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Female technopreneur role models and technopreneurial intentions among South African female technology students

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A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Management in Entrepreneurship and New Venture Creation

Johannesburg, 2025

ABSTRACT

Purpose – The objective was to investigate the influence that female technopreneur role models (Female TRM) have on the technopreneurial intentions (TI) among female technology students in South Africa. The theory of planned behaviour, social learning theory, and institutional theory were applied to understand role models' theoretical influence on technopreneurial intentions among female tech students in South Africa.

Design/methodology/approach—This research adopted a quantitative approach, and the data was collected through an online questionnaire from 274 consenting female technology students in South Africa. Hierarchical multiple regression analysis and Mediation analysis were applied to analyse the influence of Female TRM, attitude towards technopreneurship, technopreneurial self-efficacy, and the perception of the normative institutional environment on technopreneurial intentions.

Findings – The mediation analysis results found the influence of female technopreneur role models on technopreneurial intentions to be positive but not significant among female technology students in South Africa. However, the knowledge of female technopreneur role models has a positive significant influence on technopreneurial self-efficacy. A positive attitude towards technopreneurship emerged as the most significant predictor of technopreneurial intentions based on the results of the hierarchical multiple regression analysis. Lastly, positive perceptions of the normative institutional environment positively influence the knowledge of female tech role models among female tech students in South Africa.

Practical implications - The findings of the study show that there needs to be an emphasis on celebrating and promoting female technopreneur role models because they significantly increase the self-confidence of potential female technopreneurs. To shift

technopreneurial intentions, policies and programs aimed at enhancing the desirability of technopreneurship will significantly increase intentions and are likely to shift the gender gap in technopreneurship among female technology students in South Africa.

Originality/value – New empirical evidence was generated to evaluate the effectiveness of the role model recommendation in closing the technopreneurship gender gap in South Africa.

DECLARATION

I, Nokukhanya Ngoma, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the Master of Management in Entrepreneurship and New Venture Creation degree at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.



Signed at ……Sandown, Sandton…….

On the ……27th……. day of ……May…… 2025

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I want to express my deepest gratitude to God, my Creator, for allowing this journey of doing what I love to happen. To God be all the glory!

I want to thank my family and best friends for all the personal support I received throughout my research journey. Everyone close to me, especially my husband, Luyanda, motivated, encouraged, and patiently supported me. Thank you for holding my hand throughout the process.

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I want to express sincere gratitude to my supervisor, Professor Boris Urban, who helped me achieve my best quality work by continuously giving me expert feedback, guidance, and patience throughout this research journey. I also appreciate all the participants in my study; without them, this research would not have been possible. Thank you for taking the time to give insightful feedback concerning this study.

Lastly, I wrote this research to impact all who need hope in starting their own technology business, including myself. I hope this research inspires, gives hope and contributes meaningfully to the world and the existing body of knowledge.

LIST OF ACRONYMS

Analysis of Variance	ANOVA
Attitude towards Technopreneurship	ATT
Confidence Interval	CI
Dependant Variable	DV
Durbin-Watson	DW
Entrepreneurial Intention	EI
Entrepreneurial Self-Efficacy	ESE
Exploratory Factor Analysis	EFA
Global Entrepreneurship Monitor	GEM
Independent Variable	IV
Information Communications Technology	ICT
Kaiser-Meyer-Olkin	KMO
Mediator Variable	MV
Missing Completely at Random	MCAR

Missing at Random	MAR
Normative Dimension	ND
Not Missing Completely at Random	NMAR
Information Communication and Technology	ICT
Institutional Theory of Entrepreneurship	ITE
Perceived Behavioural Control	PBC
Principal Axis Factoring	PAF
Shapero's Model of Entrepreneurial Event	SEE
Social Cognitive Theory	SCT
Social Norms	SN
South Africa	SA
Science, Technology, Engineering, Mathematics	STEM
Statistical Package for Social Sciences	SPSS
Sustainable Development Goals	SDGs
Technopreneur Role Models	TRM

Technopreneurial Intention	TI
Technopreneurial Self-efficacy	TSE
Theory of Planned Behaviour	TPB
United Nations	UN
Wits Business School	WBS

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CHAPTER 1: INTRODUCTION

1.1 Purpose of the study

The objective of this research is to gather empirical evidence regarding the influence of female technopreneur role models on the technopreneurial intentions of female technology students in South Africa. This study aims to investigate the level of influence female founder role models have on inspiring and encouraging female technology students to consider technopreneurship as a viable career path with the potential to significantly impact the gender gap in tech start-ups.

1.2 Background

In recent years, there has been an acceleration in emerging technologies to stimulate innovation for economic development and social empowerment to deliver responses to global issues like climate change and the COVID-19 pandemic (OECD, 2023). These technological breakthroughs and advancements have generated significant entrepreneurial opportunities in the technology space, also known as the tech space, for example, in cybersecurity, e-commerce, artificial intelligence, mobile technology, nanotechnology, and so much more (Bhat & Gulzar, 2020). This has increased the number of tech ventures and opportunities, especially in emerging economies like South Africa (Disrupt Africa, 2023). Tech ventures are recognised for their significant potential as they fuel job creation, foster innovation, cultivate new markets, and serve as role models, all while contributing to economies and societies (GEM, 2023). However, despite the increase in tech ventures globally, the tech start-up culture is still very much male-dominated and commonly referred to as "tech bros" in Silicon Valley (Kovaleva, Hyrynsalmi, Saltan, Happonen & Kasurinen, 2023). Disrupt Africa reports that the African tech scene mirrors global trends, maintaining its predominantly male-dominated environment (Disrupt Africa, 2023).

The role of women in entrepreneurship is crucial because it encourages equal participation in the economy and supports gender equality, a key Sustainable Development Goal (SDG) adopted by the United Nations (Kovaleva et al., 2023). Additionally, women's involvement in the Information Communication and Technology (ICT) sector brings significant benefits (GEM, 2023), such as creating diverse products, increasing financial gains, and accessing new markets (Daniel, 2023). A large portion of global venture capital goes into technology companies, especially software ventures, which have high margins for successful businesses (GEM, 2023). However, women mostly lead smaller businesses in lower-growth industries, like wholesale and retail, which have low-profit margins (GEM, 2023). Statistics show that women make up one-third of the global technology entrepreneurship sector, compared to men (GEM, 2022, p. 37). The startup rates in technology and software sectors reveal that women are less engaged in the ICT sector; they are half as likely as men to report involvement in ICT startups (GEM, 2023). Thus, women remain under-represented in high-growth industries, particularly in technology entrepreneurship, referred to as "technopreneurship."

No single definition of technopreneurship appears in the literature (Bhat & Gulzar, 2020). This concept originates from the broader definition of entrepreneurship, which involves risk-taking, innovation, and proactiveness in launching new ventures. Technopreneurship specifically emphasizes technology as the core of the entrepreneurial process. It is characterized as a high-growth, technology-intensive, and highly innovative field (Abbas, 2018). Dorf and Byers (2005) highlight technopreneurship as involving technology-driven commercial opportunities, high risk, and significant potential for capital gain. Shane and Venkataraman (2000) define it as the assembly of resources, systems, and strategies to pursue technological opportunities through entrepreneurial ventures. A key distinction in all definitions is that technopreneurs differ from traditional entrepreneurs; they are individuals who organise, manage, and take on the substantial risks of technology-based enterprises (Salhieh & Al-Abdallat, 2021).

The literature indicates that women remain underrepresented in technopreneurship despite the increasing number of female students pursuing STEM (Science, Technology, Engineering, and Mathematics) degrees (Bhat & Gulzar, 2020). While research on women's entrepreneurship exists, studies specifically addressing women's technopreneurship are limited (Kovaleva et al., 2023; Bhat & Gulzar,

2020). This underrepresentation in STEM fields is well-documented and has sparked interest in women's technopreneurship (Poggesi, Mari, De Vita & Fossi, 2019). The literature consistently shows low representation of female founders in technology, although the reasons for women's limited entrepreneurial activity in this sector vary.

This study posits that technopreneurial intention precedes technopreneurial activity, making it essential to understand these intentions to address the low levels of technopreneurial activity among South African women (Malebana, 2014; Ndofirepi, Rambe & Dzansi, 2018). The emergence of women technopreneurs hinges on their technopreneurial intentions, defined as the willingness to start technology-driven ventures, which distinguishes them from general entrepreneurial intentions (Salhieh & Al-Abdallat, 2021). Previous research in traditional entrepreneurship indicates that women generally score lower in entrepreneurial intention compared to men (Malebana, 2016; Pruett & Sesen, 2014; Ndofirepi et al., 2018).

The literature does not provide a single explanation for why some women choose to be technopreneurs while others do not. However, it is clear that entrepreneurial motivation stems from various factors. Several scholars have examined the diverse influences on the entrepreneurial intentions of aspiring women, including environmental, social, cultural, economic structures, and individual characteristics (Bhat & Gulzar, 2020; Kovaleva et al., 2023; Vega & Leskin, 2020; Shafi & Gulzar, 2020; Poggesi et al., 2019; Malebana, 2016; Pheaha & Schachtebeck, 2020; Jusoh & Halim, 2006).

Technopreneurship, as outlined by Hisrich, Peters, and Shepherd (2019) and Stephan and Uhlaner (2010), is a social endeavour influenced by the social context in which technopreneurs operate. Because of social media exposure in the 21st century, role models have wielded significant influence in explaining the motivations behind career choices. (Bosma, Hessels, Schutjens, Praag & Verheul, 2012). In technopreneurship, most celebrated role models are male, including Elon Musk, Jeff Bezos, Mark Zuckerberg, Steve Jobs, Jack Ma, Patrice Motsepe, and Adrian Gore (Vega & Leskin, 2020). The lack of representation and visibility of women in technopreneurial roles could explain why fewer women intentionally pursue technopreneurship as a viable career path (Kovaleva et al.,

2023). Previous literature that focused on the influence of role models on traditional entrepreneurship careers found that lack of female role models inhibited women's entrepreneurial intentions (Bhat & Gulzar, 2020; Kovaleva et al., 2023; Shafi & Gulzar, 2020; Nowinski & Haddoud, 2019).

Representing female technopreneur founders as role models in the media and education is recommended as a catalyst to encourage more women to engage in technopreneurship (GEM, 2022). The GEM Women's Entrepreneurship Report (2022) advocates for celebrating female founders as role models to inspire aspiring women and showcase the possibilities for starting and growing new ventures. In tackling equality, Chabalala (2020) emphasises the paramount importance of representation within the entrepreneurial ecosystem, as women lack adequate representation.

Technopreneur Role Models (TRM) embody exemplary figures who have succeeded in establishing technology-driven ventures, inspiring aspiring technopreneurs to shape their career trajectories. The TRM influence on female technopreneurial intention is yet to be researched. It, therefore, presents a research gap at this critical time when the tech start-up space is booming in South Africa and could massively benefit from women's inclusivity. Building on the consistent recommendation in the literature to highlight positive examples of female role models to promote women's technopreneurship, this research will investigate how female role models influence entrepreneurial intentions in a technology setting (Poggesi et al., 2019; Kovaleva et al., 2023; Bhat & Gulzar, 2020; Liu, Ma & Li, 2019). To better understand the influence that technopreneur role models have on potential female technopreneurs, the research will investigate the influence that female technopreneurs as role models have on female students' intention to pursue technopreneurship.

1.3 Research Context

Emerging economies like South Africa have a unique socio-cultural context, so academic research is needed to explore known phenomena of technopreneurship within the South African context. The first African tech incubator commenced in South Africa, launching tech start-ups in the 1990s, making it Africa's most established tech start-up ecosystem (Disrupt Africa, 2022). Today, South Africa, alongside Nigeria, Egypt, and Kenya, has launched the most tech start-ups in Africa (Disrupt Africa, 2023), making Africa's four countries the most significant tech ecosystems. South Africa is said to be a technology hub on the rise, presenting lots of potential for South Africans to create new tech ventures supported by one of the most developed infrastructures in Africa (Price, 2023). The tech start-up scene in South Africa is steadily increasing, with an estimated 521 tech start-ups as of April 2023 (Disrupt Africa, 2023, p. 16). Despite that, the South African tech start-up ecosystem is male-dominated (Disrupt, 2023).

The statistics show that women co-founded 13.6% of South African tech start-ups compared to 86.4% of men (Disrupt Africa, 2023, p. 16). This shows that too few women are becoming tech founders, emphasising gender inequality in technopreneurship in South Africa. However, addressing the gender disparity in the technopreneurship sector remains an urgent imperative because the economic advancement of women is part of South Africa's National Policy Framework goals for women's empowerment and gender equality (South Africa’s National Policy Framework for Women’s Empowerment and Gender Equality, 2002). In alignment with the Parliament of South Africa, key objectives of the 4th Industrial Revolution state that it is crucial to recognise and include women to promote transformation and inclusion in tech spaces to generate more economic activity and lessen unemployment in South Africa (Arendse, 2023).

To bridge this gender gap in South Africa and meet broader economic goals, women need to participate in creating employment opportunities and economic growth that technopreneurship provides. Women could be encouraged to create employment as technopreneurs rather than wait to be employed in a tough South African economy with a 32.1% unemployment rate (“Full Quarterly

Bulletin—No11—March 2024," 2024, para. 11). South African organisations have been created with initiatives geared towards helping to close the gender gap in technology. This includes organisations such as WOMHUB, WeThinkCode, Girl Code, Social Coding, Women in Tech, and more. What can be seen is that these initiatives are mostly helping to address the gender gap in STEM employment and not specifically technopreneurship (Writer, 2023).

The question of why South African women are not as active as men in technopreneurship is a multi-faceted issue because the country has a myriad of wicked problems like food insecurity, unemployment, ill health, and HIV/AIDS and elevated levels of poverty that may affect any career choice decision (Niskanen, Rask & Raisio, 2021). Herrington, Kew, and Mwanga (2017) assert that the measures of desirability, fear of failure, and self-belief in South Africa are notably lower than those observed in other sub-Saharan African nations. A recent study done in South Africa found that the level of entrepreneurial self-efficacy among women entrepreneurs and potential women entrepreneurs is low (Msimango-Galawe & Mazonde, 2021). Because it is known that overconfidence is the most significant psychological predictor of whether a person will be an entrepreneur, one can wonder if the low entrepreneurial activity among women is attributed to their low confidence levels in their ability to run a business (Mollick, 2015).

Notably, a key factor in South Africa is that the tech space does not provide many female role models that potential technopreneur students can look up to and emulate (Toesland, 2018). This is mainly because the history of South Africa led to a 'necessity-driven entrepreneurship culture' where most small businesses started to provide livelihoods and were not innovation-driven (OC&C Strategy Consultants, 2018). Because the innovation-driven entrepreneurship culture is relatively new and growing, there are a few role models in technopreneurship in South Africa. South Africa boasts prominent female technopreneur role models like Rapelang Rabana, Aisha Pandor, and Arlene Mulder. Their innovative ventures have fostered job creation and contributed significantly to the country's economic advancement (FOUNDERSAUCE, 2020). Kovaleva et al. (2023) identified women's limiting factors to an interest in technopreneurship, including a lack of role models.

On an individual level, the awareness of these role models may serve as a source of motivation and inspiration for South African women in the tech start-up space to achieve success despite all the challenges in the country. On a country level, celebrating female role models in technopreneurship will create a culture that promotes tech entrepreneurship. Therefore, it is essential to investigate the level of influence that female technopreneur role models have on the technopreneurial intentions of potential women technopreneurs in South Africa.

To better comprehend how technopreneur role models influence technopreneurial intentions among South African tech students, it is also essential to recognise that entrepreneurial activity varies across economies due to differing institutional environments in which entrepreneurs or aspiring entrepreneurs operate (Valliere & Peterson, 2009).

1.4 Research problem

One of the most significant gender gaps in entrepreneurship is in technopreneurship, where females in South Africa co-founded less than 15% of tech start-ups. Gender inequality in technopreneurship needs to be addressed to have diversity and inclusion in technology solutions, have more people participate in the economy's growth, and meet the global UN SDG Goal 5 to achieve gender equality and empower women and girls. The state of gender inequality in tech start-ups poses questions on how to encourage women better to be more active in the technopreneurship sector. One proposed avenue to encourage women to become tech founders is celebrating female role models to bring awareness and inspire younger generations towards the same career path (GEM, 2022). This recommendation needs to be explored further to understand the extent of the influence this phenomenon has on shifting aspiring women's intentions to become technopreneurs in an emerging economy like South Africa.

Theoretically, a literature review by Shafi and Gulzar (2021) called for more quantitative research in technopreneurship, especially on potential women technopreneurs. While previous studies have explored the entrepreneurial motivations and perceptions of existing women in technology, research on potential women technopreneurs and their motivations remains limited (Shafi & Gulzar, 2021). A

review of the literature on technopreneurial intentions reveals that many studies focus on the Eastern parts of the world, including Malaysia, India, Thailand, Indonesia, Pakistan, and the Middle East (Hoque, Awang & Siddiqui, 2017; Bhat & Gulzar, 2020; Koe, 2020; Rajchamaha & Prapojanasomboon, 2021; Koe, Rahim & Mohd Halim, 2023; Soomro & Shah, 2021; Salhieh & Al-Abdallat, 2021; Shafi & Gulzar, 2021). However, research in the South African context remains scarce (Abbasianchavari & Moritz, 2020). Given South Africa's unique normative institutions, this investigation aims to contribute solutions that effectively address local challenges. This study seeks to examine the influence of female technopreneurs as role models on the technopreneurial intentions of female technology students in South Africa. Additionally, it will investigate how positive perceptions of the normative institutional environment affect technopreneurial intentions, mediated by attitudes toward technopreneurship and subjective norms related to female role models.

1.5 Delimitations of the study

- Gender and sexuality have become a sensitive topic in society, and because of that, the research will focus on role models identified biologically as women. This study will exclude sexual orientations.
- The perception of role models can vary from person to person, so this study aims to examine all women tech founders, regardless of whether they are actively managing their businesses or have moved on from them.
- The study focuses on technopreneurial intention and, thereby, neglects other nascent entrepreneurial activity aspects.
- The study focuses on potential women technopreneurs, specifically female technology students in South Africa.
- The study focuses on South Africa; however, it specifically includes representation in the provinces of Western Cape, Gauteng, Kwazulu Natal, Limpopo, and Mpumalanga, thereby excluding the Northern Cape, North West, and Free State provinces.
- The study focuses only on the normative institutional environment and excludes the cognitive and regulatory dimensions of the institutional environments.

1.6 Research questions

The research study seeks to answer the following research questions:

1. What level of influence does attitude towards technopreneurship have on the technopreneurial intentions among female technology students in South Africa?
2. What level of influence does technopreneurial self-efficacy have on the technopreneurial intentions among female technology students in South Africa?
3. What level of influence do female technopreneur role models have on technopreneurial intentions as mediated by attitude towards technopreneurship and technopreneurial self-efficacy among female technology students in South Africa?
4. What is the effect of the normative institution on technopreneurial intentions as mediated by attitude towards technopreneurship and subjective norms: knowledge of female role models among female technology students in South Africa?

1.6 Research objectives

This study seeks to examine the influence of female technopreneurs as role models on the technopreneurial intentions of female technology students in South Africa. The research sub-objectives are:

1. The objective is to investigate the level of influence that attitude towards technopreneurship has on technopreneurial intentions among female technology students in South Africa.
2. The objective is to investigate the level of influence that technopreneurial self-efficacy has on technopreneurial intentions among female technology students in South Africa.

3. The objective is to investigate the level of influence that technopreneurial role models have on technopreneurial intentions as mediated by attitude towards technopreneurship and technopreneurial self-efficacy among female technology students in South Africa.

4. The objective is to investigate the effect that positive perceptions of the normative institutional environment have on technopreneurial intentions, as mediated by attitudes toward technopreneurship and subjective norms: female role models among female technology students in South Africa.

1.8 Significance of study

This research study aims to help achieve UN SDG Goal 5 in South Africa by generating knowledge in ICT to promote women's empowerment.

The study will make contributions to technopreneurship in three ways:

Firstly, the study will contribute to policy conversations on encouraging and supporting women aspiring to be technopreneurs. According to the results of this research study, policymakers, educators, and program designers could either emphasise or de-emphasise the importance of celebrating female technopreneur role models and design customised initiatives to foster greater female involvement in technopreneurship studies in South Africa.

Secondly, the study will add to the academic field of technopreneurship by generating empirical evidence that will contribute to understanding the influence of female role models on the drive of women in South Africa to initiate tech ventures. Notably, little has been researched on the influence of technopreneur role models on technopreneurial intention. The actual effects of technopreneurial role models on entrepreneurial intentions remain to be determined (Van Auken, Fry & Stephens, 2006; Wilson, Kickul & Marlino, 2007).

This research aims to give insight into how technopreneurial role models influence the technopreneurial aspirations of individuals from various regions in South Africa. Doing so contributes to expanding this specific research domain related to South Africa.

