a positive relationship between entrepreneurial skills and venture creation (Meyer & Synodinos, 2019), innovative financing (Ullah, 2019) and venture growth (Block et al., 2021).

9.3.4 Research question 4

The study also tested the extent to which the entrepreneurial process mediated the relationship between 4IR skills and entrepreneurial readiness behaviours. The study, therefore, sought to address the following research question: To what extent does the entrepreneurial process mediate the relationship between 4IR skills and entrepreneurial readiness behaviours? Given the multi-dimensional nature of the entrepreneurial readiness behaviour and the entrepreneurial process, it was important to test the effects of selected 4IR skills on specific dimensions of entrepreneurial readiness behaviours and the entrepreneurial process. To this end, research question 4, was sub-divided into multiple hypotheses:

A total of 36 sub-hypotheses was developed, ranging from H4a-H4l (which tested the effect of 4IR skills on venture creation), H5a-H5l (which tested the effect of 4IR skills

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on innovative financing) and H6a-H6l (which tested the effect of 4IR skills on venture growth). From the 36 sub-hypotheses which examined the effects of 4IR skills on sub-dimensions of entrepreneurial readiness behaviours and entrepreneurial process, only 6 sub-hypotheses were accepted and considered as significant. These were H4i (p=0.017), H4l (p=0.005), H5i (p=0.019), H5j (p=0.019), H5l (p=0.006) and H6l (p=0.005), all with a p-value lower than 0.05. The top three hypotheses with the highest significance were H4l, H5l and H6l. Each dimension of the entrepreneurial process is present in this category along with entrepreneurial skills (dimension of selected 4IR skills) and resource mobilisation (dimension of entrepreneurial readiness behaviour). This highlights the important role entrepreneurial skills and resource mobilisation play while being mediated by the entrepreneurial process.

9.3.5 Research question 5

Given the multi-dimensional nature of the entrepreneurial process, it was important to identify its constitutive dimensions and test the mediation of these dimensions on the relationship between dimensions of 4IR skills and those of entrepreneurial readiness behaviours. The following question is an expression of the mediation (of the first dimension) of the entrepreneurial process of the relationship between 4IR skills and the entrepreneurial readiness behaviours. The question addressed is: To what extent does opportunity identification mediate the relationship between soft skills and venture creation?

Both the direct and indirect effects of this question were not statistically significant. The data in Table 8.10 refutes the hypothesis that opportunity identification mediated the relationship between soft skills and venture creation. As a result, there was no mediation in this case. However, H4i (opportunity identification mediates the relationship between entrepreneurial skills and venture creation) and H4l (resource mobilisation mediates the relationship between entrepreneurial skills and venture creation) indicated that there is full mediation, since only the indirect effects are statistically significant, whereas the direct and total effects are statistically not significant. Furthermore, H5i (opportunity identification mediates the relationship between entrepreneurial skills and innovative financing) indicated that there is partial mediation, since the indirect and total effects are statistically significant. The fact that

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the total effect is statistically significant suggests that there is still a direct effect of X on Y, even after accounting for the indirect effect through the mediator M. The outcome of these results was reached in Chapter 8 (see Table 8.10 and Table 8.12).

9.3.6 Research question 6

The extent to which another dimension of the entrepreneurial process (e.g. opportunity validation) mediates the relationship between a dimension of 4IR skills (e.g. technical skills) and a dimension of entrepreneurial readiness behaviour (e.g. innovation financing) was also considered. The study, therefore, posed the question: To what extent does opportunity validation mediate the relationship between technical skills and innovation financing?

Both the direct and indirect effects of this question are not statistically significant. The data in Table 8.12 refutes the hypothesis that opportunity validation mediated the relationship between technical skills and innovative financing. As a result, there was no mediation in this case. However, H5j (opportunity validation mediates the relationship between entrepreneurial skills and innovative financing) and H5l (resource mobilisation mediates the relationship between entrepreneurial skills and innovative financing) indicated that there is partial mediation, since the indirect and total effects are statistically significant. The fact that the total effect is statistically significant suggests that there is still a direct effect of X on Y, even after accounting for the indirect effect through the mediator M.

9.3.7 Research question 7

The extent to which another dimension of the entrepreneurial process (e.g. opportunity exploitation) mediates the relationship between a selected 4IR skill (e.g. entrepreneurial skills) and a dimension of entrepreneurial readiness behaviour (e.g. venture growth) was also measured. This study therefore asked the following question: To what extent does opportunity exploitation mediate the relationship between entrepreneurial skills and venture growth?

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Both the direct and indirect effects of this question are not statistically significant. *The data in Table 8.14 refutes the hypothesis that opportunity validation mediated the relationship between technical skills and innovative financing. As a result, there was no mediation in this case. However, H6l (resource mobilisation mediates the relationship between entrepreneurial skills and venture growth) indicated that there is partial mediation, since the indirect and total effects are statistically significant.* The fact that the total effect is statistically significant suggests that there is still a direct effect of X on Y, even after accounting for the indirect effect through the mediator M. Opportunity exploitation was the only dimension of the entrepreneurial process that did not mediate the relationship between any of the selected 4IR skills and any dimension of entrepreneurial readiness behaviours.

9.4 STUDY CONTRIBUTIONS

This study makes four main contributions to theory, methodology, policy and practice. Each of these is discussed below.