Lastly, the study will add to the literature on technopreneurial intention by using Ajzen's Theory of planned behaviour and Bandura's Social cognitive theory to predict technopreneurial intention**.** The validity of both the theory of planned behaviour and social cognitive theory has been proven by multiple previous studies (Fellenhofer & Mueller, 2018; Malebana & Mothibi, 2023; Amofah & Saladrigues, 2022; Austin & Nauta, 2015).

1.9 Definition of Terms

- This study defines *potential female technopreneurs* as female technology students who are developing the skills required to establish a new tech start-up (Shafi & Gulzar, 2021; Koe et al., 2023; Koe, 2020). The focus on this group stems from the assumption that technology students are more likely to pursue tech entrepreneurship as a natural career path after graduation.
- In this study, the terms *"women" and "females"* are used interchangeably to refer to individuals of the female biological sex. This approach aligns with previous literature, including the works of Bhat and Gulzar (2020) and Msimango-Galawe and Mazonde (2021).

- *Technopreneurship* is entrepreneurship in a technology context encompassing innovation, technology, and business (Balachandran, 2018). It can be seen in the ICT, IT, and software industries, among many others (Koe, Rahim & Mahphoth, 2021).
- *Technopreneur Role Models (TRM)* embody exemplary figures who have achieved success in establishing technology-driven ventures. They inspire aspiring technopreneurs to shape their career trajectories (Abbasianchavari & Moritz, 2020; Laviolette, Lefebvre & Brunel, 2012). The definition was adapted from the concept of entrepreneur role models to better fit the context of technopreneurship (Koe, 2020).

- *Technopreneurial Intention (TI)* refers to an individual's willingness to establish a new technology-based business (Venter & Urban, 2015). As entrepreneurial intention is the initial step in launching a new venture, the specific intent to create a technology-focused enterprise is termed technopreneurial intention (Koe et al., 2023).
- *Technopreneurial Self-efficacy (TSE)* refers to the individual's belief that they possess the technological and entrepreneurial skills necessary to start a tech venture (Soomro & Shah, 2021). This definition is adapted from Bandura's (1986) concept of self-efficacy, which refers to individuals' judgements about their capability to perform the actions required to attain their goals.
- *Attitude towards technopreneurship (ATT)* refers to the attitude toward technopreneurial behaviour, adapted from Ajzen's (2005) concept of attitude toward a behaviour, which pertains to the beliefs individuals hold about the potential outcomes of engaging in that behaviour.

1.10 Assumptions

To complete this research, the following assumptions were raised:

- The respondents have a good understanding of English, so they were able to understand the questions and answer them properly.
- The respondents have enough knowledge of technology entrepreneurship, so their answers are relevant and reliable.

CHAPTER 2: THEORETICAL OVERVIEW AND LITERATURE REVIEW

Keywords:

Technopreneurship; Women Technopreneurship; Entrepreneurial Role Models; Entrepreneurial Self-Efficacy; Entrepreneurial Intention; Technopreneurial Intention; Theory of Planned Behaviour; Normative Institutions.

2.1 Introduction

Using Ajzen's theory of planned behaviour and Bandura's social cognitive theory as a theoretical framework, this research study will investigate the influence of female technopreneur role models on technopreneurial intentions among female technology students in South Africa. This research study will be organised as follows: First, literature on women's technopreneurship will be introduced; second, the literature on women's technopreneurial intention using the theory of planned behaviour and social cognitive theory; third, the literature on role models and same-gender role models; fourth, literature on role models and technopreneurial intentions and its antecedents; fifth, literature on the institutional effect on technopreneurial intention; and lastly, the study will propose a hypothetical conceptual framework.

2.2 Background Discussion

A literature review on women in STEM (Science, Technology, Engineering, and Mathematics) called for more research on women's entrepreneurship in STEM fields, mainly to expand the research on women's motivations towards the fields (Poggesi et al., 2019). Literature shows us that women are highly participative in retail or service-orientated businesses (Shafi & Gulzar, 2021), and therefore, women are under-represented in the technology sector.

The technology sector is known as a high-risk, highly innovative, and highly dynamic field in which women have previously been subtly discouraged from pursuing this career path but encouraged to pursue less risky career paths (Shafi & Gulzar, 2021). To provide more insight into strategies that can encourage more women to participate in technopreneurship, this study will focus on understanding how female technopreneur role models influence potential female technopreneurs. A literature review has shown that few studies have been done on potential women technopreneurs, so this research hopes to add to the academic literature (Shafi & Gulzar, 2021).

Literature review

2.3 Theory of Planned Behaviour (TPB) – Technopreneurial Intentions

- **Women Technopreneurial Intention**

Entrepreneurship fundamentally begins with the intention to create a new venture (Venter & Urban, 2015). This means most people who start businesses first intend to start the business; then they start it. An intention represents the depiction of forthcoming actions directed towards an entrepreneurial endeavour (Venter & Urban, 2015). Entrepreneurial Intention (EI) can be defined as the willingness to start a business (Bae, Qian, Miao & Fiet, 2014) and the conviction that a person will start a business soon (de Pillis & Reardon, 2007). EI is said to be the best predictor of entrepreneurial behaviour in entrepreneurial literature (Krueger & Brazeal, 1994). To understand the technopreneurship background, there is a need to start by understanding the processes leading up to the creation of the new venture (Krueger, 2003).

Technopreneurship is a branch of entrepreneurship distinguished by its focus on technology (Kovaleva et al., 2023). The term "technopreneurship" gained recognition in 1983, according to Jolly (1997), and has since gained more recognition in Asia and academia; therefore, the term will be used to merge entrepreneurship and technology (Hoque et al., 2017). Similarly, technopreneurship requires deliberate intent before individuals will pursue it as a career path (Koe, Krishnan & Alias, 2021). For this research study, the concept of

technopreneurial intention (TI) - adapted from entrepreneurial intention (EI) - represents an individual's willingness to establish a technology-based venture (Hoque et al., 2017). This follows several scholars' previous research that customised EI to TI, including Hoque et al. (2017), Koe (2020), and Machmud, Suwatno, Nurhayati, Aprilianti & Fathonah (2020). As such, the TI construct will be valuable in predicting and explaining the technopreneurial behaviour of different individuals in this research study. TI represents an individual's psychological readiness to create a technology venture, a concept studied through established intention models (Ajzen, 1991).To predict entrepreneurial intention, researchers commonly rely on two intention models (Shook, 2003) extensively examined in empirical research, including Shapero's Entrepreneurial Event Model (1982) and Ajzen's Theory of Planned Behaviour (1991).

- **Entrepreneurial Intention Models**

Shapero proposed the SEE model in 1982 as a framework for understanding entrepreneurial intentions (Shapero & Sokol, 1982). According to this model, entrepreneurial behaviour emerges when specific conditions are met - primarily when an individual perceives an opportunity as both desirable and feasible. Second, the new venture is initiated by some displacing event, for example, a job retrenchment, winning the lotto, or moving elsewhere, which would propel the individual to act on the idea to make it into a business (Shapero & Sokol, 1982). This is an entrepreneurial event, and it happens when all three conditions are met: perceptions of desirability, perceptions of feasibility, and the propensity to act (Krueger, 1993; Shapero & Sokol, 1982). This model is illustrated in Figure 1 below:

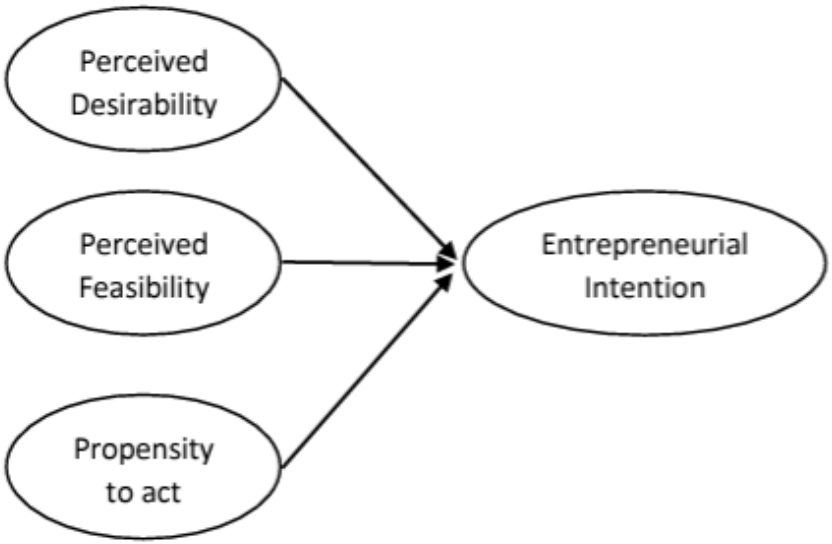


Figure 1: The Model of Entrepreneurial Event (Shapero & Sokol, 1982)

The Theory of Planned Behaviour (TPB) identifies three key factors that influence behavioural intentions: attitudes toward the behaviour, subjective norms, and perceived behavioural control (Ajzen, 1991). This framework closely parallels Shapero's Entrepreneurial Event (SEE) model, where perceived behavioural control in TPB corresponds to perceived feasibility, both reflecting an individual's self-efficacy (Krueger, 1993). Furthermore, the SEE model's concept of perceived desirability aligns with TPB's emphasis on attitudes toward venture creation, demonstrating significant theoretical overlap between these intention models (Krueger, 1993). Ajzen (2005) further emphasised that the TPB model accounts for demographics and contextual factors that shape entrepreneurial intention. This makes it particularly suitable for studies exploring the influence of role models and gender within specific contexts, such as technology. In related research on technopreneurial intention, the TPB model has been successfully applied (Koe et al., 2021). Consequently, this study adopts the TPB model to predict technopreneurial intention.

Theory of Planned Behaviour (TPB)

The most used theory underpinning EI is the Theory of Planned Behaviour by Ajzen (1991), and many scholars have used it, including most recently, Amofah and Saladrigues (2022); Koe et al. (2023); Mfazi and Elliot (2022); Malebana and Mothibi (2023); and Fellenhofer and Mueller (2018). The research study utilised the TPB model, widely regarded as the benchmark for investigating entrepreneurial intention due to its proven accuracy and successful application in South African studies. Ajzen (1991) asserted that intentions predict entrepreneurial activity. The theory of planned behaviour is used to understand why some people may choose an entrepreneurship career and offers valuable insights for crafting and assessing interventions to shape entrepreneurial intentions (Malebana & Mothibi, 2023). It is also important to note that this theory of planned behaviour has been used successfully to predict EI within the South African context through scholars like Malebana and Mothibi (2023) and Ndofirepi et al. (2018). Therefore, this research study will follow suit to predict technopreneurial intention in South Africa.

According to Ajzen's theory of planned behaviour, an intention to perform a specific behaviour is predicted if the individual has perceived that the outcome will be favourable, if they have confidence in their ability to succeed, and if they expect that they will receive approval and support from their environment in doing the behaviour (Ajzen & Fishbein, 2005). In this aspect, the TPB has put forward three antecedents for entrepreneurial intention: the individual's attitude towards behaviour, subjective norms, and perceived behavioural control (Ajzen & Fishbein, 2005). These three collectively influence entrepreneurial intention (Ajzen, 1991). It can be concluded that attitudes, subjective norms, and perceived behavioural control form entrepreneurial intentions. The TPB model is illustrated below in Figure 2.

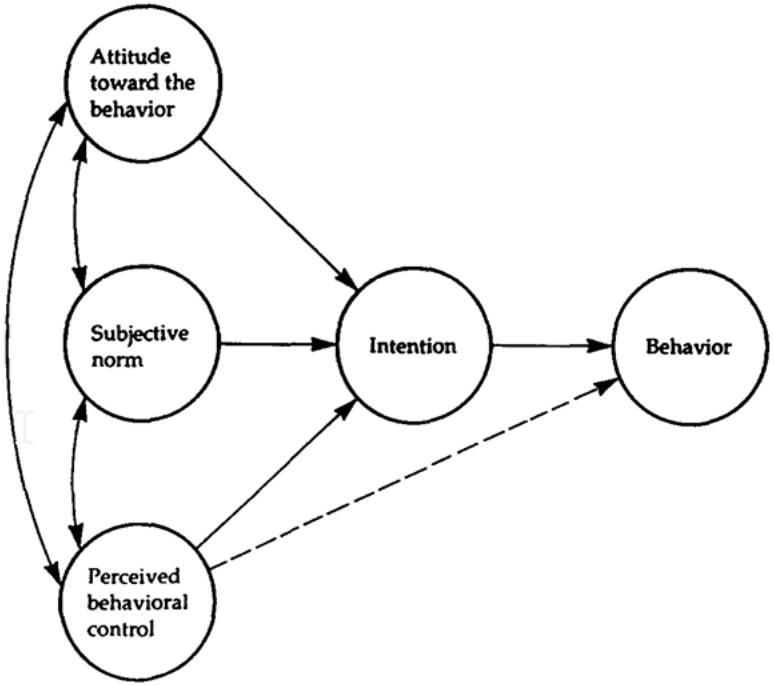


Figure 2: Theory of planned behaviour [Source: Ajzen (1991)]

2.3.1 Attitude towards the Behaviour

The attitude towards the behaviour reflects the individual's beliefs of whether its consequences will be favourable or unfavourable (Ajzen, 2005). How individuals view a behaviour reflects how desirable they think it is to engage in it (Krueger, Reilly & Carsrud, 2000). The Theory of Planned Behaviour (TPB) states that a positive outcome leads to a positive attitude toward the behaviour (Ajzen & Fishbein, 2005).Previous studies found that attitude towards entrepreneurship positively influences entrepreneurial intention (Krueger & Carsrud, 1993; Linan, Urbano & Guerrero, 2011). More recent studies also found that attitude towards entrepreneurship had a significant and positive relationship with entrepreneurial intention (Pheaha & Schachtebeck, 2020; Solomon, Das, Ghadai & Bajpai,

2019). In the context of technopreneurship, this behaviour involves initiating a new tech venture. If an individual anticipates a positive outcome, they are likely to adopt a favourable attitude toward starting this new venture.

2.3.2 Subjective norms

Subjective norms speak to the individuals' beliefs on whether they will receive support from others in their social network if they perform the behaviour (Ajzen, 2005). According to the theory of planned behaviour (TPB), a belief that the behaviour will lead to approval and support from others will motivate the individual to perform the behaviour (Ajzen, 2005). The opposite is suggested as true in that a belief that the behaviour will lead to disapproval from others, the less motivated the individual will be to perform the behaviour (Ajzen & Fishbein, 2005). Ultimately, based on the approval or disapproval of others, the less or more desirable the behaviour will be to an individual. Prior studies have revealed that subjective norms play a minimal role in predicting entrepreneurial intentions (Liñán & Chen, 2009; Krueger & Carsrud, 1993). On the contrary, another research study found that social norms contribute positively to entrepreneurial intentions (Saeed, Yousafzai, De-Sariano & Muffatto, 2013). Heuer and Linan (2013) highlighted the importance of contradictions in their findings, showing that subjective norms directly contribute to entrepreneurial intention and also influence it indirectly through attitude and perceived self-efficacy. In technopreneurship, the behaviour of starting a new tech venture may lead to disapproval or approval of others, therefore making the decision to start a new venture less desirable or more desirable to the individual.

2.3.3 Perceived Behavioural Control

Perceived behavioural control speaks to an individual's belief in their ability to perform a particular behaviour, sometimes called self-efficacy (Ajzen & Fishbein, 2005). According to the Theory of Planned Behaviour, an individual with a positive perception of the feasibility of performing the behaviour is likelier to perform the behaviour than an individual with a negative perception of the feasibility of performing the behaviour (Ajzen & Fishbein, 2005). Women's beliefs towards an entrepreneurship career have been reported to depend on their perceptions and self-assessment of their competence to start a new venture (Veciana, Aponte & Urbano, 2005). Studies

have indicated that self-efficacy surpasses attitude towards behaviour and subjective norms as the most influential predictor of entrepreneurial intention (Urban & Chanston, 2018).

It can be concluded that an individual's technopreneurial intention will be predicted by their perception of a technopreneurship career being positive, their confidence that they will succeed in tech start-ups, and if they believe that the people around them will show support and approve of their decision to become a technopreneur (Venter & Urban, 2015). Individuals will process their knowledge, experiences, and beliefs to assess their confidence to start a new tech venture, which will either stimulate or discourage technopreneurship career aspirations (Ajzen & Fishbein, 2005).

This study, therefore, proposes that technopreneurial intentions are positively influenced by all their antecedents, namely attitude towards technopreneurship, subjective norms, and self-efficacy using the theory of planned behaviour. The report is organised as follows: a discussion of subjective norms will follow, as their hypothesis specifically relates to role models. Because self-efficacy and perceived behavioural control are similar constructs, this study will use the construct of technopreneurial self-efficacy to replace perceived behavioural control, which will be discussed in the next section.

Hypothesis 1: Attitude towards technopreneurship positively influences technopreneurial intention among female technology students in South Africa

Social Cognitive Theory

Albert Bandura articulated the social cognitive theory, which explains how people learn behaviours within a social context, in his 1986 book *Social Foundations of Thought and Action: A Social Cognitive Theory*. According to the theory, the acquisition of new behaviours is shaped by the dynamic interaction of cognitive, behavioural, and environmental factors (Bandura, 1986). Environmental factors influencing behaviour include social norms, cultural practices, and resource access. Behavioural factors encompass an individual's skills,

competencies, and patterns of behaviour. Personal factors include cognitive abilities, knowledge, values, self-efficacy, and more. The theory emphasises the continuous interplay of these three factors in shaping human behaviour (Bandura, 1986).

A key term emphasised in the SCT theory is self-efficacy, which is described as individuals' assessments of their capability to plan and execute the necessary actions to accomplish their objectives (Bandura, 1986). It pertains to individuals' assessments of their confidence in effectively executing specific behaviours. The SCT theory suggests that individual self-efficacy plays a significant role in shaping behaviour and choice of activities (Bandura, 1977). High self-efficacy may result in an individual initiating behaviour, whereas low self-efficacy may result in an individual's avoidance of action (McGee, Peterson, Mueller & Sequeira, 2009).

In 1997, Bandura expanded the concept of self-efficacy by proposing that four key factors shape efficacy beliefs: mastery experiences, vicarious experiences, social persuasion, and emotional/physiological states (Bandura, 1997; Newman, Obschonka, Schwarz, Cohen & Nielsen, 2019).

Mastery experiences refer to an individual's past successes and failures. Positive experiences bolster self-efficacy, encouraging confidence in handling similar tasks or behaviours, while repeated failures may undermine this belief (Bandura, 1997). These experiences are the most robust source of self-efficacy, as they provide direct evidence of one's capabilities.

Vicarious experiences involve observing the successes and failures of others. By witnessing how others navigate tasks or behaviours, individuals can gauge their confidence levels. Positive outcomes observed in others can enhance self-efficacy, while negative observations can diminish it. This form of influence is particularly significant when individuals lack direct experience with the task or behaviour themselves (Bandura, 1997).

Social persuasion encompasses the feedback and encouragement received from others, including family, friends, peers, and role models. Positive reinforcement can strengthen an individual's confidence to undertake a task, while negative or discouraging comments can

weaken it (Bandura, 1997). The credibility and relationship of the persuader play a crucial role in determining the impact of social persuasion.

Finally, **emotional and physiological states** influence self-efficacy by affecting how individuals perceive their readiness to perform a task. Feelings of stress, fatigue, pain, or negative mood states can diminish self-efficacy, while positive emotions and physical well-being can enhance it (Bandura, 1997). Managing these states can, therefore, be essential in building and sustaining self-confidence.

Together, these four sources of self-efficacy provide a comprehensive framework for understanding how individuals develop confidence in their abilities and approach tasks or challenges (Bandura, 1997).

Self-efficacy has been recognised as a strong predictor and precursor of entrepreneurial intention (Chen, Greene & Crick, 1998). In entrepreneurship, it is known that individual self-efficacy predicts entrepreneurial behaviour; therefore, entrepreneurial self-efficacy was adopted to speak to entrepreneurial behaviour distinctly (McGee et al., 2009; Chen et al., 1998). Entrepreneurial self-efficacy (ESE) emerged as a concept derived from self-efficacy and refers to individuals' confidence in initiating and managing a new business venture, encompassing tasks such as marketing, personnel management, financial administration, and risk-taking (Chen et al., 1998). To frame self-efficacy specifically to represent technopreneurs and not just entrepreneurs, the study will make use of the term Technopreneurial Self-efficacy (TSE). TSE refers to the individual's belief that they possess the technological and entrepreneurial skills necessary to start a tech venture (McGee et al., 2009; Salhieh & Al-Abdallat, 2021).