9.4.1 Contribution to theory

The theoretical contribution of this study to the body of entrepreneurial literature is that it demonstrates how the Human Capital Theory provides a useful lens for predicting entrepreneurial readiness behaviours. Specifically, the theory spotlights how aspects of human capital, especially higher education, provide opportunities for the development of specific 4IR skills. Moreover, the theory enriches understanding of which specific skills significantly affect entrepreneurial readiness behaviours, including the different ways through which several skills interact with the entrepreneurial process in shaping specific forms of entrepreneurial readiness behaviours. Given that entrepreneurial education and training have not always guaranteed the nurturing of capabilities for students' effective engagement in entrepreneurship (Sousa et al., 2019), the lack of clarity on which set of skills lend themselves to the advancement of specific entrepreneurial behaviours charts the efficacy of the Human Capital Theory to explain this interaction.

Given the variations in orientation towards entrepreneurship among students who are exposed to entrepreneurship education (Jiang et al., 2017; Byun et al., 2018; Shah et

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al., 2020), it was also necessary to explore the mechanisms through which 4IR skills interact with specific mediators in shaping specific entrepreneurial behaviours. Considering the growing literature that presents the entrepreneurial process as a vehicle through which behavioural outcomes such as venture creation (Jones et al., 2018), innovative financing (Celliers et al., 2021) and venture growth (Meyer & Synodinos, 2019) could be realised, the entrepreneurial process was identified as a potential mediator of the relationship between selected 4IR skills and entrepreneurial readiness behaviours. The Human Capital Theory provided a useful framework for a broad understanding of how higher education serves as a useful platform and conduit for developing the 4IR skills of student entrepreneurs that lead to successful ventures. This was critical since there is compelling evidence that HC plays a vital role in promoting aspects of entrepreneurship (Unger et al., 2011; Martin et al., 2013).

The Human Capital Theory enforces a singular linear pathway between heterogeneous education and transition to the world of work. This contributes to the limitations of the Human Capital Theory's understanding between higher education and the world of work (Marginson, 2019). Since this study seeks to predict entrepreneurial readiness behaviours, this research therefore also utilises the Theory of Planned Behaviour to counter the weaknesses of Human Capital Theory by presenting knowledge of the entrepreneurial process as a possible bridge connecting the possession of 4IR skills to the shaping of behavioural outcomes (Douglas, 2013; Rauch & Hulsink, 2015) which manifests, inter alia, in the creation of new ventures (Aloulou, 2018). The Theory of Planned Behaviour (see Chapter 4) suggests that entrepreneurial behaviour is predicted by entrepreneurial intentions formed by attitudes, subjective norms and perceived behaviour control. Entrepreneurial ability, personality traits and entrepreneurial experience are antecedent variables of perceived behaviour control. Entrepreneurial ability includes skills and knowledge necessary for entrepreneurship (Lihua, 2022). It can be argued that the possession of technical skills confer on the student the confidence (e.g. perceived behavioural control) to better understand the entrepreneurial process. Since entrepreneurial readiness behaviours are observable, overt, demonstrable, and can be measured in an objective and reliable ways, one could expect antecedents of such behaviours to include possession of entrepreneurial and technical skills aligned to TPB variables such as perceived behavioural control (Palma et al., 2009; McAdam & Cunningham,

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2019) in comparison to the approach of the Human Capital Theory. Furthermore, TPB is also linked to the possession of entrepreneurial skills necessary to engage in entrepreneurial readiness behaviours (Ferreira et al., 2012; Gieure et al., 2020). Gieure et al. (2020) suggest that entrepreneurial skills play a significant role in the formation of entrepreneurial intention. The entrepreneurial process, entrepreneurial skills and the intention-behaviour link in the TPB model is also established. It is for these reasons that the Theory of Planned Behaviour is used to counter the weaknesses of the Human Capital Theory.

Accordingly, the acquisition of 4IR skills is introduced as the outcome of human capital investments that manifests in the provision of training and entrepreneurial education (Mamabolo et al., 2017b). Prior knowledge, also known as human capital, therefore facilitates the process of recognising entrepreneurial opportunities (Baeta & Andreassi, 2021) and ultimately improving students' entrepreneurial readiness behaviours.

9.4.1.1 Validation of theory and application of entrepreneurial context

Numerous researchers have applied the Human Capital Theory as a guiding framework to evaluate entrepreneurial readiness behaviours (Becker, 1964; Unger et al., 2011; Olugbola, 2017). However, students' entrepreneurial readiness behaviours in the context of HEIs in South Africa is yet to emerge. The current study enriches the HCT by drawing on this theory to understand the entrepreneurial readiness behaviours of students who studied in educational contexts increasingly being reinvented by the 4IR. The application of the theory among students studying at different academic levels and in different disciplines provided some useful insights into the role of academic contexts and educational levels in shaping orientation towards entrepreneurial readiness behaviours. The credibility of the theory is accepted as a measure for developing selected 4IR skills through education and training to enhance students' entrepreneurial readiness behaviour. Applicability of selected 4IR skills to improve students' entrepreneurial readiness behaviour has produced positive and significant results and direct relationships between these constructs, based on the research findings.

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9.4.1.2 Introduction of the entrepreneurial process to the Human Capital Theory

This study introduces the entrepreneurial process for the first time as a mediator in the relationship between selected 4IR skills and entrepreneurial readiness behaviour of students at HEIs in an emerging economy, such as South Africa. Although the entrepreneurial process has been thoroughly researched (Mets, 2015; Gieure et al., 2020), the entrepreneurial process in a mediating role is new in entrepreneurship research. The concept encompasses EE in the form of training and education (HC investment), by developing students' skill sets (HC outcomes), to improve their entrepreneurial readiness behaviour in relation to opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation. This study is a response to Mets' et al. (2022) call to ascertain the entrepreneurial process as a learning outcome complementing skills, through EE intervention.

9.4.2 Contribution to model development

The next section demonstrates the mediating role of the dimensions of the entrepreneurial process on the relationship between the dimensions of 4IR skills and entrepreneurial readiness behaviour based on the empirical evidence and the propositions derived from the research findings. Considering that 4IR skills and entrepreneurial readiness behaviour were discussed comprehensively in the conclusion based on literature, this section zooms on the propositions made on these relationships. Although extant research differentiates between 4IR skills (Deloitte, 2018b), and the relationship between these skills and the entrepreneurial readiness behaviour (Mamabolo et al, 2017a), this framework (see Figure 9.2) integrates the variables of the entrepreneurial process (Clough et al., 2019) as moderator.

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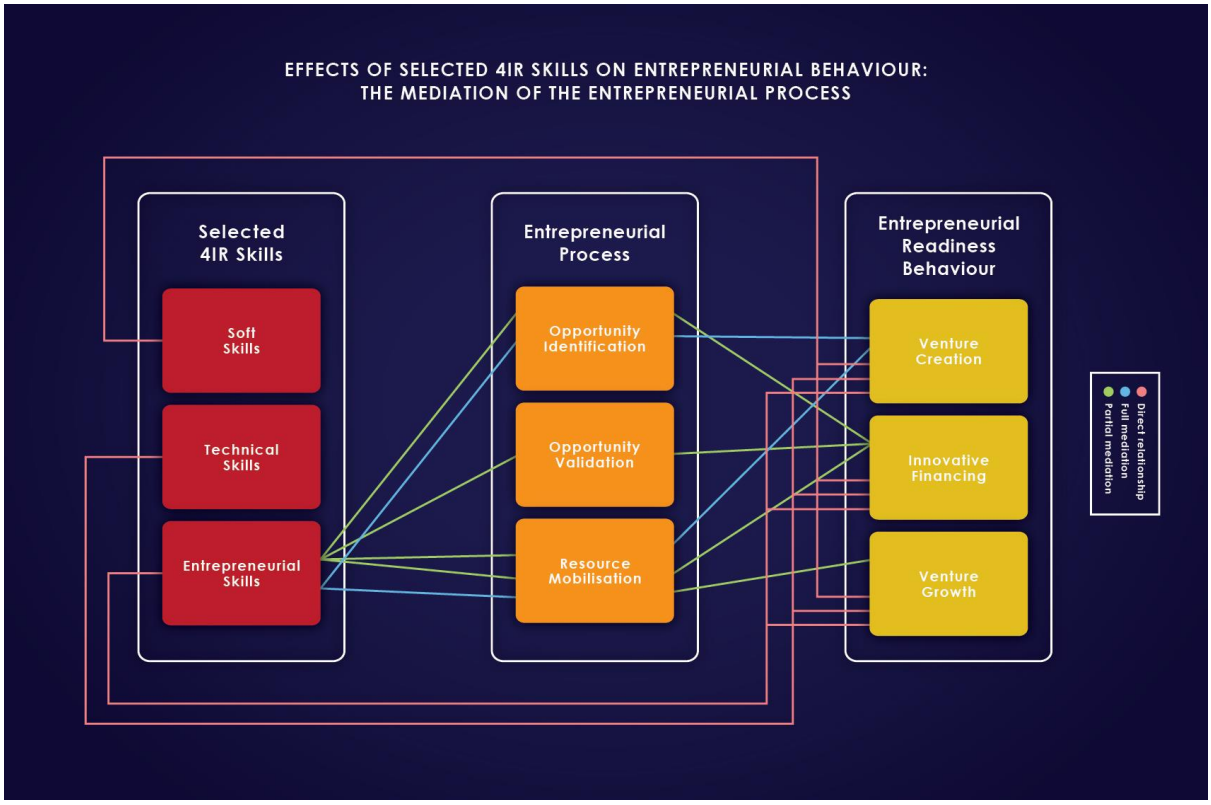

Figure 9. 2: Researcher's revised framework illustrating the interactions between 4IR skills and the entrepreneurial process in shaping entrepreneurial readiness behaviour

The nature of the relationships between the 4IR skills and entrepreneurial readiness behaviour can be surmised as direct relationships (positive and statistically significant relationships), while full or partial mediation is ascertained by the incorporation of the entrepreneurial process in the model. All direct relationships among the variables are indicated in the framework in red arrows, full mediation as blue arrows and the partial mediation in green arrows. These relationships are discussed in subsequent sections. Figure 9.2 is therefore different from the proposed conceptual framework in Figure 5.5, which only indicated the direct relationships among all variables without specifying the level of mediation. Opportunity exploitation was removed from Figure 9.2 as it did not exert any form of mediation between the dimensions of selected 4IR skills and the dimensions of entrepreneurial readiness behaviours.

9.4.2.1 Direct relationships among variables

The direct effect of selected 4IR skills on entrepreneurial readiness behaviour was proposed in this research study. Although the direct relationships investigated in this study have been examined before, the originality of this research lies in the

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simultaneous examination of several dimensions of 4IR skills, entrepreneurial readiness behaviour and mediation analysis of the entrepreneurial process in a single study.

Students considered soft skills as important for becoming an entrepreneur. Based on empirical findings and the propositions, the first direct relationship was the effect of soft skills on venture creation, indicating that respondents with higher levels of soft skills were more likely to engage in entrepreneurial activities. Communication was deemed as the most important soft skill for an entrepreneur. Communication skills such as the ability to receive and express information (Dean & East, 2019) were important to the development of new ventures, one of the dimensions of entrepreneurial readiness behaviour. The second direct relationship was between soft skills and innovative financing. Respondents with higher levels of soft skills were more likely to secure different forms of innovative financing. Research by Polcz (2021) proposed that an entrepreneur's ability to communicate could influence investor decisions of business angels. The third direct relationship is to what extent soft skills impacted venture growth. Based on the evidence of the findings, soft skills were a strong predictor of the growth of ventures.