Findings from a study done in Pakistan show that TSE has a positive and significant influence on technopreneurial intentions (Soomro & Shah, 2021). Another study in the United Arab Emirates confirmed that TSE positively and significantly influenced technopreneurial intentions (Salhieh & Al-Abdallat, 2021). Lastly, a study in Malaysia also confirmed that TSE had a positive and significant relationship with technopreneurial intention (Hoque et al., 2017). Several studies have adopted TSE as a predictor of technopreneurial intention, and therefore, this study will follow suit to give insight into technopreneurial intention and its antecedents (Machmud et al., 2020; Soomro

& Shah, 2021; Salhieh & Al-Abdallat, 2021; Hoque et al., 2017). This study proposes that technopreneurial intentions are positively influenced by the antecedent of technopreneurial self-efficacy, using social cognitive theory.

Hypothesis 2: Technopreneurial self-efficacy positively influences technopreneurial intention among female technology students in South Africa

2.3.4 Gender and Technopreneurial Intention

Whilst the TPB and SCT theories have proposed four antecedents of entrepreneurial intention, research has shown that other factors influence entrepreneurial intention indirectly, like gender (Sullivan & Meek, 2012; Ndofirepi et al., 2018; Malebana, 2015; Pruett & Sesen, 2014; Pheaha & Schachtebeck, 2020; Abbasianchavari & Moritz, 2020). The concept of gender introduces vulnerabilities and biases when students make career decisions (Ndofirepi et al., 2018). A study has shown that males have higher entrepreneurial intentions than women (Ndofirepi et al., 2018).

In South Africa, research conducted by Malebana (2016) and Ndofirepi et al. (2018) showed that females have less favourable attitudes towards entrepreneurship; they perceive low capabilities and subjective norms towards entrepreneurial decisions. This proves that there are significant differences between the two genders' entrepreneurial intentions and their antecedents, and therefore, more efforts need to be made towards increasing the self-efficacy of women, influencing favourable attitudes, and generating favourable subjective norms towards starting a new business.

A literature review of women's technopreneurship revealed that women have low self-efficacy compared to men, which may affect their desire to start technology ventures (Bhat & Gulzar, 2020; Shafi & Gulzar, 2021). The research also revealed that women tend to harbour a sort of fear towards technology, stemming from their level of technological skills and experience (Brush, 2008). The two combined factors suggested to significantly affect women's technopreneurial intentions (Brush, 2008). Because there is not much research

explicitly based on gender and technopreneurial intentions, the findings from female entrepreneurship intentions will also be inferred to affect female technopreneurial intentions.

2.4 Role Models and Technopreneurial Intention

Technopreneur role models

Academic research identifies three main umbrella factors that generate entrepreneurial activity: individual, psychological, and environmental factors. As part of the environmental factors, global entrepreneurial research found that role models influence entrepreneurial activity (Sieger, Fueglistaller, Zellweger & Braun, 2018; Bosma et al., 2012). Therefore, this research study will focus on role models as an influential factor in female technopreneurial intentions.

Role models are individuals whose behaviours, traits, characteristics, and journeys can be emulated by others (Shapiro, Haseltine & Rowe, 1978). The knowledge of role models is sometimes accessed through media and books through stories of entrepreneurial journeys and successes influenced by other entrepreneurs (Bosma et al., 2012). Role models can be understood in two forms: direct role models, including parents, educators, peers, and famous people, and symbolic role models, represented as stories/narratives in media and books (Radu & Loue, 2008). The concept of role models in entrepreneurship can be understood as the ability of an individual to identify and learn from the behaviours of entrepreneurs with whom they identify, relate, or are influenced (Singh, Vinnicombe & James, 2006). As a result, people observe role models creating their 'ideal self' and emulate the traits they identify with, which effectively chooses their careers (Singh et al., 2006). Researchers widely recognise that role models serve as significant drivers of entrepreneurial careers (Wyrwich, Stuetzer & Sternberg, 2015).

Different empirical studies suggest a link between the presence of role models and the decision to become an entrepreneur (Fornahl, 2003; Sternberg, 2009; Lafuente, Vaillant & Rialp, 2007). The study conducted by Bosma et al. (2012) reveals that role models serve

numerous purposes in pursuing an entrepreneurial career. These include learning through emulation, boosting entrepreneurial self-efficacy (ESE), offering support, and inspiring and motivating individuals (Bosma et al., 2012). Van Auken and Stephens (2006) expanded upon the idea, asserting that the beneficial effects of role models, such as lifestyle choices and career discussions, wield more significant influence than detrimental aspects, like extended work hours and bringing work home. Based on previous research findings, it can be concluded that individuals are influenced by the achievements and behaviours of their role models in their desired careers.

In technopreneurship, role models represent what is possible with technopreneurship careers. It has been stated that potential women technopreneurs develop their perceptions of technopreneurship based on vicarious exposure, such as reading about, watching, and knowing another person who has created a tech venture (Shafi & Gulzar, 2021). Research has shown that knowledge of role models does matter in raising awareness of the career path and increasing technopreneurial intentions (Kovaleva et al., 2023; Bhat & Gulzar, 2020; Bosma et al., 2012; Malebana & Mothibi, 2023).

2.4.1 Same-gender role models

Social learning theory posits that individuals acquire knowledge and behaviours by observing and mimicking others within their social environment (Bandura, 1977). The people they observe and imitate their behaviour against are role models and serve as sources of motivation and guidance (Rajchamaha & Prapojanasomboon, 2021). According to Bandura (1977), individuals are likelier to emulate the behaviours of role models with whom they identify or perceive as like themselves in some way. Role model identification can occur based on numerous factors such as age, gender, occupation, social status, or personality traits. Through identification with a role model, individuals may adopt similar behaviours, attitudes, and values, and this process plays a crucial role in shaping one's development and behaviour.

Following the definition of role models, including an individual being able to identify with the role model, the findings from Laviolette et al. (2012) show that exposure to role models positively influences behavioural intentions if students identify with the role model. A

study by Bosma et al. (2012) showed that role models and potential entrepreneurs have similar resemblances, for example, gender, sector, and nationality. Entrepreneurial role model research has shown that the influence of role models on the individual's desire to become an entrepreneur is conditioned by factors like gender, profession, ethnic group, etc. (Brush, Edelman, Manolova & Welter, 2018; Wyrwich et al., 2015). A previous study confirmed that role models are more effective when individuals are the same gender in influence and inspiration (Marx, Ko & Friedman, 2005). Empirical evidence of this gendered effect is shown in the research done in Colombia by Moreno-Gomez, Lafuente & Vailant (2018), with results showing that the strongest was the father and son role model influence of nascent entrepreneurial activity. A study done in Taiwan (Wannamakok & Chang, 2020) found that role models have a significant positive influence on female entrepreneurial intentions. In contrast, another study found that the presence of female entrepreneurs did not strengthen the link between role models and entrepreneurial intention through self-efficacy (Austin & Nauta, 2015). When an aspiring female tech founder is exposed to a female role model who has successfully founded a tech start-up, it can be deduced that the same-gender role model relationship strongly influences technopreneurial intentions because it increases the perceived feasibility of starting a technology venture. Based on much of the evidence from previous studies, exposure to female tech role models will make the career attractive, desirable, and acceptable to potential women technopreneurs (Byrne, Fattoum & Diaz Garcia, 2018). In the context of this research study, the proposition underpinning the study is that potential technopreneurs who know female technopreneur role models who intend to emulate these role models will increase their aspiration to become technopreneurs.

2.4.2 Subjective Norms: Technopreneur Role Models and Technopreneurial Intention

Role models have been found to positively influence entrepreneurial intention and its antecedents, namely attitude towards entrepreneurship, perceived self-efficacy, and subjective norms (Karimi, Biemans, Lans, Chizari, Mulder & Mahdei, 2013). This is because a person's decision to pursue entrepreneurship is shaped by the perspectives and behaviours of others and the examples they set (Akerlof & Kranton, 2000). The others in an individual’s social context, as mentioned by Krueger et al. (2000), typically include family, friends, significant others, mentors, and role models. This study will focus on the role model dimension of social norms as the others

impact an individual's choice to embark on technopreneurship. Therefore, an individual's motivation to comply with a role model's opinions and actions influences the desirability of a career.

Previous literature has found that role models influence entrepreneurial intention; however, most research found an indirect influence on entrepreneurial intention (Krueger & Carsrud, 1993; Amofah & Saladrigues, 2022; Austin & Nauta, 2016; Fellenhofer & Mueller, 2018; Laviolette et al., 2012; Malebana & Mothibi, 2023; Murari & Pathak, 2022). The indirect effects of subjective norms role models on technopreneurial intention will be tested in this study adopted from previous studies (Heuer & Liñán, 2013; Urban & Chanston, 2018; and Liñán et al., 2011); however, with a focus on role models as subjective norms. This study will adopt the stance from Krueger and Carsrud (1993), stating that role models strongly predict entrepreneurial intention only if they influence attitudes towards behaviour and self-efficacy.

2.4.3 Technopreneur Role Models and Attitude towards Technopreneurship

Role models can influence entrepreneurial intentions by shifting attitudes toward the outcomes of entrepreneurial ventures and instilling confidence in individuals that they can successfully start new ventures (Laviolette et al., 2012).

Findings from the literature show that attitude to entrepreneurial behaviour was the main predictor of entrepreneurial intentions (Urban & Chanston, 2018; Malebana & Swanepoel, 2015). A study done in South Africa by Malebana and Mothibi (2023) confirmed that knowledge of successful entrepreneurs positively influenced entrepreneurial intention and all its antecedents, including attitude towards the behaviour. Various studies have been done to determine whether all types of role models influence attitudes towards entrepreneurship, and the consistent result found that successful role models have a more significant impact on influencing attitudes and entrepreneurial intentions. Murari and Pathak (2022) highlighted that successful role models reinforce favourable attitudes towards entrepreneurship. Laviolette et al. (2012) also found that successful and unsuccessful story-bound role models enhance entrepreneurial

attitudes and intentions. Nowinski & Haddoud's (2019) study affirmed that role models predict entrepreneurial intentions solely when coupled with favourable attitudes towards entrepreneurship. Based on the findings mentioned in the literature, the study proposes that the knowledge of technopreneur role models positively influences technopreneurial intention through attitudes towards technopreneurship.

Hypothesis 3a: Technopreneur Role Models (TRM) have a positive influence on Technopreneurial Intention as mediated by attitude towards technopreneurship.

2.4.4 Role Models and Technopreneurial Self-Efficacy

Bandura's social learning theory is an important underlying theory that explains how role models can facilitate entrepreneurial self-efficacy, which is an antecedent to entrepreneurial intention (Bandura, 1977). In this theory, Bandura proposed that individuals learn behaviours, attitudes, and values through observing and modelling the actions of others, particularly those whom they perceive as role models or influential figures (Bandura, 1977). In technopreneurship, aspiring technopreneurs often look up to successful individuals as role models (Bhat & Gulzar, 2020). Observing role models' behaviours, strategies, and success stories can inspire individuals to pursue technopreneurship. Depending on the role model's failure or success, the observation may decrease or increase an individual's technopreneurial intentions. This heightened self-assurance drives engagement in entrepreneurial endeavours (Murari & Pathak, 2022). It can be said that role models are instrumental in bolstering individuals' confidence in their abilities.

Findings show that entrepreneurial role models positively influence ESE (Murari & Pathak, 2022; Austin & Nauta, 2015; Nowinski & Haddoud, 2019). Various studies have examined the influence of role models on self-efficacy, demonstrating that different contexts yield consistent outcomes: role models positively influence self-efficacy. Laviolette et al. (2012) findings show that exposure to story-bound role models positively impacts self-efficacy and behavioural intentions**.** Murari and Pathak's (2022) research revealed that specifically successful role models enhance self-efficacy and entrepreneurial aspirations compared to unsuccessful ones. Amofah and

Saladrigues (2022) found that a parental entrepreneurial role model positively influences a female student's self-efficacy and entrepreneurial intentions. By observing the ins and outs of entrepreneurship, individuals can realize the feasibility of this career path, which boosts their confidence to follow in similar footsteps. In South Africa, a study done in 2023 found that knowledge of successful entrepreneurs had a significant positive relationship with perceived behavioural control, which controls the perceived feasibility of starting a new venture (Malebana & Mothibi, 2023).

In alignment with the studies mentioned, Fellnhofer and Mueller (2018) found that entrepreneurial role models increase entrepreneurial self-efficacy. Based on the consistent findings in the literature, the study proposes that technopreneur role models positively influence technopreneurial intentions through technopreneurial self-efficacy. As part of vicarious experiences, role models can enhance an individual's technopreneurial self-efficacy by demonstrating the feasibility of pursuing and succeeding in new ventures. This, in turn, can increase the individual's technopreneurial intentions (Bandura, 1986). However, fostering these intentions may be challenging if exposure to technopreneurs highlights predominantly adverse outcomes. Krueger and Carsrud (1993) argued that educating people about entrepreneurship could reduce self-efficacy and entrepreneurial intention. Research by Lent, Brown, and Hackett (1994); BarNir, Watson, and Hutchins (2011); Austin and Nauta (2016); Laviolette et al. (2012); and Murari and Pathak (2021) consistently shows that self-efficacy mediates the relationship between role model exposure and entrepreneurial intentions. Building on these findings, this study hypothesizes that knowledge of technopreneur role models positively influences technopreneurial intentions, mediated by enhanced technopreneurial self-efficacy.

Hypothesis 3b: Technopreneur Role Models (TRM) have a positive influence on Technopreneurial Intention as mediated by technopreneurial self-efficacy.

2.4.5 South African Institutional Context and Technopreneurial Intention

Since entrepreneurship is deeply rooted in a social context, socio-cultural factors such as social norms, beliefs, and practices significantly impact the formation of entrepreneurial intentions and their antecedents (Busenitz, Gomez & Spencer, 2000). Shane and Venkataraman (2000) describe entrepreneurship as a dynamic process in which an entrepreneur acts on an opportunity embedded in the local entrepreneurial environment. OC&C Strategy Consultants (2018) emphasize that tech entrepreneurship thrives when people cultivate the necessary conditions for success, including a local culture that supports technopreneurship. A local culture that encourages technopreneurship promotes role models and their success stories. It has media coverage of tech entrepreneurship and a positive societal attitude towards technopreneurship as a desirable career choice. Therefore, investigating the South African-specific institutional context is vital for understanding technopreneurial intentions among South African female tech students.

Institutions represent prevalent ways of thinking or acting within a group, along with standard rules that govern various activities (Neale, 1987). In entrepreneurship and tech entrepreneurship, institutions encompass the collection of rules that structure economic, social, and political interactions among individuals, thereby influencing business activities (Linan et al., 2011).

The institutional environment includes formal institutions like laws, regulations, and governmental policies, as well as informal institutions such as cultural norms, societal values, and unwritten social rules (North, 1990). Technopreneurs must navigate this environment to start and grow businesses. The ease and difficulty of technopreneurship can vary depending on the institutional context.

Institutional theory posits that the behaviour of individuals is largely influenced by the institutional environment, which comprises the cognitive, normative, and regulatory dimensions (Scott, 1995). These dimensions help shape society's beliefs, norms, and rules, guiding actions and decisions. Scott (1995) introduced the concept of the three pillars of the institutional environment, which include regulatory, cognitive, and normative dimensions. Kostova (1997) introduced the country-level institutional profile and investigated how these three pillars influence entrepreneurship activities. The institutional framework shapes, generates, and constrains entrepreneurial opportunities, which in turn impacts the rates of entrepreneurial activity (Shapero & Sokol, 1982; Manolova, Eunni & Gyoshev, 2009; Aldrich & Fiol,

1994). This theory will apply in the context of tech entrepreneurship, where the institutional framework influences technopreneurial activity and intentions.

The **regulatory dimension** encompasses laws, regulations, and government policies designed to support new businesses and assist entrepreneurs in securing necessary resources (Busenitz et al., 2000). There are different types of programs and policies that either hinder or support technopreneurial intention. Generally, the lower barriers to entry encourage people to want to pursue technopreneurship; however, when the perception of government regulations is negative, people are more discouraged from pursuing technopreneurship (Urbano & Alvarez, 2013).

The **cognitive dimension** includes shared understanding and common societal beliefs (Scott, 2008). These include the knowledge base, cognitive frameworks, and mental models that influence how people perceive and engage in entrepreneurial activities (Scott, 2008). An example is the prevalence of role models, and success stories can inspire and shape the cognitive mindset towards technopreneurship in a community (Chhabra, Gera, Hassan & Hasan, 2020). The cognitive dimension and technopreneurship promotion programs can present technopreneurship as a viable career option, educating the public about successful entrepreneurs, their qualities, and their strategies (Farashah, 2015; Aloulo, 2021; Li, Wang & Long, 2019).

Because this study is primarily about the influence of social norms, such as female technopreneur role models and technopreneurial intention, the study will focus on normative institutions that refer to the social norms of society regarding technopreneurship. The **normative dimension** refers to the norms and values that prevail in society, including societal attitudes towards risk, innovation, and failure, which play a crucial role in shaping technopreneurial activity (Busenitz et al., 2000). Social norms dictate the appropriate methods for achieving desirable goals and validate the strategies used to pursue them (Urbano & Alvarez, 2013). Applied on a country level, a culture that values innovation and risk-taking is often conducive to general entrepreneurship and technopreneurship (Busenitz

et al., 2000). De Clercq, Danis, and Dakhli (2010) reported that the intention to start new businesses tends to be lower in countries where entrepreneurship is not universally viewed positively.

An earlier study by Urban (2013) found that positive perceptions of different institutional profiles were positively but not significantly correlated with entrepreneurial intentions. Urbano and Alvarez (2013) and Oftedal, Iakovleva, and Foss (2018) found that a favourable normative dimension, such as greater media attention for new businesses, increases the likelihood of becoming an entrepreneur. In alignment with this, Duong (2021) found that the normative dimension positively promotes entrepreneurial intention through attitude towards entrepreneurship and entrepreneurial self-efficacy. A study focusing on female entrepreneurship revealed that normative factors significantly influence the levels of nascent female entrepreneurs in India and Vietnam (Chhabra, 2020). This insight is particularly helpful because India, like South Africa, is an emerging economy, making it useful for formulating a similar hypothesis. For this study specific to technopreneurship, the hypothesis will be formed with the above evidence as technopreneurship is a type of entrepreneurship and will, therefore, be inferred when formulating the hypothesis. A recent study by Aloulou in 2021 confirmed that institutional dimensions influence entrepreneurial intention through perceived desirability (attitude towards technopreneurship).

Monteiro, Iwai, and Bruscato (2021) found that positive perceptions of local normative institutions positively affected attitudes towards entrepreneurship and subjective norms and, in turn, significantly positively affected entrepreneurial intentions. Research findings from Aloulou (2021) reveal that perceived desirability and feasibility fully mediate the relationship between institutional dimensions and entrepreneurial intention. Considering the explanation of attitude towards technopreneurs can be considered as the perceived desirability of technopreneurship according to the TPB and SEE theory, the study will apply the findings to hypothesise the relationship between the normative dimension and technopreneurial intention mediated by attitude towards technopreneurship. Another study done amongst Vietnamese students found the mediating role of attitude towards entrepreneurship between contextual factors (normative dimension) and entrepreneurial intention. Lastly, the findings from the study by Li et al. (2019) showed that the perception of the normative environment significantly affects subjective norms and entrepreneurial growth intentions. In alignment with findings from previous

research, the study proposes that the positive perception of normative institutions has a positive effect on technopreneurial intentions as mediated by attitude towards technopreneurship and subjective norms: knowledge of female technopreneur role models.

Hypothesis 4: Positive perceptions of the normative institutional environment have a positive effect on technopreneurial intentions as mediated by attitude towards technopreneurship and subjective norms: knowledge of female role models among South African female tech students

2.5 Conceptual framework

The research study seeks to investigate the influence of female technopreneur role models on the technopreneurial intentions of female technology students in South Africa.

Independent Variables

- IV & MV: Attitude towards technopreneurship
- IV & MV: Subjective Norms: Knowledge of female technopreneur role models
- MV: Technopreneurial Self-efficacy
- MV: Perception of Normative Institutional Environment

Dependent Variables

- DV: Individual Technopreneurial Intention

Summary of Hypotheses

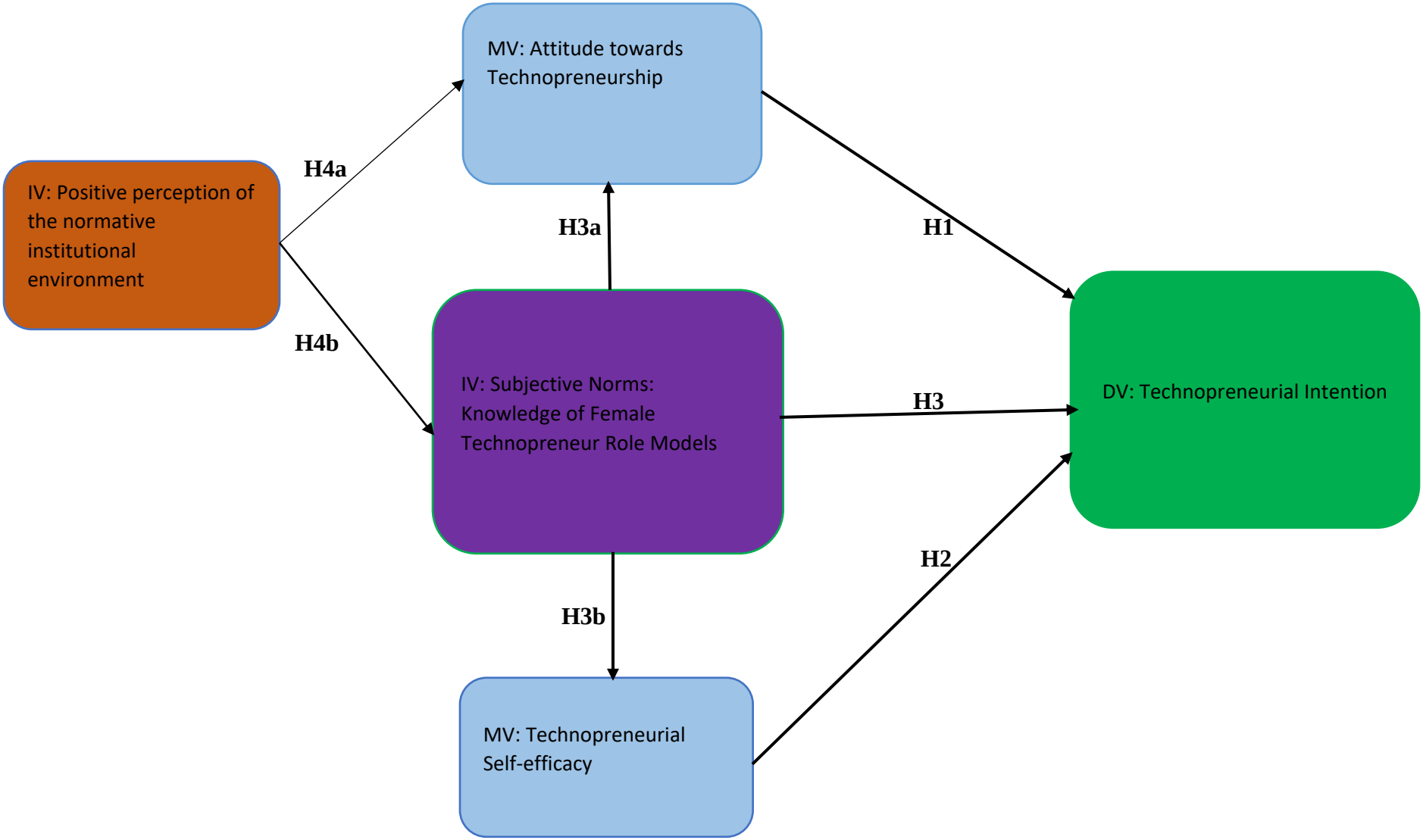
Hypothesis 1: Attitude towards technopreneurship positively influences technopreneurial intentions among female technology students in South Africa

Hypothesis 2: Technopreneurial self-efficacy positively influences technopreneurial intentions among female technology students in South Africa

Hypothesis 3: Technopreneur Role Models (TRM) have a positive influence on technopreneurial intentions as mediated by attitude towards technopreneurship (H3a) and technopreneurial self-efficacy (H3b)

Hypothesis 4: Positive perceptions of the normative institutional environment have a positive effect on technopreneurial intentions as mediated by attitude towards technopreneurship (H4a) and subjective norms: knowledge of female role models (H4b) among South African female tech students

Figure 1: Conceptual Diagram of Hypothesised Relationships



2.6 Consistency Matrix

Table 1: Consistency Matrix

Research Title: Female technopreneur role models and technopreneurial intentions among South African female technology students							
Problem statement: Understand the influence that female technopreneur role models have on the technopreneurial intentions of female technology students to evaluate the effectiveness of the role model recommendation in addressing the gender gap in Technopreneurship within the South African context.							
Research objective: To investigate the influence female tech entrepreneurs as role models have on the technopreneurial intentions of female students in South Africa.							
Sub-objectives	**Literature review**	**Hypotheses**	**Research questions**	**Variables (Independent & Dependant)**	**Source of data**	**Type of data**	**Analysis**
1. The objective is to investigate the level of	Theory of planned behaviour - Technopreneurial	**H1**: Attitude towards technopreneurship	What level of influence does attitude towards	IV: Attitude towards	Questionnaire:	Ordinal data	Regression analysis will be used to

influence that attitude towards technopreneurship has on technopreneurial intentions among female technology students in South Africa.	Intention and Antecedents. ✓ Bhat and Gulzar (2020) ✓ Malebana and Mothibi (2023) ✓ Urban and Chantson (2018) ✓ Kovaleva et al (2023) ✓ Laviolette et al (2012)	positively influences technopreneurial intentions among female technology students in South Africa	technopreneurship have on technopreneurial intentions among female technology students in South Africa?	technopreneurship DV1: Technopreneurial Intention	Attitude towards technopreneurship**:** (Questions 15 to 20) Technopreneurial Intention (Questions 6 to 11)	(7 Likert scale)	analyse the influence.

2. The objective is to investigate the level of influence that technopreneurial self-efficacy has on technopreneurial intentions among female technology students in South Africa.	Social Cognitive Theory – Technopreneurial Self-efficacy Theory of planned behaviour - Technopreneurial Intention. ✓ Bhat and Gulzar (2020) ✓ Malebana and Mothibi (2023) ✓ Urban and Chantson (2018) ✓ Kovaleva et al (2023)	**H2**: Technopreneurial Self-efficacy positively influences technopreneurial intentions among female technology students in South Africa	What level of influence does technopreneurial self-efficacy have on technopreneurial intentions among female technology students in South Africa?	IV: Technopreneurial self-efficacy DV1: Technopreneurial Intention	Questionnaire: Technopreneurial self-efficacy**:** (Questions 12 to 14) Technopreneurial Intention (Questions 6 to 11)	Ordinal data (7 Likert scale)	Regression analysis will be used to analyse the influence.

	✓ Laviolette et al (2012)						
3. The objective is to investigate the level of influence that technopreneurial role models have on technopreneurial intentions as mediated by attitude towards technopreneurship and technopreneurial self-efficacy among female	Theory of planned behaviour – Role models and Technopreneurial Intention. ✓ Bhat and Gulzar (2020) ✓ Malebana and Mothibi (2023) ✓ Urban and Chantson (2018)	**H3a**: Female Technopreneur role models positively influence technopreneurial intentions as mediated by attitude towards technopreneurship among female technology students in South Africa **H3b**: Female Technopreneur role models positively	What level of influence do female technopreneur role models have on technopreneurial intentions mediated by attitude towards technopreneurship among female technology students in South Africa? What level of influence do female technopreneur role models have on	IV: Female technopreneur role models DV1: Technopreneurial Intention MV1: Attitude towards technopreneurship MV2: Technopreneurial self-efficacy	Questionnaire: Female technopreneur role models**:** (Questions 1 to 5) Technopreneurial Intention (Questions 6 to 11)	Ordinal data (7 Likert scale)	Regression analysis and Mediation analysis will be used to analyse the influence.

technology students in South Africa	✓ Kovaleva et al (2023) ✓ Laviolette et al (2012)	influence technopreneurial intentions mediated by technopreneurial self-efficacy among female technology students in South Africa	technopreneurial intentions as mediated by technopreneurial self-efficacy among female technology students in South Africa?		Technopreneurial self-efficacy**:** (Questions 12 to 14) Attitude towards technopreneurship**:** (Questions 15 to 20)		
4. The objective is to investigate the effect that the positive perceptions of the normative institutional environment have on	Institutional Theory – Normative institutional environment Theory of planned behaviour -	**H4a**: Positive perceptions of the Normative institutional environment have a positive effect on technopreneurial intentions as mediated by	How do positive perceptions of the normative institutional environment affect technopreneurial intentions, as mediated by attitudes towards	IV: Positive perception of the normative institutional environment	(Questions 21 to 25) Busenitz et al. (2000)	Ordinal data (7 Likert scale)	Regression analysis and Mediation analysis will be used to analyse the effect.

technopreneurial intentions as mediated by attitude towards technopreneurship and subjective norms: female technopreneur role models among female technology students in South Africa	Technopreneurial Intention. ✓ Busenitz et al. (2000) ✓ Urbano and Alvarez (2014) ✓ Scott (2008)	attitude towards technopreneurship among female technology students in South Africa **H4b**: Positive perceptions of the Normative institutional environment have a positive effect on technopreneurial intentions as mediated by subjective norms: female technopreneur role models among female technology students in South Africa	technopreneurship among female technology students in South Africa? What is the effect of the positive perceptions of the normative institutional environment on technopreneurial intentions as mediated by the subjective norms: female technopreneur role models among female technology students in South Africa?	DV1: Technopreneurial Intention MV1: Attitude towards technopreneurship MV2: Subjective norms: female technopreneur role models			

2.7 Chapter Summary

In this chapter, a comprehensive literature review was done using the theory of planned behaviour and social cognitive theory, formulating three hypotheses. Firstly, technopreneurial intention was explored, and entrepreneurial intention antecedents were found to be significant in explaining motivations for technology students to create tech ventures. Attitude towards technopreneurship was found to have a positive influence on technopreneurial intention. Secondly, the literature on entrepreneurial self-efficacy was explored, and this antecedent was found to be very significant in explaining technopreneurial intention. Therefore, a hypothesis was formulated that technopreneurial self-efficacy has a positive influence on technopreneurial intentions. Thirdly, the literature on role models was explored, and interesting findings were made on their influence on entrepreneurial intentions. The hypothesis for role models was formulated to state that role models influence technopreneurial intention but indirectly through attitude towards technopreneurship and technopreneurial self-efficacy. Fourthly, the South African normative institutional profile was considered a factor affecting technopreneurial intention. A hypothesis was proposed to state that the positive perception of the normative institutional environment has a positive effect on technopreneurial intention but through attitude towards technopreneurship and subjective norms. Lastly, the conceptual framework was created and used to explain the hypothesised relationships between the TRM, TSE, ATT and TI. The next chapter will then propose data collection methods and discuss data analysis.

CHAPTER 3: RESEARCH METHODS

This chapter describes the research approach, the paradigm adopted, the research design, the population and sample strategy, the research instrument, data quality control measures put in place to ensure the validity and reliability of instruments, ethical considerations considered to ensure confidentiality and consent, and lastly the data collection and analysis techniques.

3.1 Research approach

The research study adopted the quantitative research method to investigate two variables, namely role models and entrepreneurial intention, in the context of women's technopreneurship. A quantitative research method is the most appropriate for this research study because it will achieve the outcome of the research objective to investigate the influence female technopreneurs as role models have on the technopreneurial intention of female students in South Africa. Additionally, this research method has been used by previous researchers with similar research goals to test hypotheses (Malebana & Mothibi, 2023; Kovaleva et al., 2023; Byrne et al., 2018; Laviolette et al., 2012; Amofah & Saladriques, 2022; Van Auken et al., 2006).

3.2 Research paradigm

The research will adopt a positivist point of view to add to the proof that there is an objective reality that can be measured through a scientific investigation (Creswell & Creswell, 2018). To understand the influence of role models on entrepreneurial intention in the context of women technopreneurship in South Africa, this study will adopt a positivist worldview due to its methodological approach and suitability for testing hypotheses (Creswell & Creswell, 2018). The theory will be tested empirically, and the data will be analysed

statistically, making it the most appropriate paradigm to adopt for this research study, and that is why we chose the Positivism paradigm (Chantson, 2015).

What stands out in the ontology of the positivist paradigm is the researcher's independence, indicating that they do not exert influence on the world (Maksimović & Evtimov, 2023). To maintain objectivity, the researcher eliminated the need for personal and emotional biases when conducting this research study (Creswell & Creswell, 2018). The challenge with this view is that neutrality may be impossible, and therefore, there will always be some bias (Maksimović & Evtimov, 2023). Replicability is an advantage of this positivist worldview for other researchers interested in replicating a similar research study in different contexts from South Africa or women's tech entrepreneurship (Schindler & Cooper, 2014). The downside of the positivist worldview for this research study is that it will give limited qualitative insight into how role models influence entrepreneurial intention because of the focus on quantifying the extent of influence used in this research study (Chantson, 2015). Lastly, empirical evidence from the research study will add to scientific progress in research scholarship regarding role models and entrepreneurial intention (Creswell & Creswell, 2018).

3.3 Research Design

The research relies on a cross-sectional questionnaire survey that examines the influence of role models on the technopreneurial intentions of female technology students in South Africa in 2024 (Schindler & Cooper, 2014). This is preferred because it allows for the collection of data at a single point in time and, therefore, allows a snapshot of technopreneurial intentions that can be generalised about students in the year 2024 (Maksimović & Evtimov, 2023). The quick and cost-effectiveness of a cross-sectional questionnaire survey was advantageous for the researcher as the research study had a deadline (Chantson, 2015). This research design approach was recommended by previous literature when measuring the influence of role models on entrepreneurial intention (Chantson, 2015; Malebana & Mothibi, 2023). The researcher asked participants to complete a questionnaire measuring the impact of female role models on their entrepreneurial intentions in technology (Nowinski & Haddoud, 2019). This allowed for collecting primary data directly from

the source (Schindler & Cooper, 2014). The closed-ended questionnaire only allowed the users to answer based on predetermined answers, which made it easier to analyse for quantitative purposes due to the study's research objectives (Creswell & Creswell, 2018). An open-ended questionnaire would have allowed for more in-depth feedback; however, it was unsuitable for this quantitative research study (Creswell & Creswell, 2018).

The researcher tailored the questionnaire to align with specific research objectives and effectively address the research questions. The type of questionnaire was non-experimental, which allowed the researcher to observe the relationship between two variables, namely role models and technopreneurial intention, at a quicker turn-around time and did not require the manipulation of variables to observe other variables (Creswell & Creswell, 2018). The research study did not adopt the experimental questionnaire because the research objectives do not aim to establish the causality of technopreneurial intention but aim to investigate the level of influence that role models have on entrepreneurial intention in the context of women technopreneurship in South Africa (Schindler & Cooper, 2014). Secondary data was utilised to provide context and to gain insights from existing research on the influence of role models on entrepreneurial intentions among women in tech entrepreneurship (Schindler & Cooper, 2014).

3.4 Population and sample

To conduct research in 2024, the population was selected from two software development training academies in South Africa: We Think Code (WeThinkCode, 2024) and Girl Code (Girl Code, 2024). This population includes female software development college students across three main cities in South Africa: Cape Town, Johannesburg, and Durban, and other smaller towns. The study generalised research findings for South Africa based on a study conducted with participants mainly from the three main metropolises, Johannesburg, Durban, and Cape Town populations, which is where most technopreneurship is situated, and smaller towns (Disrupt Africa, 2022). This was a calculated assumption based on the 2022 South African Start-up Ecosystem Report by Disrupt Africa; Cape Town hosts 45.9% of tech start-ups, Johannesburg accommodates 41.6%, while Durban houses 1.6% of these ventures.

Following the definition of potential women technopreneurs in this study, software technology students were selected as the ideal population because they represent potential women technopreneurs as they study for careers in technology (Van Auken et al., 2006). Before participating in the survey, the students had to meet the three criteria of being female, technology students, and not already self-employed in technology. Software development students have the knowledge and skills needed to create technological solutions; therefore, it can be deduced that the students have the potential to create tech ventures. This population also predominantly excludes women who are already tech entrepreneurs because they must report to their main training campuses for 40 hours a week, making it much more accurate to test entrepreneurial intention in technology (WeThinkCode, 2024; Girl Code, 2024). South African literature was also helpful in guiding this decision; the researcher noted the population of Malebana and Mothibi (2023) selected for a similar research study.

According to the findings of the GEM report from 2022, entrepreneurial activity among individuals in the 18–34 age bracket is prevalent. Consequently, this demographic will likely possess the cognitive and psychological capacity to comprehend tech role models' significance and influence on entrepreneurial aspirations. WeThinkCode and Girl Code enrol students from 17 to 35 to learn how to develop code for technology software. Therefore, this fits the population (WeThinkCode, 2024 & Girl Code, 2024). Finally, according to CareerKarma.com (2023), the student population enrolled at WeThinkCode and Girl Code across Johannesburg, Durban, and Cape Town exceeds 500, establishing a sizable pool for sampling purposes (Creswell & Creswell, 2018).

Literature from academic journals written on ‘role models and entrepreneurial intention’ shows an average of 301 responses in terms of sample size (Van Auken et al., 2006; Nowinski & Haddoud, 2019; Bosma et al., 2012; Malebana & Mothibi, 2023; Amofah & Saladrigues, 2022; Entrialgo & Iglesias, 2017; and Laviolette et al., 2012). This research's final ideal sample size was 300 female software development students, including participants from Johannesburg, Cape Town, and smaller towns in South Africa. A sample size of 300 students was selected to address potential non-response sampling issues (Schindler & Cooper, 2014; Field, 2018). This

sample, drawn from different cities, aims to generalize findings for the target population in South Africa (Creswell & Creswell, 2018). A summary of the final population and sample size appears in Table 2.

Table 2: Summary of Population and Sample

Population	**South African Female technology students**
Sample	274 female technology students
Sampling Strategy	Stratified convenience sampling strategy
Research design	Online Survey

3.5 Sample Strategy and Frame

A stratified convenience sampling strategy was used to ensure that the sample would be female technology students in all three main cities of Cape Town, Johannesburg, Durban, and smaller towns. This sampling strategy was stratified because the female representation of participants was needed for the research study to cover the three leading tech metropolises in South Africa (Creswell & Creswell, 2018). Researchers used a non-probability (convenience) sample to allow respondents from WeThinkCode and GirlCode who chose to participate in the questionnaire survey. This will reduce the forced responses that may be invalid (Creswell & Creswell, 2018). This

selection group allowed participants with insight into technology and entrepreneurship to answer the relevant questions for this research study. The disadvantage of implementing the sampling strategy is that it comes with complexity because each city will need a sample size sufficient to provide meaningful results (Creswell & Creswell, 2018). To manage this complexity, the researcher emphasised to the campus director during data collection the importance of students from all different campuses participating in the survey to get more comprehensive insight into the influence of role models on technopreneurial intention.

If the different cities exhibit hidden differences, bias could enter the sample. To mitigate this risk, the study collected demographic information regarding the students' provinces and ethnicities (Schindler & Cooper, 2014). This approach helps uncover hidden differences between the cities, which will be discussed later in the demographic profile.

3.6 Research instrument

The study used a self-administered online questionnaire for female WeThinkCode and Girl Code students. Researchers chose the online survey for its convenience, cost-effectiveness in covering different city samples, and confidentiality (Chantson, 2015). They customized the survey instrument based on guidance from Malebana and Mothibi (2023), Wei-Loon Koe (2020), and Laviolette et al. (2012). However, this survey method has a downside: survey fatigue, which can reduce responsiveness (Chantson, 2015). This study evidenced survey fatigue, as participants completed many responses but left the last few questions unanswered. A 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree), allowed for more nuanced feedback by including "somewhat agree" options (Schindler & Cooper, 2014). Researchers adapted the "role model" 7-point Likert scale from Nauta and Kokaly (2001) to include technopreneur role models. They also adapted the technopreneurial intention 7-point scales from Linan and Chen (2009) to reflect technopreneurial intentions. Additionally, they adapted the scales for entrepreneurial intention, including PBC, ATT, and SN, from Linan and Chen et al. (2009) to incorporate technopreneurial intentions. Other researchers, including Wei-Loon Koe (2020), successfully used these scales, ensuring their reliability for hypothesis testing. The researchers adapted the technopreneurial self-efficacy 7-point Likert scale from McGee et al. (2009). Laviolette et al. (2012) used this scale in their study, demonstrating its reliability and consistency. Finally, they

customized the technopreneurship institutional profile 7-point Likert scale from Busenitz et al. (2000) to measure the region's institutional profile for technopreneurship. This scale has proven effective in a South African study (Danisa, 2021) and other research, including studies by Doanh (2021) and Chhabra et al. (2020). A summary of the research instrument scales, and their sources appears in Table 3.

Table 3: Summary of Research Instrument

Scale Items	Construct	Sources
Consent	Consent	• Chantson (2015) • (Danisa, 2021)
Question a - e	Demographics	• Chantson (2015) • (Danisa, 2021)
Question 1 - 5	Female technopreneur role models	• Nauta and Kokaly (2001)
Question 6 - 11	Technopreneurial Intentions	• Linan & Chen (2009) • Wei-Loon Koe (2020)
Question 12 - 14	Technopreneurial Self-efficacy	• McGee et al. (2009) • Laviolette et al., (2012)
Question 15 - 20	Attitude towards technopreneurship	• Linan & Chen (2009)

		• Malebana & Mothibi (2023)
Question 21 - 25	Perception of the Normative Dimension	• Busenitz et al. (2000) • Doanh (2021) • (Chhabra et al 2020)

Table 3, the research instrument consistency Table, is included below. The research instrument email cover letter was included in Appendix A, and the actual questionnaire was included in Appendix B.