The significance of technical skills in the formation of new ventures was the next direct relationship examined. Technical skills in the form of management skills tend to predict entrepreneurs' engagement in venture creation. The other direct relationship was that technical skills affected innovative financing. Extant research confirmed that entrepreneurs with technical skills such as financial and numeracy literacy skills were more likely to engage in innovative financing. The findings suggest that technical skills positively impacted venture growth. These results differ from Agénor and Canuto (2017), who postulated that technical skills were not critical to the development of entrepreneurial behaviour.

Another proposition was that entrepreneurial skills contributed to venture creation. The wide range of entrepreneurial skills necessary to facilitate venture creation could include risk-taking, resilience and persistence (Drewery et al., 2020). These entrepreneurial skills could play a significant role in the navigation of the challenges and uncertainties arising from the unpredictable process of new venture creation.

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Drawing on another proposition, this study established that entrepreneurial skills is positively impacted by and through innovative financing. An entrepreneur in possession of entrepreneurial skills is in a better position to improve bootstrapping strategies which would sustain venture growth (Block et al., 2021). Lastly, there was a direct relationship between entrepreneurial skills and venture growth. The findings indicated that entrepreneurs possessing entrepreneurial skills stood a good chance of expanding ventures.

9.4.2.2 Mediation among variables

From a conceptual perspective, this study employs mediation analysis to establish the role of entrepreneurial process in the relationship between selected 4IR skills and the entrepreneurial readiness behaviours. This was critical given the fragmentation of literature confirming relationships between 4IR skills and the entrepreneurial process (Mamabolo & Myers, 2020) on the one hand, and the entrepreneurial process and entrepreneurial readiness behaviours (Markowska, 2018; Pathak & Goltz, 2021) on the other. However, findings of this study suggest instances of full mediation and partial mediation of the entrepreneurial process of the relationship between 4IR skills and the entrepreneurial readiness behaviours.

The motivation for mediation analysis is to understand the mediating role of the constituent parts of the entrepreneurial process in the relationship between the subdimensions of the selected 4IR skills and the constitutive dimensions of the entrepreneurial readiness behaviours. The effect of entrepreneurial skills on venture creation was fully mediated by opportunity identification (H4i), while the effect of entrepreneurial skills on venture creation was also fully mediated by resource mobilisation (H4l). The effect of entrepreneurial skills on innovative financing was partially mediated by opportunity identification (H5i), while the effect of entrepreneurial skills on innovative financing was also partially mediated by opportunity validation (H5j). The effect of entrepreneurial skills on innovative financing was also partially mediated by resource mobilisation (H5l), while the effect of entrepreneurial skills on venture growth was only partially mediated by resource mobilisation (H6l). This is new knowledge extending our understanding of these entrepreneurial variables, which could be used in future frameworks. Although Mamabolo & Myers (2020) find that certain skills are required in the different stages of the entrepreneurial process, the

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current study presents evidence that opportunity identification, opportunity validation, opportunity exploitation and resource mobilisation (dimensions of the entrepreneurial process), play a mediating role in soft, technical and entrepreneurial skills' (dimensions of selected 4IR skills) interactions with venture creation, innovative financing and venture growth (dimensions of entrepreneurial readiness behaviour).

9.4.3 Contribution to policy

This research study makes the following policy recommendations:

9.4.3.1 Developing policy on innovative financing based on identified selected 4IR skills

The findings suggest that innovative financing was the only dimension of entrepreneurial readiness behaviour affected extensively by all selected 4IR skills. Given the evidence of a strong connection between innovative financing and engagement in entrepreneurial readiness behaviours, this points to the need to explore the current barriers to finance for prospective entrepreneurs such as students. Given that literature has reported the challenges student entrepreneurs encounter in accessing innovative financing such as venture capital, this study emphasises the need to develop policies that support and endorse alternative funding strategies such as innovative financing vehicles which include crowdfunding, angel finance, lease finance, supplier finance and private equity (Hanssens et al., 2015). It is consequently recommended that alternative funding policies should be crafted by funding agencies, government departments, regional bodies and local authorities, based on an audit of students' 4IR skills. A major impediment to the provision of equity finance for student entrepreneurs is obviously the lack of effective channelling of 4IR skills to ensure that entrepreneurial readiness behaviours can flourish. These policies should increase chances of funding success and ensure that these funds are deployed for the purpose of supporting engagement in entrepreneurial readiness behaviour.

9.4.3.2 Policy strategies to support aspects of the entrepreneurial process

The relationship between the opportunity identification and venture creation had the highest positive and significant relationship of all dimensions, which in turn has implications for national and regional policies. Given that despite the ability of student

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entrepreneurs to identify opportunities, the success rate of establishing new ventures in South Africa has remained low, specific policies that outline broad strategies for effective opportunity identification can be developed. Evidence from the study suggests that the initial stage of the entrepreneurial process (identifying perceived opportunities) is necessary for the successful formation of a new venture (Kunene & Van Vuuren, 2008).

Despite the national policies, such as the National Development Plan that emphasise using economic activities to deepen entrepreneurship pursuits, students at HEIs indicated the lack of entrepreneurial support. Given the direct link between opportunity identification and venture creation, it is recommended that national structures that support venture creation such as the National Empowerment Fund (NEF) and the Department of Small Business Development (DSBD) provide strategies and guidelines on how universities could cultivate opportunity identification to increase the entrepreneurial drive of students to fuel venture creation. The only way for South Africa to effectively address students' low levels of entrepreneurial readiness behaviour is through policies that support entrepreneurs who identify opportunities that can be exploited to support new ventures creation.