Table 4: Research Instrument Consistency Table

Research Instrument Adapted from similar studies namely Malebana & Mothibi (2023); Wei-Loon Koe (2020); Laviolette et al., (2012); Doanhl (2021).

Constructs	Scales	Questions	Sources
H1: Attitude towards technopreneurship positively influences technopreneurial intentions among female technology students in South Africa	7-point Likert Scales	• Being a tech entrepreneur implies more advantages than disadvantages to me. • A career as a tech entrepreneur is totally attractive to me. • If I had the opportunity and resources, I'd like to start a tech business. • Amongst various options, I would rather be a tech entrepreneur. • Being a tech entrepreneur would give me great satisfaction. • My qualifications have contributed positively to my attitude towards becoming a tech entrepreneur. **Individual Technopreneurial Intention** • I am ready to do anything to be a technopreneur • My professional goal is to become a technopreneur. • I will make every effort to start and run my technology-based firm. • I am determined to create a technology-based firm in the future.	Attitude towards technopreneurship – Adapted from Linan & Chen (2009) Similar to the study by Malebana & Mothibi (2023) Technopreneurial Intention – Adapted from (Linan & Chen, 2009) Similar to the study by Wei-Loon Koe (2020); 7-point scale.

		• I have very seriously thought of starting a technology-based firm. • I have the firm intention to start a technology-based firm someday.	
H2: Technopreneurial Self-efficacy positively influences technopreneurial intentions among female technology students in South Africa	7-point Likert Scales	Degree of confidence in the ability to: • Identify the need for a new tech product • Brainstorm and come up with a new idea for a tech product or service • Design a new product or service that would satisfy the customer's needs or wants **Individual Technopreneurial Intention** • I am ready to do anything to be a technopreneur • My professional goal is to become a technopreneur. • I will make every effort to start and run my technology-based firm. • I am determined to create a technology-based firm in the future.	Technopreneurial self-efficacy: Adapted from McGee et al. (2009) Similar to the study by Laviolette et al., 2012 Technopreneurial Intention – adapted from (Linan & Chen, 2009) Similar to the study by Wei-Loon Koe, 2020); 7-point scale.

		• I have very seriously thought of starting a technology-based firm. • I have the firm intention to start a technology-based firm someday.	
H3: Female Technopreneur role models positively influence technopreneurial intentions as mediated by (3a) attitude towards technopreneurship and (3b) technopreneurial self-efficacy among female technology students in South Africa	7-point Likert Scales	**Subjective Norms: Knowledge of Female role models** • There is a female tech entrepreneur I am trying to be like in my career pursuits. • There is a female tech entrepreneurial person particularly inspirational to me in my career path. • In the career path I am pursuing, there is a female tech entrepreneurial person that I admire. • I have a female mentor in my potential tech entrepreneurial career field. • I know a female tech entrepreneur who has a career I would like to pursue. **Individual Technopreneurial Intention** • I am ready to do anything to be a technopreneur • My professional goal is to become a technopreneur.	Knowledge of Female Role Models – Adapted from Nauta and Kokaly (2001) Technopreneurial Intention – adapted from (Linan & Chen, 2009) Similar to the study by Wei-Loon Koe, 2020); 7-point scale.

		• I will make every effort to start and run my technology-based firm. • I am determined to create a technology-based firm in the future. • I have very seriously thought of starting a technology-based firm. • I have the firm intention to start a technology-based firm someday. **Attitude towards technopreneurship** • Being a tech entrepreneur implies more advantages than disadvantages to me. • A career as a tech entrepreneur is totally attractive to me. • If I had the opportunity and resources, I'd like to start a tech business. • Amongst various options, I would rather be a tech entrepreneur. • Being a tech entrepreneur would give me great satisfaction.	

		• My qualifications has contributed positively to my attitude towards becoming a tech entrepreneur. **Technopreneurial self-efficacy** Degree of confidence in the ability to: • Identify the need for a new tech product • Brainstorm and come up with a new idea for a tech product or service • Design a new product or service that would satisfy the customer's needs or wants	

Hypothesis 4: Positive perceptions of the normative institutional environment have a positive effect on technopreneurial intentions as mediated by attitude towards technopreneurship (H4a) and subjective norms: knowledge of female role models (H4b) among South African female tech students	7-point Likert Scales	**Normative dimension** • In this region, innovative and creative thinking is viewed as the route to success • Tech entrepreneurs are admired in this region • People in this region tend to greatly admire those who start their own technology business • Turning new ideas into tech businesses is an admired career path in this region • In your region, you often come across success stories of tech entrepreneurs in public media **Individual Technopreneurial Intention** • I am ready to do anything to be a technopreneur • My professional goal is to become a technopreneur. • I will make every effort to start and run my technology-based firm. • I am determined to create a technology-based firm in the future. • I have very seriously thought of starting a technology-based firm.	Adapted from Busenitz et al. (2000). Similar to the study by Doanh (2021) and (Chhabra et al 2020) women's scale

		• I have the firm intention to start a technology-based firm someday. **Attitude towards technopreneurship** • Being a tech entrepreneur implies more advantages than disadvantages to me. • A career as a tech entrepreneur is totally attractive to me. • If I had the opportunity and resources, I'd like to start a tech business. • Amongst various options, I would rather be a tech entrepreneur. • Being a tech entrepreneur would give me great satisfaction. • My qualifications has contributed positively to my attitude towards becoming a tech entrepreneur. **Subjective Norms: Knowledge of Female role models** • There is a female tech entrepreneur I am trying to be like in my career pursuits.	

		• There is a female tech entrepreneurial person particularly inspirational to me in my career path. • In the career path I am pursuing, there is a female tech entrepreneurial person that I admire. • I have a female mentor in my potential tech entrepreneurial career field. • I know a female tech entrepreneur who has a career I would like to pursue.	

3.7 Data collection strategy

To collect secondary data, the researcher began with a literature review, searching for keywords on Google Scholar, Web of Science, and related databases to identify relevant literature on the influence of role models on entrepreneurial intention in women technopreneurship. The researcher used keywords such as "women," "women technopreneurship," "female entrepreneurship," "female technopreneurship," "entrepreneurial efficacy," "entrepreneurial intention," and related terms like "STEM," "STEM entrepreneurship," "women entrepreneurship factors," "normative institutions," and "technopreneurship" (Nowinski & Haddoud, 2019). After reading all abstracts and ensuring that the authors write about the influence of role models on entrepreneurial intentions, the researcher also noted that the literature was published in recent years from 2024 (Schindler & Cooper, 2014). A selection of relevant literature was saved and used to write the literature review and other chapters in the research paper.

The primary data collection process began by grouping the target population into strata based on their cities. The researcher identified and deliberately targeted two coding training academies for data collection. Data collection started in the first week of September 2024, after the University of Witwatersrand granted ethics clearance and the researcher signed the necessary documents. The first step involved contacting the campus directors of WeThinkCode and GirlCode to obtain permission letters for data collection at their campuses. Once the campus directors signed and returned the permission letters, the researcher distributed the questionnaire for responses.

The researcher started by sending the anonymous questionnaire to 5 pilot testers who could test and give feedback on the question's clarity and if any detail was unclear before sending it out to the targeted students. The responses that were given by the five pilot testers allowed the researcher to proceed with sending out the online survey to WeThinkCode and Girl Code. Specifically, a cover letter with the anonymous link to the survey was sent to the campus directors for distribution to students for voluntary completion (Creswell & Creswell, 2018). The survey responses were distributed and collected through the software platform Qualtrics in the space of 1.5 months to allow sufficient time for students to complete the survey at their convenience. The researcher sent reminder emails weekly to the

campus directors to encourage an increase in responses. This consistent effort aimed to achieve a reasonable response rate for the online survey, which typically has a low response rate (Chantson, 2015).

On the questionnaire, participants consented to participate in the research study. They also provided background information to ensure the data collected was from the intended recipients, specifically female tech students in South Africa. Participants indicated their level of agreement with statements on Technopreneur Role Models, Technopreneurial Intention, ATT, SN, Technopreneurial Self-Efficacy, and Normative Institutional Environments using a 7-point Likert scale ranging from "1 = strongly disagree" to "7 = strongly agree" (Malebana & Mothibi, 2018).

The total number of responses was 274, and the respondents were from different provinces. After completion, the researcher cleaned all received data to ensure accurate analysis and results (Schindler & Cooper, 2014).

3.8 Data Screening and Analysis

3.8.1 Qualtrics Quality Checks

The data was collected through the software Qualtrics, which allowed for the creation of the online survey and the collection and analysis of data. After the survey was closed in mid-October 2024, the data was first cleaned up on Qualtrics. Before cleaning up on Qualtrics, the survey gathered 274 responses in one and a half months of the survey response collection period. Qualtrics has response quality checks that include checking for duplicate responses, potential bots, and completion rate, and as a result, 75% of the responses received passed the Qualtrics quality checks. After filtering out the 25% poor-quality responses, the data exported out of Qualtrics for data analysis included 200 responses. This process was used by previous researchers and proved to clean up the data for potential errors; therefore, it was the basis of choice for this research study (Galawe, 2017).

3.8.2 Statistical Package

The data retrieved from Qualtrics was then imported into IBM SPSS Statistics Version 29.0.2.0 (20) for further data quality checks and statistical analysis. Previous researchers with similar studies successfully used this software, which yielded accurate analysis results. Therefore, it was used for this research study based on being tried and tested (Urban & Chanston, 2018; Galawe, 2017; Sigauke, 2020; Lakha, 2021).

3.8.3 SPSS Data Screening

The data screening process is vital because it allows for the checking and elimination of errors that could affect the analysis results (Pallant, 2016). This process includes checking for out-of-range errors, coding, missing data, incomplete data, and reversed questions (Schindler & Cooper, 2014; Pallant, 2016; Rachad Antonius, 2004). The data view and variable view in SPSS displayed all the value labels, which made it simpler to remove the system variables collected by Qualtrics, including start dates, status, duration, user language, and relevant ID. This left only the answers to the survey questions, which resulted in 31 variables left, including categorical and continuous variables.

Evident from the variable view in SPSS, all continuous variables were coded numerically, and the measure was scaled, which is expected and suitable for the level of measurement for continuous variables (Rachad Antonius, 2004). Initially, the categorical variables were coded on a scale, but the researcher updated them to a nominal measure, as suggested by Pallant (2016).

Initially, the categorical variables were coded on a scale, but the researcher updated them to a nominal measure, as suggested by Pallant (2016). The variable names and labels were then updated for easier identification of variables during the analysis process compared to just question numbers with no context (Rachad Antonius, 2004 & Pallant, 2016).

The researcher examined exclusion questions to remove any responses that did not meet the qualifying criteria of the study (Galawe, 2017). The research study aims to analyse data from all consenting female tech students who have not yet started their tech business to be able to measure technopreneurial intention. All responses that did not meet the qualifying criteria were removed listwise: non-consenting (1), male (1), not a technology student (8), and already started a tech business (15). After the cases were removed, the variables were also removed. The researcher checked the maximum and minimum values for each variable to identify out-of-range values, discovering evidence of reversed questions. The researcher identified these reversed questions and recoded them to align with the other responses, as shown in Table 5 (Pallant, 2016).

Table 5: Reversed questions that were recoded to different variables

Variable measured	Question Number	The total number of items recoded
Technopreneurial Intentions (TI)	T1, T2, T3, T4, T4, T5, T6	6
Attitude towards Technopreneurship (ATT)	ATT1, ATT2, ATT3, ATT4, ATT5, ATT6	6

The questions with different minimum and maximum values were also recoded to align with the coding of a minimum of 1 and a maximum of 7 (Pallant, 2016). The questions recoded to the same variable have different scores than the minimum of 1 and maximum of 7, as shown in Table 6.

Table 6: Questions recoded to the same variables

Variable measured	Question Number	The total number of items recoded
Technopreneurial Self Efficacy (TSE)	TSE1	1
Normative Dimension (ND)	ND1, ND2, ND3, ND4, ND5	5

After cleaning up the variables, the data was checked for missing values because the respondents were allowed to partially complete the survey and complete it at different times (Rachad Antonius, 2004). This flexibility given to respondents also introduced incompleteness of the data. The researcher deleted all cases where respondents did not complete all or most questions, as these were easy to identify in the dataset. This process is called listwise deletion, and it is recommended to be performed when the cases have more than 10% missing values to reduce the chances of introducing bias, as complete cases will be used in the analysis (Schindler & Cooper, 2014 & Tabachnick & Fidell, 2019). This method posed a disadvantage because it also removed all data associated with those incomplete cases (Schindler & Cooper, 2014; Field, 2018).After listwise deletion, the results showed that none of the cases had missing values of more than 10% (Tabachnick & Fidell, 2019). The resulting sample was 150 cases. To check whether this missing data had a pattern, Little's MCAR test was run to test if the data was missing completely at random (Schindler & Cooper, 2014). The results showed a p-value of 0.000, which is less than 0.05 and means that the data is not missing at random (Schindler & Cooper, 2014). The p-value, being less than 0.05, indicated statistical significance (Pallant, 2016). It can be concluded that the data is missing at random (MAR) or not missing at random (NMAR) because there is strong evidence that the data are not MCAR (Pallant, 2016). By using logical reasoning to test for NMAR versus MAR, the researcher observed that respondents likely did not complete the last few questions of the survey due to survey fatigue (Schindler & Cooper, 2014). This can be assumed because the survey was structured in a way that forced the respondents to answer each question before moving on to the next question and, therefore, was not related to the type of question asked. The research study assumed that the data was missing at random (MAR/NMAR) because of survey fatigue, an external observable factor, rather than due to the missing values themselves (Moore, Lang & Grandfield, 2020). The researcher noticed that only 3 cases had missing data, which would not affect the sample size as much; therefore, the cases were deleted listwise (Field, 2018). After data clean-up, the final sample size was 147 and was still adequate for analysis (Schindler & Cooper, 2014).

3.9 Validity and Reliability

3.9.1 Validity

Validity refers to the degree to which a test accurately measures its intended measure (Rachad Antonius, 2004). Verifying the dataset's accuracy and relevance is essential to ensure that the data accurately represents the intended constructs (Pallant, 2016). To ensure the internal validity of the research design, a research instrument consistency table was used to ensure that the instrument included all the variables it was supposed to test (Appendix B).

Exploratory factor analysis was used to assess the internal validity of the measurement model, mainly because this research study used multiple regression analysis (Creswell & Creswell, 2018). This process ensures that the hypothesised model fits the observed data (Pallant, 2016). The validity control measures that were used are supported by previous similar researchers, including Malebana and Mothibi (2023), Kovaleva et al. (2023), Byrne et al. (2018), Laviolette et al. (2012), Amofah and Saladriques (2022), and Van Auken and Stephens (2006). To confirm the dataset's suitability for factor analysis, all 25 quantitative variables were subjected to principal axis factoring (PAF) with Promax rotation in SPSS and Kaiser normalisation (Field, 2018 & Pallant, 2016). The PAF method was chosen because it accounts for shared, which makes it suitable to uncover latent factors influencing the variables (Field, 2018). The Promax rotation method assumes that the variables are not independent and will reveal the relationships between variables (Field, 2018). Kaiser normalisation standardises the loadings, making the interpretation more accessible for the researcher. This approach enables the identification of underlying factors that account for correlations among variables, thereby enhancing interpretability (Pallant, 2016).

To ensure the external validity of the data, also known as generalisability, the research study included a diverse sample to ensure variations of characteristics exist within the sample (Creswell & Creswell, 2018). External validity refers to the extent to which the observed relationship can be generalised across different populations, settings, and periods (Schindler & Cooper, 2014). This diverse sample was collected from participants from Cape Town, Johannesburg, Durban, Mpumalanga, and Limpopo, who were of different ethnicities, and this was generalised as the population of female technology students in South Africa. This research study also followed

the example of previous researchers in South Africa who generalised the population of South Africa and proved the validity of the instrument in South Africa (Malebana & Mothibi, 2023; Malebana, 2016).

3.9.2 Reliability

Reliability ensures that the instrument can measure accuracy and consistent results across different sets of data (Schindler & Cooper, 2014). It is essential to test the instrument for reliability to ensure accurate results in data analysis. The scales used in this study were tested in previous studies, including studies done by Malebana and Mothibi (2023), Koe et al. (2020) and Laviolette et al. (2022), therefore ensuring the reliability of the instrument (Schindler & Cooper 2014). The scales all have more than three questions for each construct being tested to ensure the reliability of the data received (Nunnally, 1978). Questions in the survey that were coded in reverse, meaning the questions were asked negatively, 'I would be tense to start my own tech business, were coded in reverse to get results that could be correctly integrated with the rest for data that was positively asked (Creswell & Creswell, 2018).

To test for internal consistency, the literature recommends using Cronbach's alpha, which is typically used to test the reliability of scales (Schindler & Cooper, 2014). For internal consistency, Cronbach's alpha for all the used scales has to be above 0.7, which is considered good reliability (Schindler & Cooper, 2014). The scales for 'role models', adapted from Fellnhofer and Mueller (2018), had a Cronbach Alpha equal to 0.809, and the scales for 'entrepreneurial intention' (2009) had a Cronbach Alpha of 0.922. Therefore, the research study will follow the same principles to ensure the reliability of scales (Fellnhofer & Mueller, 2018). Lastly, pilot testing was used to assist with uncovering any issues that may come up during the data collection process (Creswell & Creswell, 2018).

3.10 Data Analysis and Interpretation

Correlation Analysis

After the data was cleaned up for data integrity, the validity and reliability of the instrument were tested, and the data was then put through correlation analysis to test the linear relationships between the dependent variables and predictor variables. This correlation test is suitable for the research study, as it examines the relationship between interval variables, with survey Likert scales typically treated as interval data. This test is done so the researcher knows the strength and direction of the relationships between the dependent and predictor variables (Schindler & Cooper, 2014; Field, 2018). Pearson's correlation matrix was used to test the linearity between technopreneurial intention and technopreneurial self-efficacy, subjective norms: female technopreneur role models, attitude towards technopreneurship, and perception of the normative dimension (Pallant, 2016). Pearson correlation coefficients (r values), which range from -1 to 1, indicate the linear relationship between the predictor and dependent variables (Field, 2018), with -1 being the perfect negative relationship and 1 being the perfect positive relationship between the predictor and dependent variable.

The result of using Pearson's correlation matrix is interpreted as follows: if the r-value is less than 0.3, the relationship has a small effect; if the r-value is between 0.3 and 0.49, the relationship has a medium effect, and if the r-value is more than 0.5, then the relationship has a large effect (Schindler & Cooper, 2014). The identical Pearson's correlation matrix also tested the multicollinearity amongst the predictor variables, which was done so that the researcher could gain insight into the multicollinearity between the predictor variables (Pallant, 2016). Evidence of multicollinearity between the predictor variables is measured using the r-value, evident when the r-value is more than 0.8 (Pallant, 2016). By addressing multicollinearity, the researcher ensures that the regression model produces more reliable results (Schindler & Cooper, 2014).

Regression analysis

The data will be analysed using SPSS software, which has a proven track record in prior research studies (Malebana & Mothibi, 2023). To test the study's hypothesis, the researcher used regression analysis to assess the strength and direction of relationships between the variables. This method is recommended for the testing of relationships between continuous variables, especially since both are

scale/interval variables and because the study had to test the relationship between one dependent variable (TI) and several predictor variables (TSE, ATT, Female TRM, and ND) in their specified order. (Schindler & Cooper, 2014). This decision drew upon similar methodologies in prior literature for similar studies (Laviolette et al., 2012; Bhat & Gulzar, 2020; Amofah & Saladriques, 2022).

However, regression assumptions must be tested first to ensure the regression analysis's findings are correct (Tabachnick & Fidell, 2019; Field,2018; Pallant, 2016). The regression assumptions tested include sample size, normality, outliers, linearity, homogeneity of regression, multicollinearity, singularity, and homogeneity of variance-covariance matrices (Field, 2018; Pallant, 2016). After the assumption testing has passed, the standard coefficient beta results of the regression testing can be interpreted as follows:

β Value (Absolute)	**Strength of Relationship**
$\beta \geq 0.70$	Very Strong Relationship
$0.50 \leq \beta < 0.70$	Strong Relationship
$0.30 \leq \beta < 0.50$	Moderate Relationship
$0.10 \leq \beta < 0.30$	Weak Relationship
$\beta < 0.10$	Very Weak or Negligible

(Field, 2013)

Hierarchical Multiple Regression Analysis

Hierarchical multiple regression analysis was most suitable because the test involves one dependent variable against multiple predictor variables in a specific order. This process examines how adding different sets of independent variables improves the prediction of the dependent variable. It allows researchers to assess the incremental value of adding predictors to the model, one step at a time.

The researcher added the control variables to predict technopreneurial intention: Province: Gauteng and Ethnicity: Black. These were first recoded into dummy nominal variables that could be used in the analysis (Pallant, 2016). The demographic variables added included the Province, Gauteng, and Ethnicity: Black participants because they contributed highly to the study and therefore used to predict technopreneurial intention.

The researcher then added the direct predictor variables to assess the incremental variance, which was explained by adding different sets of predictors step-by-step beyond the control variables. This included defining the constructs being tested, which included the dependent variable "Technopreneurial Intention" and the predictor variables "Technopreneurial Self-Efficacy" and "Attitude Towards Technopreneurship" (Creswell & Creswell, 2018).

The researcher added indirect predictors to test whether each set of variables improved the prediction of technopreneurial intention beyond the direct predictors and control variables (Pallant, 2016; Field, 2018). The indirect predictors included 'Female Technopreneur Role Models' and 'Normative Dimensions'.

The analysis results showed the strength and direction of the tested constructs as observed through path coefficients (Schindler & Cooper, 2014). The multiple regression analysis was insufficient to test all the hypotheses; therefore, mediation analysis was done to test whether the relationships had mediators for hypotheses 3 and 4.

Mediation Analysis: Hypothesis 3 and 4

Mediation analysis is a process used to test whether one predictor variable influences the dependent variable through another variable. This process involves a predictor variable, mediator and dependent variable (Creswell & Creswell, 2018). The pathway through which this influence may occur is important in mediation analysis. The three paths that are tested in mediation analysis for hypotheses 3 and 4 include:

1. Path a: The effect of the predictor variable on the mediator
2. Path b: The effect of the mediator variable on the dependent variable.
3. Path c: The direct effect of the predictor variable on the dependent variable (after including the mediator variable)

To run the three regression models for hypotheses, the researcher used the PROCESS Macro by Andrew Hayes, as this is considered a simplified mediation analysis method and allows testing for the significance of indirect effects (Hayes, 2017; Sigauke, 2020). The regression analysis was done through the PROCESS Macro Version 4.2 Beta release, with the bootstrapping option set to 5000 samples and a confidence level of 95%, as recommended by Hayes (2017). Confidence levels that contain zero suggest that there are no mediation effects, and the opposite is true when the confidence interval does not contain zero; it can be concluded that mediation is present. (Morera & Castro, 2013). The results were then used to test for mediation assumptions. (Hayes, 2017).

Mediation is said to have occurred when the following assumptions have been met (Baron & Kenny, 1986):

1. Path a is significant (IV → Mediator).
2. Path b is significant (Mediator → DV).
3. The indirect effect (a × b) is significant and typically tested using bootstrapping.
4. Path c may remain significant (partial mediation) or non-significant (complete mediation).

The results were then used to confirm or reject hypotheses 3 and 4:

Hypothesis 3a: Technopreneur Role Models (TRM) have a positive influence on technopreneurial intentions as mediated by attitude towards technopreneurship (H3a) among South African female tech students

Hypothesis 3b: Technopreneur Role Models (TRM) have a positive influence on technopreneurial intentions as mediated by technopreneurial self-efficacy (H3b) among South African female tech students

Hypothesis 4a: Positive perceptions of the normative institutional environment have a positive effect on technopreneurial intentions as mediated by attitude towards technopreneurship (H4a) among South African female tech students

Hypothesis 4b: Positive perceptions of the normative institutional environment have a positive effect on technopreneurial intentions as mediated by subjective norms: knowledge of female role models (H4b) among South African female tech students

Hypotheses for these constructs were mapped out on the software (Creswell & Creswell, 2018). Following the Baron and Kenny (1986) approach for testing mediation effects, the study first tested mediation assumptions, including path a, b using linear regression analysis and then path c using bootstrapping to test the indirect effect of each hypothesis. The results were then lastly interpreted to state whether there were mediating effects and the strength and direction of the influence on technopreneurial intention.

3.11 Demographic profile of respondents

Descriptive statistics are statistical methods that help summarise, organise, and simplify data. Descriptive statistics are vital because they paint a picture of the sample characteristics and are used to present demographic data (Pallant, 2016). These include measures of spread like range, variance and standard deviation. They also include measures of central tendency, such as mean, median, and mode, in a dataset (Schindler & Cooper, 2014; Pallant, 2016). Descriptive statistics for categorical variables include frequency counts and percentages, which can be presented in pie charts, histograms and many more visualisations.

In this study, descriptive statistics for categorical variables of ethnicity and province gave insight into the demographics of the respondents for the study using frequencies, bar graphs, pie charts and cross-tabulation to present the data (Pallant, 2016). All

respondents were female technology students in South Africa, but province and ethnicity added more interesting insight into the sample characteristics.

Descriptive statistics for continuous variables were also used to give insight into the data distribution of all variables. This included the data's frequencies, mean, mode, median and dispersion (Pallant, 2016; Field, 2018).

3.12 Limitations of study

- The study results may not generalise the South African population based on samples from only WeThinkCode and Girl Code participants in the Gauteng, Western Cape, KwaZulu Natal, and Limpopo populations. As much as it is a calculated risk, many students from different institutions and areas that produce technopreneurs are excluded, including the Free State, North West, Northern Cape, and Eastern Cape (Disrupt Africa, 2022).
- The scales used to test Technopreneurial intention have not been developed to consider the myriads of challenges in emerging economies. Therefore, there may be hidden reasons not to choose technopreneurship, like poverty.
- Since the researcher conducting this study is a woman, there is a possibility of gender bias influencing the writing of the research report. To address this concern, the researcher plans to have a supervisor review the report for any biases that may not be immediately apparent.
- The accuracy of the data analysis was limited to the researcher's knowledge.

3.13 Research ethics

The researcher initiated data collection only after obtaining approval from the University of Witwatersrand Ethics Committee. The committee signed the ethical clearance certificate with protocol number WBS/EN2359817/597 on 16 August 2024 (APPENDIX E). The researcher promptly requested and received permission letters from WeThinkCode and GirlCode, providing informed consent for participation in the research (APPENDIX F and G). The data collection process began in early September 2024. The researcher started

by sending a cover letter to participants, outlining the survey's purpose, the benefits of the research, the estimated duration of the survey, and assurances that participation was voluntary, with responses kept confidential and anonymous. Along with the cover letter, the researcher shared an anonymous link with WeThinkCode and GirlCode, ensuring confidentiality and anonymity for the respondents (Chantson, 2015).To uphold participants' autonomy, individuals could opt out of the survey if they chose not to participate in the research study. Furthermore, the Qualtrics software was configured to anonymize all response records, maintaining the anonymity of participant responses. In conclusion, the researcher adhered to ethical considerations in compliance with the guidelines provided by the University of Witwatersrand Ethics Committee and Schindler and Cooper (2014).

CHAPTER 4: RESULTS PRESENTATION AND INTERPRETATION

The objective of this chapter is to present and interpret the findings from the analysis of the research study. It starts by describing the respondents' sample characteristics regarding ethnicity and province. This is followed by assessing the reliability of measurement scales, evaluating scale validity, conducting correlation analysis, and conducting a hierarchical multiple regression with mediation analysis to confirm or deny the hypothesis.

4.1 Demographic profile of respondents

This section summarises the demographic profile of respondents by province location and ethnicity. The study focused on all female respondents, all technology/coding students who have not started a technology business. These three characteristics will be mentioned along with the demographic profile of the respondents. The total number of respondents who will be analysed is 147, representing full and complete responses that qualify for statistical analysis. The summary table for demographics is presented below in Table 7.

Table 7: Summary Table of Demographics [Source: Primary Data]

		Ethnic Background	Province
N	Valid	147	147
	Missing	0	0
Range		5	8
Minimum		1	1
Maximum		6	9

4.1.1 Province

Sample characteristics results in Figure 2 and Table 8 show that most respondents are located in the province of Gauteng (South Africa) by a considerable margin of 75%. This is followed by respondents located in the Western Cape at 12.2%, KwaZulu Natal at 6.8%, Limpopo at 3.4% and Mpumalanga at 2%. These frequencies indicate that most of the technology/coding students at WeThinkCode and Girl Code are predominantly located in Gauteng, followed by Cape Town and Durban. This is confirmed by the fact that their main offices are located in the three provinces mentioned. The samples from the five provinces are suitable for this research study as it aims to generalise the influence of female technopreneurial role models on technopreneurial intentions of female technology students across South Africa. The other provinces unmentioned, including Northern Cape, North West, and Free State, are generally not where the central technology metropoles are stationed, and therefore, it makes sense that the students will probably relocate to be part of these coding/technology in-person learning programmes.

Figure 2: Province [Source: Primary Data]

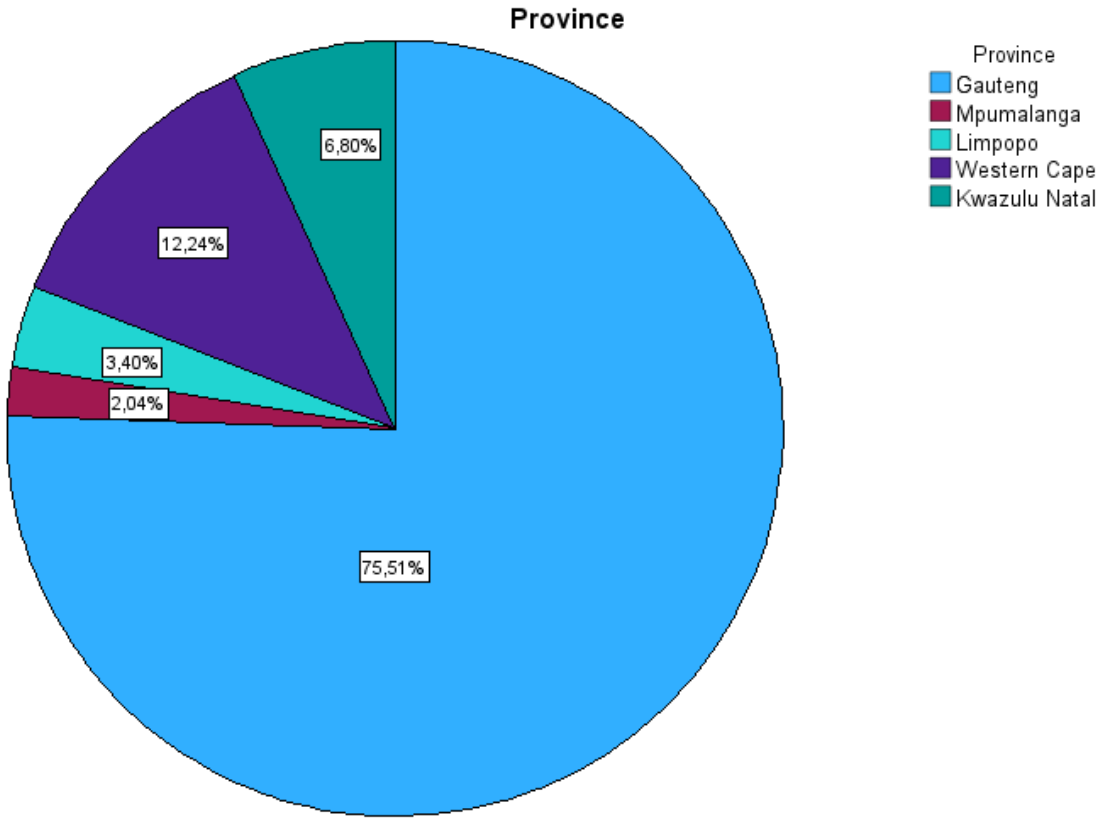


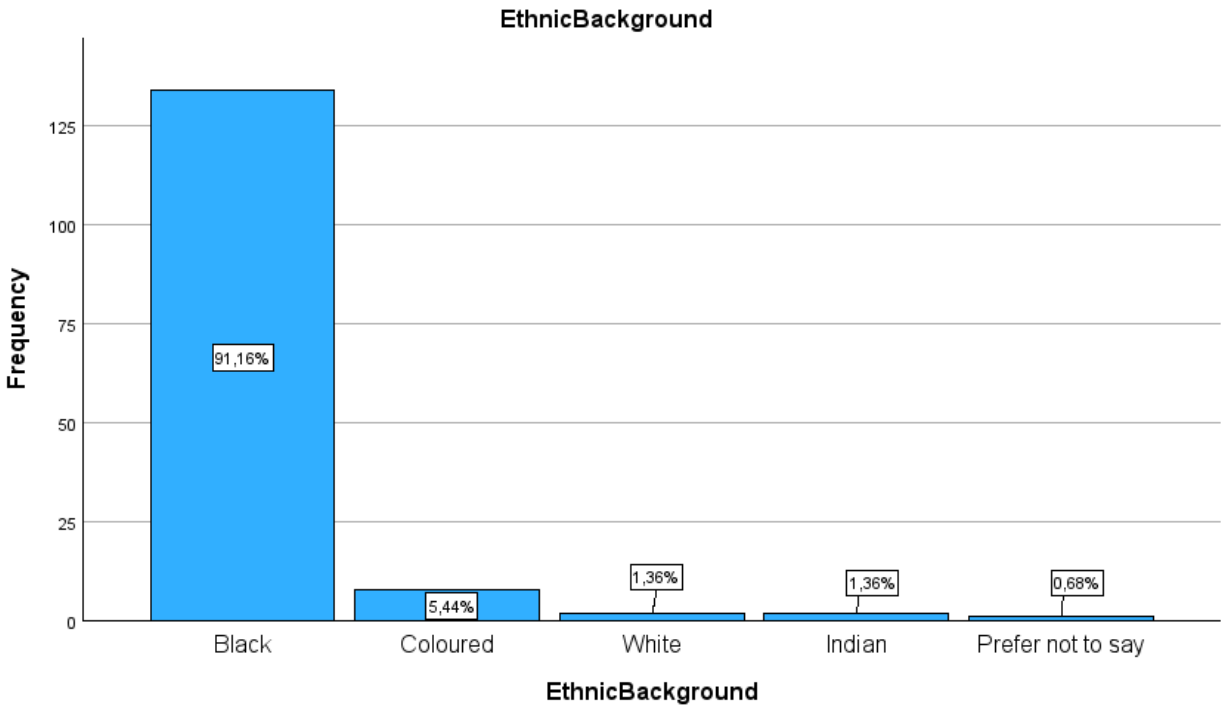
Table 8: Province

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Gauteng	111	75,5	75,5	75,5
	Mpumalanga	3	2,0	2,0	77,6
	Limpopo	5	3,4	3,4	81,0
	Western Cape	18	12,2	12,2	93,2
	KwaZulu Natal	10	6,8	6,8	100,0
	Total	147	100,0	100,0	

4.1.2 Ethnicity

The sample characteristics reveal that 91.2% of the respondents are Black, 5.4% are Coloured, 1.4% are White, 1.4% are Indian, and 0.7% chose not to disclose their race, as per Figure 3. This demographic distribution is expected, given that WeThinkCode and Girl Code, as non-profit learning organisations, often admit students from disadvantaged backgrounds. In South Africa, the majority of previously disadvantaged students are black, followed by coloured students.

Figure 3: Ethnic Background [Source: Primary Data]



Overall, the diverse demographics are good for the research study as they represent the country and province ethnicity make-up in general, as per Figure 4 and Table 9, and can be used to generalise findings.

Figure 4: Cross tabulation of Ethnic Background and Province [Source: Primary Data]

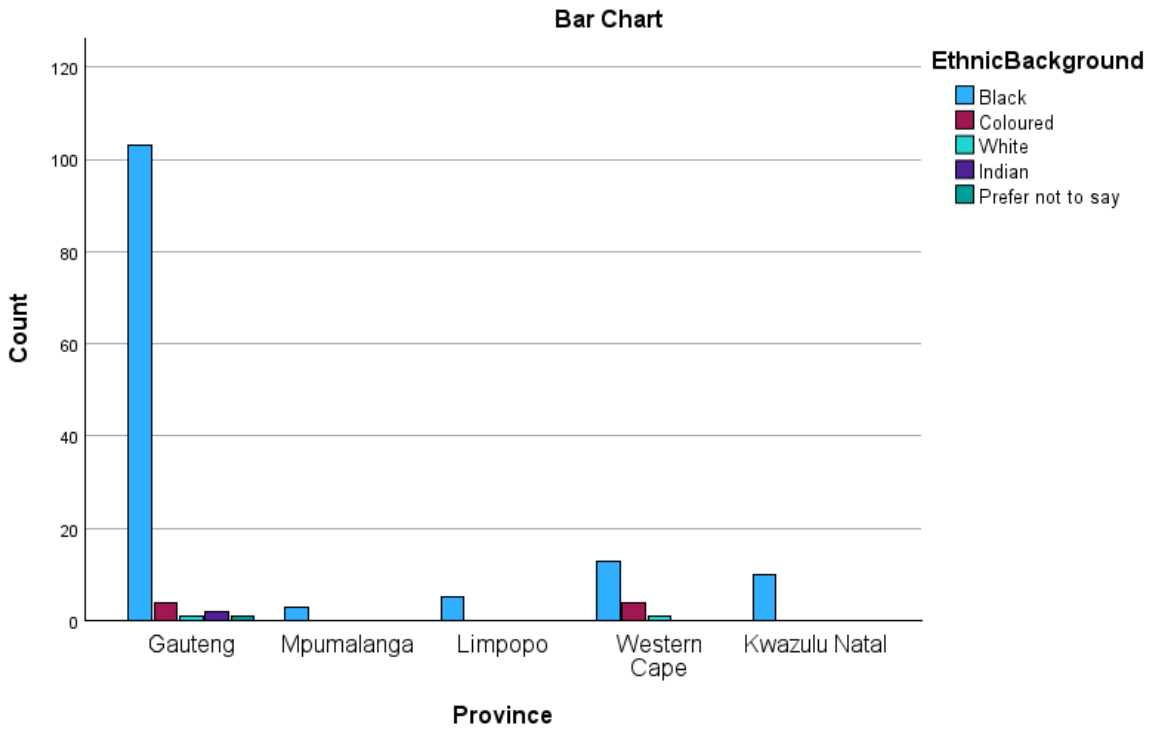


Table 9: Province * Ethnic Background Crosstabulation

			Ethnic Background					
			Black	Coloured	White	Indian	Prefer not to say	Total
Province	Gauteng	Count	103	4	1	2	1	111
		% within Province	92,8%	3,6%	0,9%	1,8%	0,9%	100,0%
		% within EthnicBackground	76,9%	50,0%	50,0%	100,0%	100,0%	75,5%
		% of Total	70,1%	2,7%	0,7%	1,4%	0,7%	75,5%
	Mpumalanga	Count	3	0	0	0	0	3
		% within Province	100,0%	0,0%	0,0%	0,0%	0,0%	100,0%

		% within EthnicBackground	2,2%	0,0%	0,0%	0,0%	0,0%	2,0%
		% of Total	2,0%	0,0%	0,0%	0,0%	0,0%	2,0%
	Limpopo	Count	5	0	0	0	0	5
		% within Province	100,0%	0,0%	0,0%	0,0%	0,0%	100,0%
		% within EthnicBackground	3,7%	0,0%	0,0%	0,0%	0,0%	3,4%
		% of Total	3,4%	0,0%	0,0%	0,0%	0,0%	3,4%
	Western Cape	Count	13	4	1	0	0	18
		% within Province	72,2%	22,2%	5,6%	0,0%	0,0%	100,0%
		% within EthnicBackground	9,7%	50,0%	50,0%	0,0%	0,0%	12,2%
		% of Total	8,8%	2,7%	0,7%	0,0%	0,0%	12,2%
	Kwazulu Natal	Count	10	0	0	0	0	10
		% within Province	100,0%	0,0%	0,0%	0,0%	0,0%	100,0%

	% within EthnicBackground	7,5%	0,0%	0,0%	0,0%	0,0%	6,8%
	% of Total	6,8%	0,0%	0,0%	0,0%	0,0%	6,8%
Total	Count	134	8	2	2	1	147
	% within Province	91,2%	5,4%	1,4%	1,4%	0,7%	100,0%
	% within EthnicBackground	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
	% of Total	91,2%	5,4%	1,4%	1,4%	0,7%	100,0%

4.2 Data Analysis

4.2.1 Validity: Exploratory Factor Analysis

Sample Size

Researchers often check the sample size before conducting the factor analysis (Pallant, 2016). In this study, it was determined that a sample size of 147 was adequate based on the recommended 5:1 ratio for each variable being tested (Field, 2018). With 25 variables in the study, the sample needed to include at least 125 cases, making the sample of 147 sufficient (Field, 2018). This Researcher assessed the suitability of the data for factor analysis using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity (Field, 2018). The KMO test, which evaluated sampling adequacy, produced a value of 0.851, indicating excellent suitability for factor analysis. Shrestha (2021) noted that a KMO value above 0.8 is deemed excellent and appropriate for exploratory factor analysis (EFA).