9.4.3.3 Policies to stimulate resource mobilisation

The results show that resource mobilisation (dimension of entrepreneurial process) best mediates the relationship between venture creation (dimension of entrepreneurial readiness behaviour) and entrepreneurial skills (dimension of selected 4IR skills). The study, in the light of such compelling evidence, recommends national and regional bodies to develop policies that foster greater collaboration and networking with HEIs to ensure greater resource mobilisation to ensure that nascent entrepreneurs can effectively deploy their skills in ways that facilitate entrepreneurship readiness behaviours especially venture creation and development. This recommendation coheres with research that identifies mobilisation of resources as fundamental to the development of new ventures (Lim et al., 2016). These policies that seek to support greater collaboration and networking for resource mobilisation could take the form of yearly funding *Lekgotla*s that connect government, industry, venture capital, universities to nascent entrepreneurs to support resource mobilisation e.g. through subsidies, grants and venture capital funding.

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Since the development of entrepreneurship skills was critical to deepening knowledge of the entrepreneurial process by students, the high theory driven nature of university content would need to be backed up by policies that emphasise the practicality of entrepreneurship. As such, working closely with the entrepreneurial bodies such as Small Enterprise Development Agency (SEDA), universities would need to develop policies that emphasise the privileging of practical aspects of content into the curricula to ensure the experiential nature of learning.

9.5 IMPLICATIONS FOR PRACTICE

The findings of the study have several implications for practice, ranging from aligning students' entrepreneurial skills to incorporating compulsory entrepreneurial education at different HEIs.

9.5.1 Aligning students' entrepreneurial skills to type of innovative financing

The findings of this study established that each dimension of the entrepreneurial process partially mediates the relationship between entrepreneurial skills and innovative financing. Given that research acknowledges the severe financial constraints that new ventures confront (Brown & Earle, 2015), coupled with the need for students to have in-depth knowledge of the entrepreneurial process, educators need to align students' mastery of entrepreneurial skills to the type of innovative financing to ensure that such acquisition transitions into effective entrepreneurial readiness behaviours. Even though the significance of venture capital (Bruton et al, 2015) and other financial sources such as angel finance, supplier finance and private equity (Hanssens et al., 2015) have been emphasised, it is still unclear how their acquisition of entrepreneurial skills translates into student securing such funding. Therefore, the alignment suggested above can contribute significantly towards such realisation.

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9.5.2 Exploring different career pathways arising from compulsory entrepreneurial education at different HEIs

Although most students indicated that they did not receive entrepreneurial education (EE) at their HEI, the majority expressed interest in pursuing an entrepreneurial career after obtaining a degree. Given the fact that EE has the capability to influence students' entrepreneurial readiness behaviour (Paray & Kumar, 2020), this implies that HEIs should integrate compulsory EE courses into their curriculum specifications. It is advised that an introductory compulsory course in entrepreneurship should form part of all degrees, irrespective whether students are inclined to follow an entrepreneurial career after their studies or not. Therefore, HEIs in South Africa need to explore the different career pathways arising from student exposure to an introductory compulsory course in entrepreneurship whether in the form of intrapreneurship, corporate entrepreneurship, social entrepreneurship or small business ownership. This could assist in locating student preferred career pathways so that universities could direct resources and their collaborative networking towards these careers rather than assume that each entrepreneurship course can result in all entrepreneurship career types.

9.6 SUGGESTIONS FOR FURTHER RESEARCH

Evidence from the study suggested some variations in student demographics especially their age, gender, level of education, discipline and field of study. Future studies could examine if the different 4IR skills persist across these diverse demographic characteristics. Moreover, other studies could also establish whether some of these demographics moderate the entrepreneurial process- entrepreneurship readiness relationship.

Given the different types of public universities in South Africa (research intensive universities, comprehensive universities and universities of technology), future studies could also examine whether these institutional archetypes have a bearing on how different types of 4IR skills are delivered in higher education. Other studies could also explore whether these archetypes moderate the relationship between 4IR skills and student knowledge of the entrepreneurial process.

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Since some of the universities studied have begun to embrace the innovation and entrepreneurial ecosystem, future research could also compare and contrast how different aspects of the entrepreneurial ecosystem (e.g. investment flows, incubators, pitching platforms, product development, educators and students) interact with 4IR skills in shaping entrepreneurial readiness behaviours of students.

9.7 LIMITATIONS OF THE STUDY

Despite the contribution towards theory and practice, certain limitations were encountered in this research study. The first limitation emerges from the small sample size, limited to students from specific study fields from selected HEIs. This limits the generalisability of the findings regarding students' entrepreneurial readiness behaviour. Increasing the size of the sample to cover all higher educational institutions could address this challenge on the extent of generalisability of the results.

The number of variables used as predictors for entrepreneurial readiness behaviour was not exhaustive. Additional variables, such as gender, prior knowledge and experience, self-efficacy and intentions, specific to the entrepreneurship domain, could generate alternative results. These variables could be included in the same framework to predict their influence on the formation of students' entrepreneurial readiness behaviour when they are considered simultaneously.

9.8 CONCLUDING REMARKS

This chapter discussed the conclusions based on extensive literature and empirical evidence, contributions and limitations of this research study and recommendations for future research. The primary objective of the research study was to examine the effect of 4IR skills on entrepreneurial readiness behaviours of students and the entrepreneurial process' extent of mediation of this relationship. This objective emanated from the lack of research on the simultaneous examination of the relationship between selected 4IR skills and entrepreneurial readiness behaviour on the one hand, and entrepreneurial process and entrepreneurial readiness behaviour, on the other. The fragmented and isolated relationships motivated the researcher to undertake such research that integrated all three concepts (selected 4IR skills, entrepreneurial readiness behaviour and the entrepreneurial process) into a single

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framework. The mediation analysis showed that opportunity exploitation was the weakest link regarding dimensions of the entrepreneurial process that mediated the 4IR-entrepreneurial readiness behaviours.

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Stefan Anton Strampe is a full-time student studying Doctor of Business Administration in the Faculty of Management Sciences at the Central University of Technology, Free State. He obtained his Master's degree in Business Management and B.Com Honours degree in Marketing at the University of the Free State. He has also received a qualification in Project Management. His recent scholarly works are published, which include:

Strampe, S.A., & Rambe, P. 2023. Effects of soft skills on entrepreneurial readiness behaviour: Evidence from students at two South African universities. *South African Journal of Entrepreneurship and Small Business Management*, In Press, 1-24.

Strampe, S.A., & Vermeulen, W. 2018. Key Success Factors for Real Estate Agencies in the Free State. *Academia*, 1(1), 1-137.

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APPENDIX A SAMPLE LETTER SENT TO PARTICIPANTS

QUANTITATIVE SURVEY INVITATION LETTER

Dear Student

You are invited to participate in an academic research study by Stefan Anton Strampe, a Doctoral student from the Central University of Technology (CUT), Bloemfontein.

This study aims to investigate the **effects of selected Fourth Industrial Revolution skills on entrepreneurial readiness behaviour: The mediation of the entrepreneurial process.** The results will be used to develop a model for enhancing the entrepreneurial readiness behaviour (venture creation, innovative financing and venture growth) of final-year university students at Higher Education Institutions (HEIs).

Please note the following:

a) This study involves an anonymous survey. Your name will not appear on the online questionnaire and your answers will be treated as strictly confidential.
b) Please provide answers in the online questionnaire as honestly as possible. This questionnaire should take approximately 20 minutes of your time.
c) The results of this study may be published in an academic journal and used for academic purposes. A summary of the results of this study will be available on request.
d) Any questions or comments regarding this study may be submitted to my supervisor, Prof Patient Rambe or my co-supervisor, Dr Karen Booysen.

I appreciate your agreement of participation in this study.

Kind regards

Stefan Anton Strampe

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APPENDIX B SURVEY QUESTIONNAIRE

Section A – Demographics

1. Please indicate your age.

18-25	26-35	36-49	50+
(1)	**(2)**	**(3)**	**(4)**

2. Please indicate your gender.

Male	Female	Other (Specify):
(1)	**(2)**	**(3)**

3. At which Higher Education Institution (HEI) do you study?

CUT	UFS	Other (Specify):
(1)	**(2)**	**(3)**

4. Please indicate your field of study.

Education	Economic and Management Sciences	Theology	Health Sciences	Natural and Agricultural Sciences	Humanities	Other (Specify):
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**

5. Have you considered becoming an entrepreneur after studying?

Yes	No	Maybe
(1)	**(2)**	**(3)**

6. Do you consider yourself equipped enough by your HEI to become an entrepreneur?

Yes	No	Maybe
(1)	**(2)**	**(3)**

7. Have you received entrepreneurship education or attended an entrepreneurship course?

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Yes	No
(1)	**(2)**

8. What is the highest level of qualification that you have obtained?

Course	Certificate	Diploma	Advanced Diploma	Bachelor's Degree	Honours Degree	Master's Degree	Doctoral Degree
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**

9. Which are the ways your institution use to develop student ideas?

Conducting workshops	Conducting case studies	Assigning academic role models	Conducting simulations	Conducting lectures	Ideation of ideas	Pitching events	Other (Specify):
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**

10. Which conditions does your university create to support students to become entrepreneurs?

Idea pitching events	Venture capital workshops	Business incubation support	Business acceleration support	Business networking events	Other (Specify):
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**

11. Which entrepreneurial activity/activities does your university encourage among students?

Enactus competitions	Ideation workshops	EDHE events	Community empowerment projects	Other (Specify):
(1)	**(2)**	**(3)**	**(4)**	**(5)**

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Section B – Selected 4IR skills

1. Soft Skills

Soft skills are aptitudes or attributes that allow humans to be more effective in job performance.

1.1 To what extent do you consider the following soft skills important for an entrepreneur?

		Not important **(1)**	Slightly important **(2)**	Important **(3)**	Very important **(4)**	Extremely important **(5)**
i)	Leadership - The ability to inspire and unlock the staff's potential to fulfil the company vision.					
ii)	Creative thinking - The ability to incorporate new perspectives and different angles.					
iii)	Critical thinking - The analysis of facts to form a judgement.					
iv)	Emotional learning - An educational intervention to improve social and emotional skills.					
v)	Communication - The ability to express and receive information.					
vi)	Teamwork - An integrating collaboration to achieve a common goal.					
vii)	Collaboration - The act of cooperation with different people.					
viii)	Initiative - The ability to decide and act independently to solve a problem.					
ix)	Adaptability - The capacity to adjust to new situations.					
x)	Growth mind-set - A belief in improving ability and intelligence through effort and learning.					
xi)	Self-confidence - The attitude where you trust and accept your abilities and skills.					

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xii)	Cultural awareness - The sensitivity to accept different cultures.					
xiii)	Empathy - The capability to share other persons' feelings.					

2. Technical Skills

Technical skills enable individuals to handle equipment and tools relevant to business-related areas.

2.1 To what extent do you consider these technical skills important for an entrepreneur?

		Not important **(1)**	Slightly important **(2)**	Important **(3)**	Very important **(4)**	Extremely important **(5)**
i)	Coding - The language for computers to develop software, websites and applications.					
ii)	Computer programming - The process of designing and writing computer programmes.					
iii)	Scientific tasks - The ability to identify evidence needed in a scientific investigation.					
iv)	Mechanical functions - These functions include the assembly and manufacturing processes.					
v)	Job-specific skills - The skills needed to excel in a specific job.					