Furthermore, Bartlett's test of sphericity, which examined the correlation between variables, revealed a significance level of <0.001. This result confirmed that the variances were suitable for EFA, as a significance level below 0.05 indicates adequacy and supports factor analysis (Field, 2018; Shrestha, 2021). Combining the results of both tests, the excellent KMO score, and the significant outcome of Bartlett's test (Table 10) confirmed that factor analysis was appropriate for this dataset (Field, 2018). Table 10 below shows the KMO and Barlett's Test scores.

Table 10: KMO and Barlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,851
Bartlett's Test of Sphericity	Approx. Chi-Square	2592,368
	df	253
	Sig.	<.001

Exploratory Factor Analysis

Principal axis factoring (PAF) analysis was performed to test the validity of the different scales used in this study. The initial results showed that two variables, including female TRM4 and ND1, were not extracted, with r values of less than 0.3. The removal of the cut-off of 0.3 was recommended in the literature (Field, 2018; Pallant, 2016). These variables were removed, and the analysis was rerun.

Total Variance Extracted

The total variance explained gives insight into how many valid factors are extracted. Results show that four valid factors were extracted because they had eigenvalues greater than 1, indicating that four factors explain the variance in the dataset (Shrestha, 2021; Pallant, 2016). The four factors explain 68.87% of the variance, as per Table 11 (Field, 2018).

Table 11: Total Variance Explained

	Initial Eigenvalues			Rotation Sums of Squared Loadings
Factor	Total	% of Variance	Cumulative %	Total
1	7,634	33,193	33,193	7,162
2	4,617	20,072	53,265	3,507
3	2,004	8,713	61,978	3,157
4	1,586	6,897	**68,875**	3,373
5	,960	4,176	73,051	
6	,901	3,918	76,969	
7	,781	3,394	80,364	

8	,621	2,699	83,063	
9	,596	2,591	85,654	
10	,466	2,025	87,678	
11	,397	1,725	89,404	
12	,343	1,492	90,896	
13	,323	1,406	92,301	
14	,298	1,296	93,598	
15	,274	1,192	94,790	
16	,252	1,096	95,885	
17	,207	,899	96,784	
18	,172	,748	97,532	
19	,152	,660	98,192	
20	,139	,604	98,797	
21	,111	,484	99,280	
22	,100	,433	99,713	

23	,066	,287	100,000	

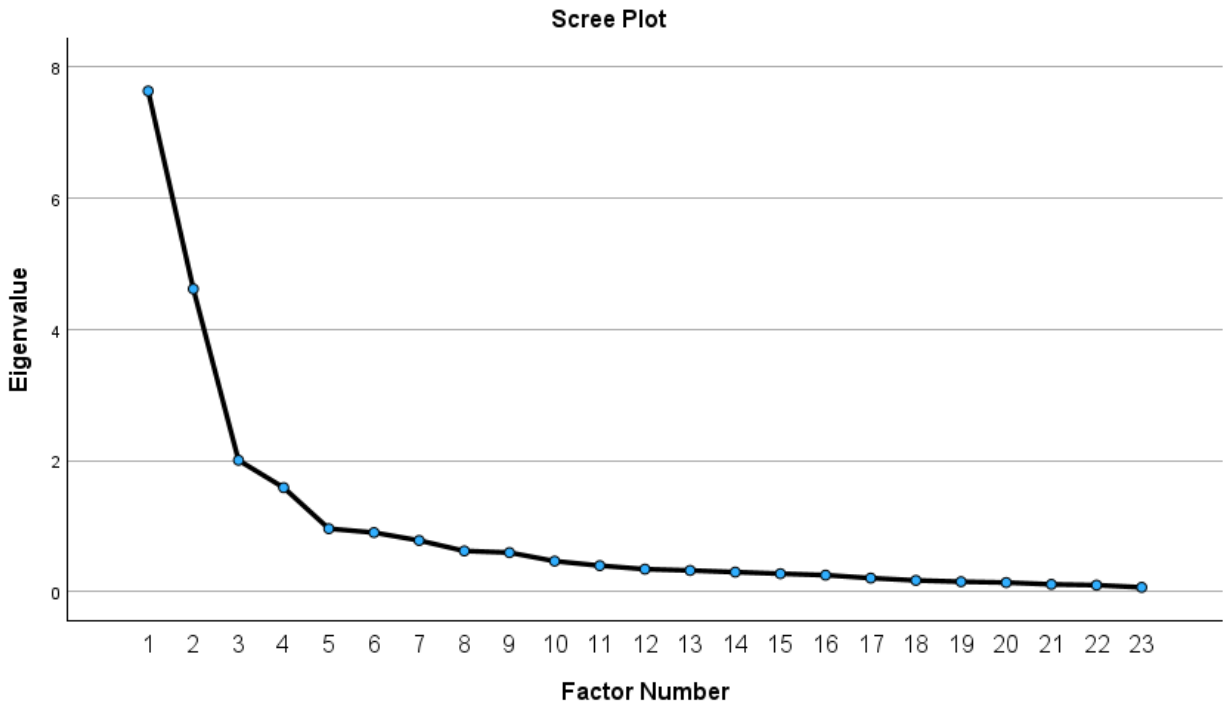
Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

Scree Plot

The scree test involves plotting each eigenvalue of the factors against a graph (Pallant, 2016). The factors that contribute most of the explanation of the variance in the dataset are above the elbow or point of inflexion of the graph (Field, 2018). The results in Figure 5 show that four factors were extracted as they are above the elbow of the curve and, therefore, can be retained in the analysis (Field, 2018). The factors below the elbow of the curve cannot be retained in the analysis as they have eigenvalues of less than 1 (Field, 2018).

Figure 5: Scree Plot [Source: Primary]



Pattern Matrix

A pattern matrix shows all the converged variables and groups them into factors that can be used in the analysis (Pallant, 2016; Field, 2018). The results show that four factors were extracted that had factor loadings greater than 0.3, which is recommended as the cut-off point in the literature (Field, 2018; Pallant, 2016). The factor loadings were significant because $p < 0.01$ is less than the recommended standard of $p < 0.05$ for significance (Field, 2018).

The four factors included Female Technopreneur Role Models variables (1, 2, 3, 5), Technopreneurial Self-efficacy (1, 2, 3), and Normative Dimensions (2, 3, 4, 5), while Technopreneurial Intention (TI) and Attitude Toward Technopreneurship (ATT) variables were cross-loaded as one factor.

A key observation is that TI and ATT items were reverse-coded, likely introducing measurement bias. Reverse coding is known to confuse participants, leading them to misunderstand the reversal in answer options (Wong, Rindfeisch, Burroughs, 2003; Weijters, Rindfleisch & Schillewaert, 2013). With that said, the two factors were taken to further analysis separately, leveraging the theoretical underpinnings of the Theory of Planned behaviour and with the understanding that ATT and TI have separate contributions to this study (Ajzen, 1991). This was also supported by previous researcher strategies for handling cross-loaded factors (Chantson, 2015; Fayolle & Liñán, 2014). Five factors were retained: female TRM, ATT, TI, TSE, and ND.

Table 12: Pattern Matrix

	Factor			
	1	2	3	4
FemaleTRM1		,821		
FemaleTRM2		,896		
FemaleTRM3		,867		
FemaleTRM5		,669		
TSE1_Recoded				,812
TSE2				,943
TSE3				,826

TI1_Recoded	,569			
TI2_Recoded	,732			
TI3_Recoded	,862			
TI4_Recoded	,886			
TI5_Recoded	,862			
TI6_Recoded	,898			
ATT1_Recoded	,482			
ATT2_Recoded	,813			
ATT3_Recoded	,806			
ATT4_Recoded	,793			
ATT5_Recoded	,811			
ATT6_Recoded	,535			
ND2_Recoded			,771	
ND3_Recoded			,871	
ND4_Recoded			,843	

ND5_Recoded			,470	

Extraction Method: Principal Axis Factoring.

Rotation Method: Promax with Kaiser Normalization.

Final KMO AND Barlett's test

The final KMO remained at 0.851, confirming sample adequacy because it is greater than 0.6 (Pallant, 2016). The final sample size is 147 cases against 23 variables. The final ratio of cases to variables is 6.39:1, demonstrating sample size adequacy for further analysis.

Table 13: Final KMO and Barlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**,851**
Bartlett's Test of Sphericity	**Approx. Chi-Square**	**2592,368**
	df	**253**
	Sig.	**<.001**

Correlation Matrix

The correlation matrix shows the correlation between multiple variables (Field, 201; Pallant, 2016). For factor analysis, the correlation coefficients above 0.3 suggest that the variables are sufficiently related to extract factors and below 0.3 means that there is not enough shared variance between the variables (Pallant, 2016). In this study,

correlation coefficients were more significant than 0.3, therefore showing suitability for factor analysis of all the factors retained (TI, ATT, TSE, ND and Female TRM) for further analysis (Pallant, 2016).

Communality

Communality shows variance in all remaining 23 variables, evidenced by extracted values all between 0 and 1 (Pallant, 2016).

Table 14: Communalities

	Initial
FemaleTRM1	,662
FemaleTRM2	,732
FemaleTRM3	,696
FemaleTRM5	,599
TSE1_Recoded	,717
TSE2	,789
TSE3	,703
TI1_Recoded	,481
TI2_Recoded	,718
TI3_Recoded	,834
TI4_Recoded	,867

TI5_Recoded	,848
TI6_Recoded	,893
ATT1_Recoded	,416
ATT2_Recoded	,722
ATT3_Recoded	,717
ATT4_Recoded	,756
ATT5_Recoded	,786
ATT6_Recoded	,449
ND2_Recoded	,609
ND3_Recoded	,654
ND4_Recoded	,653
ND5_Recoded	,395

Extraction Method: Principal Axis Factoring.

4.2.2 Scale Reliability

The reliability of the retained scales or factors is crucial as it assesses their consistency and ensures they are free from random error (Schindler & Cooper, 2014; Field, 2018; Pallant, 2016). To evaluate the internal reliability of multi-item scales, a Cronbach's alpha test was conducted on the five retained factors (Field, 2018). A scale is considered good and reliable, with a Cronbach's alpha score of 0.7 and scores above 0.7 indicating very good reliability, confirming the scale's dependability (Shrestha, 2021).

Table 15: Internal Reliability

Factor	Number of items	Cronbach alpha standardised	Reliability level
Female TRM	4	0.890	Good
TSE	3	0.899	Good
TI	6	0.927	Good
ATT	6	0.876	Good
ND	4	0.835	Good

The reliability test results in Table 13 show that the scales Female TRM, TSE, TI, ATT and ND are all reliable, as they have Cronbach's alpha greater than the minimum level of 0.7 (Pallant, 2016). Some items would have improved the Cronbach alpha if deleted; however, because of the smaller sample size, the researcher saw that the Cronbach alpha scores were already good at an average of above 0.8 for Cronbach alpha scores and, therefore, did not need any adjustment. It is also worth noting that none of the inter-item correlations were

less than 0.2, showing that the items on the scale correlated well with other items. The conclusion is that all five factors retained were reliable and can be relied on for further analysis.

4.2.3 Summary of the Validity and Reliability Analysis

EFA gave good results based on a sample size of 147 and factor loadings greater than 0.3. The results were statistically significant, p = 0.00 (Pallant, 2016). The scales were accepted as consistent and valid for further analysis. The Cronbach alpha scores of all factors (Female TRM, TSE, TI, ATT, ND) were above 0.8, and the inter-item correlation was above 0.2; therefore, the five scales were considered highly reliable for further analysis. The researcher then proceeded to create five constructs (mean scores for each construct) that were used for further analysis, including:

a. Female TRM – Female Technopreneurial Role Models
b. TSE – Technopreneurial Self-efficacy
c. TI – Technopreneurial Intention
d. ATT – Attitude towards Technopreneurship
e. and ND – Normative Dimensions.

(Pallant, 2016)

4.3 Descriptive statistics

Once the mean scores were created for the constructs Female TRM, ATT, TSE, TI, and ND, descriptive statistics were run to give insight into their sample characteristics. To summarise the characteristics of the quantitative data, descriptive statistics were run for the five constructs, and the results are shown below in Table 14.

Table 14:Descriptive Statistics for Female TRM, TSE, TI, ATT and ND

		FemaleTRM	TSE	TI	ATT	ND
N	Valid	147	147	147	147	147
	Missing	0	0	0	0	0
Mean		4,48	5,28	5,35	5,35	5,06
Median		4,75	5,67	5,50	5,50	5,25
Mode		6	6	7	5	6
Skewness		-,461	-1,111	-,626	-,869	-1,035
Std. Error of Skewness		,200	,200	,200	,200	,200
Kurtosis		-,691	,864	-,035	,736	1,394
Std. Error of Kurtosis		,397	,397	,397	,397	,397
Minimum		1	2	1	1	1

Maximum	7	7	7	7	7

Table XXX is based on a 7-point Likert scale with the following: 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither disagree nor agree, 5 = somewhat agree, 6 = agree, and 7 = strongly agree.

The total number of cases analysed for each construct is 147. The mean statistic for TSE, ATT, TI, and ND (M=Average 5) indicates that technology students somewhat agreed with having technopreneurial self-efficacy, a positive attitude towards technopreneurship, a positive perception of the normative dimension, and technopreneurial intentions on a 7-point Likert scale. Similarly, the mean statistic for Female TRM (M = 4.48) showed neither agreement nor disagreement among respondents regarding knowledge of female technopreneur role models.

The sample used for analysis was larger than 50 (N = 147). Therefore, skewness and kurtosis values should fall within the range of -2 to 2 to approximate a normal distribution (Pallant, 2016; Field, 2018). The results showed that all skewness and kurtosis values were within the range of -2 to 2 to approximate a normal distribution.

4.4 Correlation Analysis

Correlation analysis tests the relationship, strength, and direction of the relationship between the continuous variables being tested in this study (Pallant, 2016). The Pearson correlation matrix was used to test linearity between predictor and dependent variables and multicollinearity between predictor variables. The results for linearity and multicollinearity are summarised in Table 15.

Multicollinearity results showed that the relationship between the predictor variables was less than 0.8, indicating no multicollinearity between the variables (Pallant, 2016). TT and TI came very close with an ($r = 0.792$; $p < 0.01$);; however, this was expected because the variables had combined into variables when doing the exploratory factor analysis.

The linearity results show a positive correlation between all predictor and dependent variables, evidenced by the positive r values. The correlation between ND and TI is the weakest positive relationship, with an r-value of less than 0.3 ($r = 0.030$) and a non-significant relationship ($p = 0.721$). The correlation between Female TRM and TI is a weak positive relationship as the r-value is less than 0.3 ($r=0.094$; $p=0.258$), and the relationship is not significant. The correlation between TSE and TI also has a weak positive relationship ($r=0.162$) and a significant relationship ($p=0.050$). he correlation between ATT and TI is the only relationship with a large effect, as the r-value is above 0.5 ($r == 0.792$) and a significant relationship ($p < 0.001$). . When control variables are added, which are Province Gauteng and EthnicityBlack, the multicollinearity and linearity results show that none have significant relationships with the predictor variables (Female TRM, TSE, ATT, ND) and the dependent variable TI. What is also interesting is that the relationship between Province Gauteng and Female TRM, TSE is a negative but not significant relationship. The relationship between EthnicityBlack and ND is a negative but not significant relationship.

Overall, Pearson's correlation results show five weak relationships (TSE, Female TRM, ND, Province Gauteng, Ethnicity Black) and one relationship with a large effect (ATT) on the dependent variable (TI). Table 17 shows the Pearson's correlation matrix.

Table 16: Pearson's Correlation Matrix

		FemaleTRM	TSE	ATT	ND	Province Gauteng	Ethnicity Black	TI	
FemaleTRM	Pearson Correlation	1							
TSE	Pearson Correlation	,329**	1						
ATT	Pearson Correlation	,099	,176*	1					
ND	Pearson Correlation	,348**	,375**	,067	1				
ProvinceGauteng	Pearson Correlation	-0.016	-0.014	0.106	0.041	1			

EthnicityBlack	Pearson Correlation	0.135	0.045	0.072	-0.031	0.101	1		
TI	Pearson Correlation	,094	,162	,792**	,030	0.153	0.073	1	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4.5 Regression Analysis

The study used the hierarchical multiple regression analysis to test hypotheses 1, 2, 3, and 4. To run the regression model, regression assumptions must be tested first to ensure no violations have been made to the data (Tabanchnick & Fidell, 2013).

4.5.1 Assumption Testing

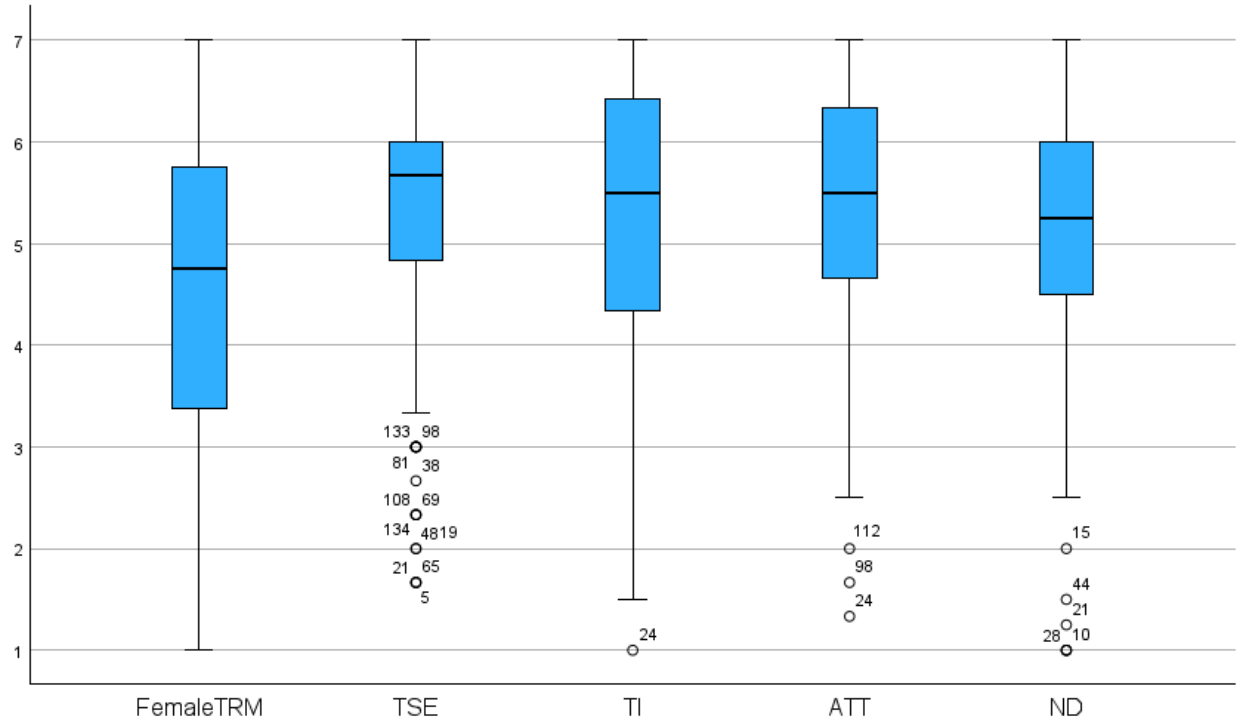
The study used hierarchical multiple regression to test the hypotheses, including multiple predictor variables, mediating variables, and one dependent variable. The regression assumptions that were tested included testing for sample size, normality, outliers, linearity, homogeneity of regression, multicollinearity and singularity, and homogeneity of variance-covariance matrices (Field, 2018; Pallant, 2016).

Outliers

Outliers are cases with standardised residuals more significant than 3.3 or less than -3.3. These are cleaned so that the regression analysis is free from distortion, as it is pretty sensitive to outliers (Schindler & Cooper, 2014). Boxplots were generated for all five constructs to detect these outliers (Schindler & Cooper, 2014; Pallant, 2016). Extreme outliers were marked by an asterisk (*) next to their case numbers on the boxplots, while less extreme outliers were indicated by a circle next to their case numbers (Pallant, 2016).

Only the TSE Composite had extreme outliers, which were dealt with using the winsorizing plus one method (Wilcox, 2017; Huber & Elvezio Ronchetti, 2009). This method involves replacing extreme values with the next highest or lowest score to avoid issues in statistical analysis (Chen & Liu, 1993). In the study, the extreme outliers that were recorded were cases (133, 98, 81, 44, 34), which all had extreme values of 1 as compared to the rest of the dataset. The box plots were done on SPSS to check if there were still any remaining extreme outliers in the dataset, and it can be seen from Figure 6 that after winsorizing the extreme outliers, there were none left.