3. Entrepreneurial Skills

Entrepreneurial skills are skills acquired by an entrepreneur to function effectively in a venture.

3.1 To what extent do you consider these entrepreneurial skills important for an entrepreneur?

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		Not important **(1)**	Slightly important **(2)**	Important **(3)**	Very important **(4)**	Extremely important **(5)**
i)	Creativity - The ability to generate new and inventive ideas.					
ii)	Innovation - The ability to transform a new idea into practical reality.					
iii)	Resourcefulness - The ability to find opportunities to overcome difficulties.					
iv)	Business execution - Implementing of a strategic plan to achieve organisational goals.					
v)	Business acumen - The ability to make good business decisions.					
vi)	Courage - The mental strength to overcome difficulties.					
vii)	Risk-taking - Making decisions when the outcome is uncertain.					
viii)	Initiative - The opportunity to act independently ahead of others.					
ix)	Industriousness - The quality of diligence and regularly working hard.					
x)	Ingenuity - The quality of being cleverly resourceful.					
xi)	Optimism - An attitude of hope and confidence in a positive future.					
xii)	Resilience - The capacity to recover quickly from setbacks.					
xiii)	Curiosity - It is inquisitive thinking to acquire knowledge.					

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Section C – Entrepreneurial Process

1. Opportunity Identification

1.1 To what extent do you agree with these statements on how entrepreneurs identify business opportunities?

		Strongly disagree **(1)**	Disagree **(2)**	Neutral **(3)**	Agree **(4)**	Strongly agree **(5)**
i)	Opportunity identification involves scanning the environment for information that enhances the business.					
ii)	Opportunity identification requires the ability to effectively use changing information from transformed external environments.					
iii)	Opportunity identification involves adapting an opportunity to suit the market need.					
iv)	Opportunity identification involves conducting systematic research to cultivate an idea to a high potential opportunity that transforms into marketable items.					

2. Opportunity Validation

2.1 To what extent do you agree with these statements about opportunity validation?

		Strongly disagree **(1)**	Disagree **(2)**	Neutral **(3)**	Agree **(4)**	Strongly agree **(5)**
i)	Opportunity validation involves establishing the competitive advantage/benefit of a product/service.					
ii)	Opportunity validation involves ascertaining the required customers of a product/service.					
iii)	Opportunity validation involves determining the size of market demand.					

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iv)	Opportunity validation involves locating the target market.					
v)	Opportunity validation involves determining the market share.					
vi)	Opportunity validation involves ascertaining the level of competition in the market.					
vii)	Opportunity validation involves determining the cost of product development.					
viii)	Opportunity validation involves comparing the prices of products/services with those of competitors.					
ix)	Opportunity validation involves determining the gross margins of the venture.					
x)	Opportunity validation involves determining the capital required to create a new venture.					
xi)	Opportunity validation involves establishing the risks inherent with the product/service.					

3. Opportunity Exploitation

3.1 To what extent do you agree with these statements about opportunity exploitation?

		Strongly disagree **(1)**	Disagree **(2)**	Neutral **(3)**	Agree **(4)**	Strongly agree **(5)**
i)	Opportunity exploitation involves developing a good business plan.					
ii)	Opportunity exploitation involves the management of a venture successfully.					
iii)	Opportunity exploitation involves determining the required resources.					
iv)	Opportunity exploitation involves obtaining the appropriate resources.					

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v)	Opportunity exploitation involves dealing with competition.					

4. Resource Mobilisation

4.1 To what extent do you agree with these statements about resource mobilisation?

		Strongly disagree **(1)**	Disagree **(2)**	Neutral **(3)**	Agree **(4)**	Strongly agree **(5)**
i)	Resource mobilisation involves combining different resources to pursue market opportunities.					
ii)	Resource mobilisation involves making strategic decisions when allocating scarce resources.					
iii)	Resource mobilisation involves determining how an entrepreneur will secure resources.					
iv)	Resource mobilisation involves impacting employees with training intellectual abilities.					

Section D – Entrepreneurial Readiness Behaviour

1. Venture Creation

1.1 To what extent do you agree with these statements about venture creation?

		Strongly disagree **(1)**	Disagree **(2)**	Neutral **(3)**	Agree **(4)**	Strongly agree **(5)**
i)	Venture creation involves establishing departments for a business.					
ii)	Venture creation involves filing for corporate tax.					
iii)	Venture creation involves establishing an office for operations.					
iv)	Venture creation involves marketing the operations of a business.					

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2. Innovative Financing

2.1 To what extent do you agree with these statements about innovative financing?

		Strongly disagree **(1)**	Disagree **(2)**	Neutral **(3)**	Agree **(4)**	Strongly agree **(5)**
i)	Innovative financing facilitates the flow of cash and finances.					
ii)	Innovative financing involves influencing productivity growth.					
iii)	Innovative financing involves human resources which increases the growth of new ventures.					
iv)	Innovative financing contributes to the increases in turnover.					

3. Venture Growth

3.1 To what extent do you agree with these statements about venture growth?

		Strongly disagree **(1)**	Disagree **(2)**	Neutral **(3)**	Agree **(4)**	Strongly agree **(5)**
i)	Venture growth involves firms' use of technology adaption to change.					
ii)	Venture growth involves firms' exploiting new products and markets to sustain strategic change.					
iii)	Venture growth involves using the venture's internal systems to promote structural change.					
iv)	Venture growth involves using managerial processes that sustain organisational change.					

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APPENDIX C ETHICAL CLEARANCE CERTIFICATE

FACULTY RESEARCH AND INNOVATION COMMITTEE

FACULTY OF MANAGEMENT SCIENCES

RESEARCH ETHICS APPROVAL LETTER

Date: 30/09/2022

This is to confirm that:

Applicant's Name	Stefan Strampe
Supervisors' Name[s] for Student Project (where applicable)	Prof. P Rambe Dr. K Booysen
Level of Qualification for Student Project (where applicable)	Doctor of Business Administration and Management
Tittle of research project	Effects of selected Fourth Industrial Revolution skills on entrepreneurial readiness behaviour: The mediation of the entrepreneurial process

Ethical clearance has been provided by the Faculty Research and Innovation Committee in view of the CUT Research Ethics and Integrity Framework, 2016 with reference number **FMSEC22421**

The following special conditions were set:

[X] None

[ ] Specific conditions

The following specific conditions apply:

1. _____NA_____
2. _____NA_____
3. _____NA_____

We wish you success with your research project.

Professor D Kokt
Acting FRIC Chairperson

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APPENDIX D LANGUAGE EDITING CERTIFICATE

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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, **EFFECTS OF SELECTED FOURTH INDUSTRIAL REVOLUTION SKILLS ON ENTREPRENEURIAL READINESS BEHAVIOUR: MEDIATION OF THE ENTREPRENEURIAL PROCESS,** submitted by **STEFAN ANTON STRAMPE,** in fulfilment of the requirements for the degree **DOCTOR OF BUSINESS ADMINISTRATION** in the Department of Business Support Studies, Faculty of Management Sciences, **Central University of Technology.**

Stefan Anton Strampe was supervised by **Professor P. Rambe,** with co-supervisor **Dr. K. Booysen**

I hold a PhD in English Language and Literature in English and am qualified to edit such a dissertation for grammatical correctness, 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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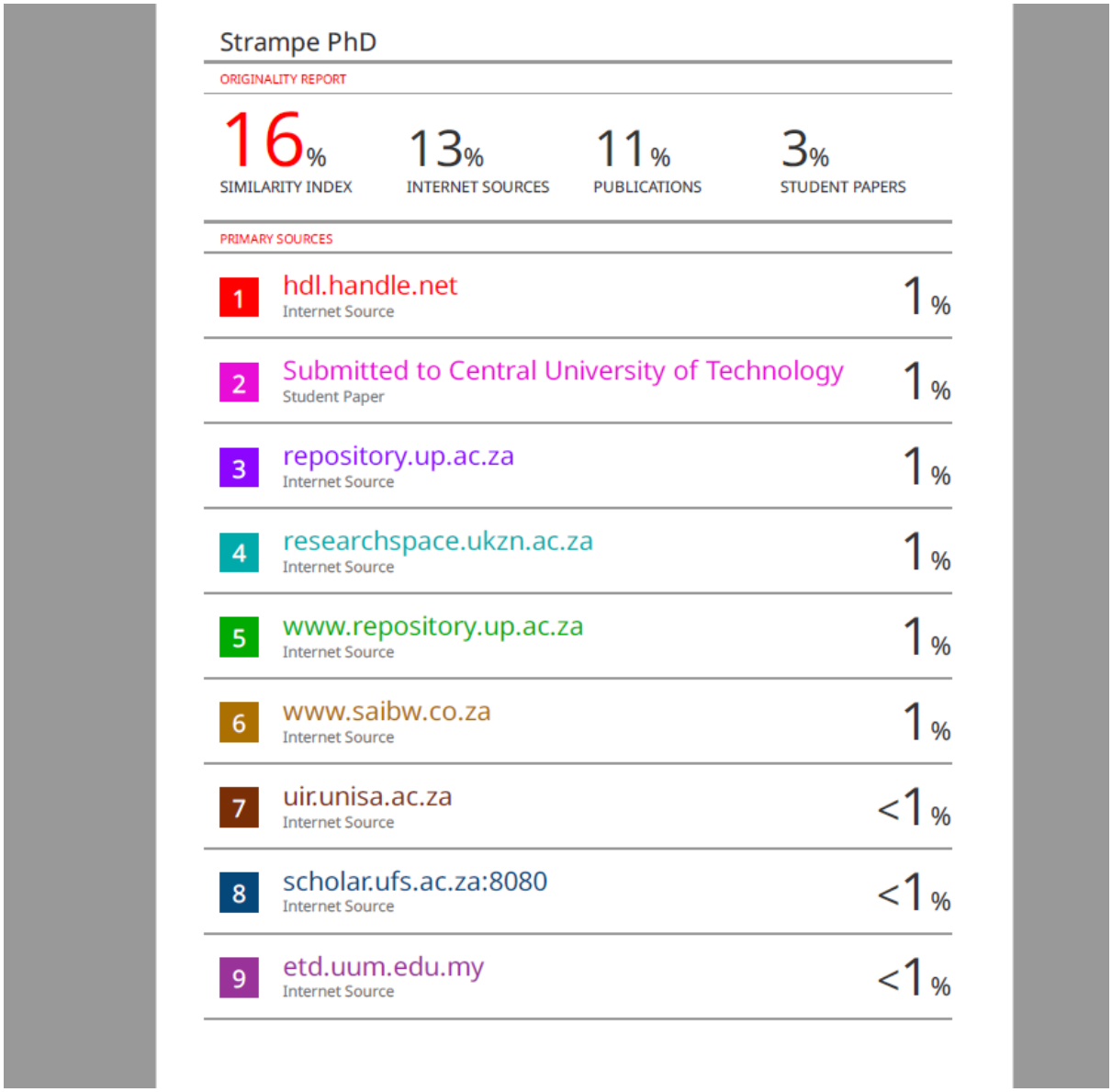
APPENDIX E SIMILARITY INDEX REPORT



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