Figure 6: Box Plot for Female TRM, TSE, TI, ATT and ND composites



The data points without asterisks were examined for potential outliers that could impact the results by calculating standardised values (z-scores) to identify such outliers (Pallant, 2016). The z-scores above three were identified as outliers that needed to be winsorised to ensure these values would not affect the analysis (Chen & Liu, 1993; Pallant, 2016). The cases that were identified to have z-scores above 3/-3 are shown in Table 18:

Table 17: Cases that were identified with z-scores above the 3/-3 z-score

	Female TRM	TSE	TI	ATT	ND

Cases (above the 3/-3 z-score)			24	24, 98,112	10, 28, 81, 21, 44

These identified cases in Table 16 were winsorised, and the final boxplots were created. They showed that only TSE and ND have minor outliers, which were left unchanged (Pallant, 2016). Thus, the Outliers assumption was not violated.

Sample Size

The assumption with sample size is that it has to be enough to generalise results (Schindler & Cooper, 2014; Pallant, 2016; Rachad Antonius, 2004). Additionally, following the size guideline formulae from Tabachnick and Fidell (2013) of N > 50 +8m, the researcher used this recommendation. Based on the present study, which has four predictor variables, the size of N (number of cases) should be as follows:

$N > 50 + 8(4)$

$N > 82$

The study has a sample size of (N =147); therefore, based on the recommended sample size guidelines, the sample size is adequate for regression analysis. It can be concluded that the sample size assumption was not violated.

Multicollinearity and Linearity

Testing multicollinearity is vital because multiple regression or singularity does not contribute well to the regression model (Pallant, 2016). Pearson's correlation matrix was re-run after winsorising outliers, and the results are displayed in Table 17. Pearson's correlation

analysis showed no evidence of multicollinearity between the predictor variables, as shown in Table 17, because there was no r-value greater than 0.8.

Linearity is important to test because the correlation between the predictor and dependent variables must be linear to run the regression analysis (Tabachnick & Fidell, 2013). Results from the correlation between predictor variables and the dependent variable showed correlations, therefore indicating a linear model, as per Table 17. It can be concluded that the multicollinearity and linearity assumptions were not violated.

Table 18: Pearson's Correlation Matrix

		FemaleTRM	TSE	TI	ATT	ND
FemaleTRM	Pearson Correlation	1				
TSE	Pearson Correlation	,329**	1			
TI	Pearson Correlation	,101	,172*	1		
ATT	Pearson Correlation	,098	,198*	,784**	1	
ND	Pearson Correlation	,356**	,344**	,084	,131	1
	N	147	147	147	147	147

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Independence of Errors

The independence of error is checked by calculating the Durbin-Watson (DW) value, which checks the presence of autocorrelation in the residuals from regression analysis (Field, 2018; Pallant, 2016). The Durbin-Watson value is assessed to check for the independence of errors, which means there is no autocorrelation. When it is between 1.5 and 2, it is considered good and independent of errors because a value of 2 means no autocorrelation (Field, 2018; Pallant, 2016). The results show that the DW = 1.762, and therefore, the independence of error assumption is not violated.

Normality of residuals

Testing that the residuals are normally distributed is essential to confirm the linearity of the correlation between predictor variables (TSE, ATT, Female TRM, ND) and dependent variable (TI). This can be tested using the Normal P-Plot, which shows whether the residuals are along a straight line and usually indicates distributed errors. The results from the Normal P-P Plot in Figure 7 show that the points are along a straight line, suggesting no significant deviations from normality (Pallant, 2016). It can be concluded that the normality assumption was not violated.

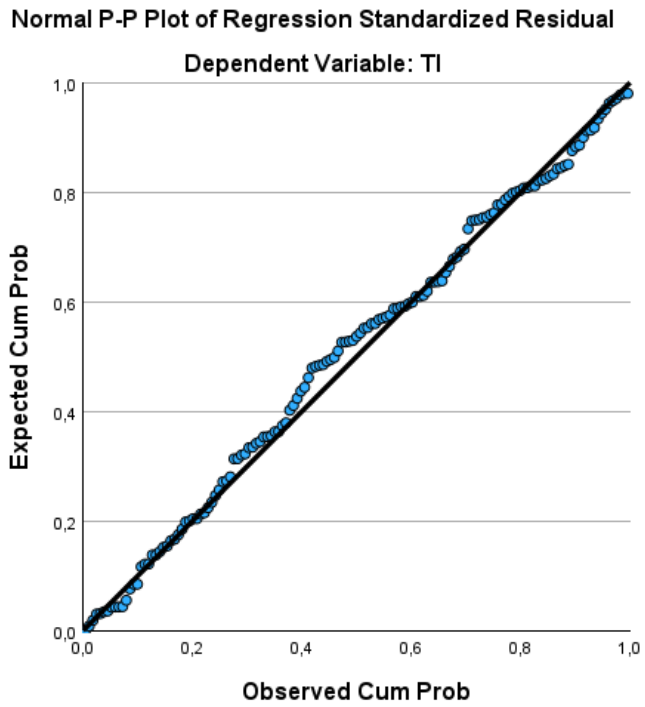


Figure 7: Normal P-P Plot of Regression Standardized Residual [Source: Primary]

The normal distribution curves for the dependent construct TI are displayed in Figure 8 below. A normal distribution presents as a bell-shaped curve on a histogram (Field, 2018). Thus, based on the shapes of the dependent construct TI, it can be concluded that the data is normally distributed, confirming that the assumption of normality was not violated (Field, 2018).

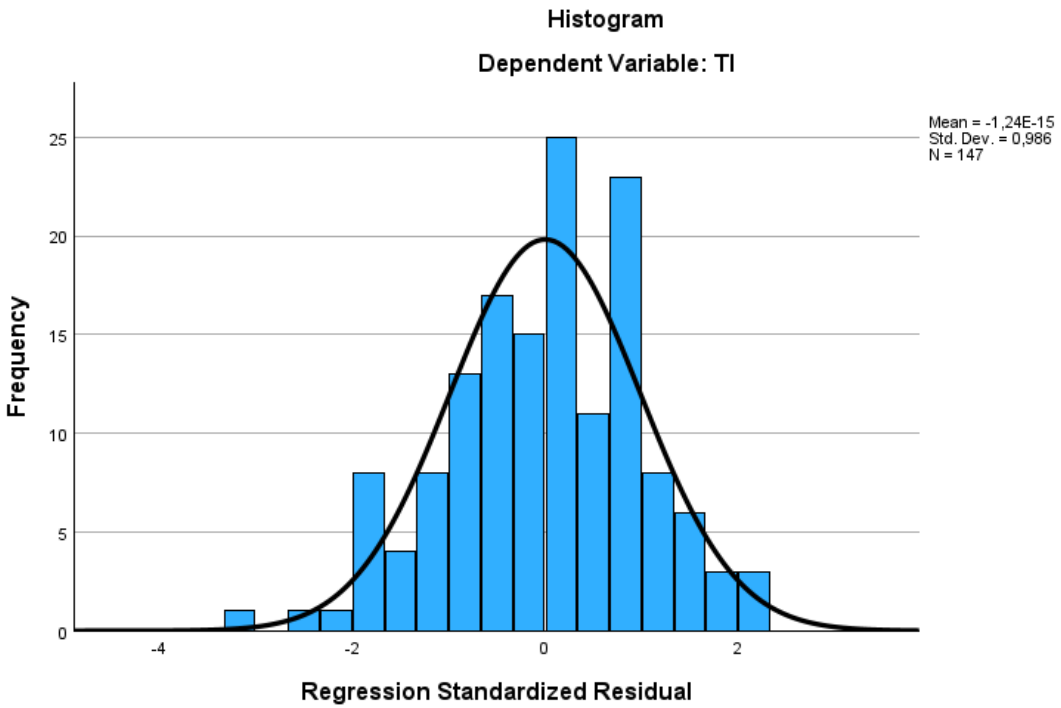


Figure 8: Histogram [Source: Primary Data]

Homoscedasticity

A Residual Scatterplot was utilised to assess equal variance, showing that the standard residuals fell within the range of -3 to 3 (Field, 2018). Any residuals outside this range would violate the assumption of equal variance (Field, 2018). The results in Figure 9 show that

most points are centralised around zero and situated in a rectangle between 3 and -3 (Field, 2018). This range indicates consistent error variance (Field, 2018). This proves that the assumption has not been violated.

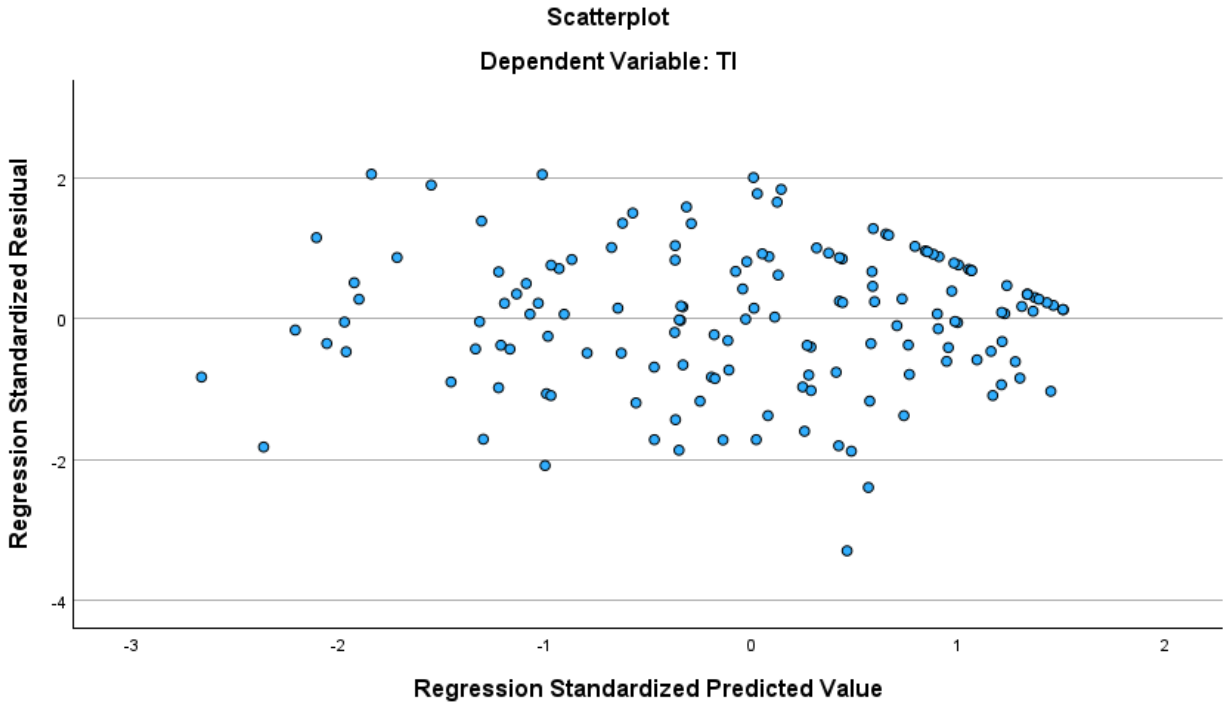


Figure 9: Homoscedasticity Test [Source: Primary Data]

4.6 Hierarchical Multiple Regression

Based on the hypotheses being tested, a hierarchical multiple regression was performed for the dependent variable to test the contribution of each predictor variable. The constructs on SPPS being tested included 'ProvinceGauteng', 'EthnicityBlack', TI, ATT, TSE, Female TRM and ND (Creswell & Creswell, 2018).

The variables were analysed using hierarchical regression with four distinct models. Model 1 included only the control variables, while Model 2 incorporated the direct predictors. Models 3 and 4 added the indirect predictors of technopreneurial intention in alignment with the tested hypotheses. The hierarchical regression analysis structure is shown below in Table 20.

Table 19: Regression analysis model structure

Model #	Predictor Variables	Dependant Variable
1	*Control Variables:* Province - Gauteng Ethnicity - Black	TI
2	*Direct Predictors:* ATT TSE	TI
3	*Indirect Predictors:*	TI

	Female TRMs	
4	*Indirect Predictors:* ND	TI

A change in the R square was used to assess the contribution that the predictors make to explain a change in TI (Field, 2018). The results from the model summary are then shown below in Table 21.

Table 20: Model Summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	,163[a]	,027	,013	1,281	,027	1,976	2	144	,142
2	,788[b]	,621	,610	,806	,594	111,136	2	142	<.001
3	,788[c]	,621	,608	,808	,000	,153	1	141	,696

4	,789[d]	,622	,606	,810	,001	,466	1	140	,496

a. Predictors: (Constant), EthnicityBlack, ProvinceGauteng

b. Predictors: (Constant), EthnicityBlack, ProvinceGauteng, TSE, ATT

c. Predictors: (Constant), EthnicityBlack, ProvinceGauteng, TSE, ATT, FemaleTRM

d. Predictors: (Constant), EthnicityBlack, ProvinceGauteng, TSE, ATT, FemaleTRM, ND

e. Dependent Variable: TI

Model 1 shows that the control variables EthnicityBlack students and ProvinceGauteng students explain 2.7% variance in Technopreneurial Intention. There was a significant change in R-squared when Model 2 was added, which included ATT and TSE, suggesting that direct predictors TSE AND ATT explain 59.4% of the variance in technopreneurial intention. There was no change in r-squared when Female TRM was added, suggesting that the variable Female TRM does not explain any variance in technopreneurial intention. Lastly, when ND was added to the regression model, there was a 0.1% change in r-squared, suggesting that ND explains 0.1% of the variance in TI. Overall, what happens on technopreneurial intention is 62.2% explained by the combined effect of EthnicityBlack, ProvinceGauteng, Technopreneurial Self-Efficacy, Attitude Towards Technopreneurship, Female TRM and Normative Dimensions (Field, 2018). The 62.2% explanatory power is quite significant as it explains more than 50% of the variance in technopreneurial intention (Pallant, 2016).

The significance of the models was then assessed using the ANOVA Table, which showed p-values for all four models. The ANOVA table shows the significance levels of each model in explaining technopreneurial intention (TI). The significance of each model is reached at a p-value of less than 0.05 (Pallant, 2016). The results of the ANOVA table are shown below in Table 22.

Table 21: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6,491	2	3,245	1,976	,142[b]
	Residual	236,455	144	1,642		
	Total	242,946	146			
2	Regression	150,771	4	37,693	58,068	<.001[c]
	Residual	92,175	142	,649		
	Total	242,946	146			
3	Regression	150,871	5	30,174	46,207	<.001[d]
	Residual	92,075	141	,653		
	Total	242,946	146			
4	Regression	151,176	6	25,196	38,438	<.001[e]

	Residual	91,769	140	,655		
	Total	242,946	146			

a. Dependent Variable: TI

b. Predictors: (Constant), EthnicityBlack, ProvinceGauteng

c. Predictors: (Constant), EthnicityBlack, ProvinceGauteng, TSE, ATT

d. Predictors: (Constant), EthnicityBlack, ProvinceGauteng, TSE, ATT, FemaleTRM

e. Predictors: (Constant), EthnicityBlack, ProvinceGauteng, TSE, ATT, FemaleTRM, ND

The results show that models 2, 3, and 4 are statistically significant, with p-values less than 0.05. This suggests that the combined predictors in models 2, 3, and 4 significantly explain the variance in TI. Model 1 is the only statistically not significant model with a p-value greater than 0.05 (p = 0.412). It can be accepted that Model 1 is not statistically significant, which is not surprising since the Model includes the demographic variables EthnicityBlack and ProvinceGauteng, which were not hypothesised to influence technopreneurial intention.

The Coefficients table was then used to interpret the influence of each predictor variable on technopreneurial intention and the significance of the relationship. The results are shown in Table 21 below.

Table 22: Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients			Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	4,793	,387		12,400	<.001					
	ProvinceGauteng	,440	,247	,147	1,781	,077	,153	,147	,146	,990	1,010
	EthnicityBlack	,261	,374	,058	,699	,486	,073	,058	,057	,990	1,010
2	(Constant)	,066	,450		,146	,884					
	ProvinceGauteng	,211	,156	,071	1,352	,178	,153	,113	,070	,978	1,022
	EthnicityBlack	,041	,236	,009	,172	,864	,073	,014	,009	,985	1,015
	TSE	,020	,054	,020	,376	,707	,172	,032	,019	,958	1,043

	ATT	,927	,064	,772	14,533	<.001	,784	,773	,751	,946	1,057
3	(Constant)	,039	,456		,085	,933					
	ProvinceGauteng	,213	,157	,071	1,359	,176	,153	,114	,070	,978	1,023
	EthnicityBlack	,029	,239	,006	,120	,905	,073	,010	,006	,969	1,032
	TSE	,013	,057	,013	,233	,816	,172	,020	,012	,863	1,159
	ATT	,926	,064	,772	14,471	<.001	,784	,773	,750	,945	1,058
	FemaleTRM	,017	,044	,022	,391	,696	,101	,033	,020	,876	1,142
4	(Constant)	,177	,500		,354	,724					
	ProvinceGauteng	,219	,157	**,073**	1,393	**,166**	,153	,117	,072	,975	1,026
	EthnicityBlack	,013	,240	**,003**	,053	**,958**	,073	,004	,003	,959	1,042
	TSE	,023	,059	**,023**	,393	**,695**	,172	,033	,020	,811	1,234
	ATT	,929	,064	**,774**	14,458	**<.001**	,784	,774	,751	,942	1,062
	FemaleTRM	,026	,046	**,033**	,567	**,571**	,101	,048	,029	,806	1,241
	ND	-,046	,067	**-,040**	-,683	**,496**	,084	-,058	-,035	,803	1,245

a. Dependent Variable: TI

It is also evident that all predictor variables (Province_Gauteng, EthnicityBlack, Female TRM, TSE, ATT) positively influence TI, except ND, which negatively influences Technopreneurial Intention. ND has an inverse relationship with TI, with a standard coefficient beta (β = -0.040). However, it is not a statistically significant relationship (p = 0.496) as the p-value is more significant than 0.05.

Female TRM positively influences TI with a standard coefficient beta (β = 0.033). The strength of the influence that Female TRM has on TI is 3.3%; however, this is also a statistically not significant relationship (p = 0.571).

TSE positively influences TI with a standard coefficient beta (β = 0.023). The strength of the influence that TSE has on TI is 2.3%; however, this is not a statistically significant relationship (p = 0.695).

ATT positively influences TI with a standard coefficient beta (β = 0.782) and p-value <0.001. This indicates that positive attitudes towards technopreneurship strongly influence technopreneurial intentions, as it is the most significant predictor compared to TSE, Female TRM and ND. The predictors Female TRM, ND, and TSE do not show significant contributions on the coefficients table; however, when ATT is included, they show significant results, which may suggest that ATT potentially mediates their effects. Potential mediation effects will be discussed under section 4.8.

4.6.1 Results of Hypothesis 1

H1: Attitude towards technopreneurship positively influences technopreneurial intentions among female technology students in South Africa

Regression results in Table 21, Model 4, show that ATT positively influences TI with a standard coefficient of (77.4%) and this is statistically significant with a p-value <0.001. This means that an increase in positive attitude towards technopreneurship has a 77.4% influence on technopreneurial intention among South African female technology students. With that said, Hypothesis 1 was supported,

and it can be concluded that Attitude towards Technopreneurship plays a significant role in increasing technopreneurial intentions among South African female technology students.

4.6.2 Results of Hypothesis 2

H2: Technopreneurial Self-efficacy positively influences technopreneurial intentions among female technology students in South Africa

Regression results in Table 21, Model 4, show that TSE positively influences TI with a standard coefficient of ($\beta = 0.023$) and, however, statistically not significant with a p-value <0.05 (p=0.695). Therefore, Hypothesis 2 was not supported, and it can be concluded that Technopreneurial Self-efficacy does not play a significant role in shifting technopreneurial intentions among South African female technology students.

4.7 Mediation Analysis

Building on hierarchical multiple regression analysis results, mediation analysis was used to test hypotheses 3 and 4. The study followed the Baron and Kenny (1986) approach, with the researcher following three steps to establish the mediation effects.

Step 1: Identifying the mediation variables

Table 23: Mediation hypotheses and variables

Model	Hypothesis	IV	Mediators	DV
1	3(a)	Female TRM	ATT	TI
2	3(b)	Female TRM	TSE	TI
3	4(a)	Normative Dimension	ATT	TI
4	4(b)	Normative Dimension	Female TRM	TI

Four models were created to be tested through the PROCESS Macro to establish the mediation effects of the four hypotheses (3a, 3b, 4a, 4b)

Step 2: To proceed to Mediation analysis, the four mediation regression models were run on PROCESS Macro, SPSS (Baron & Kenny, 1986):

The results of the mediation model summary are shown in Table 25.

Table 24: Mediation Model Summary

Direct and Indirect Effects/Influence

Path	**Causal Path**	**R-squared change**	**Coefficient Beta**	**p-value (significance)**	**95% Confidence Levels**
Model 1: Hypothesis 3(a)					
Path a	Female TRM>ATT	0.0097	0.0657	0.2363	
Path b	ATT>TI		0.9362/84	<0.001	
Path c	Female TRM>ATT>TI				
	Total Indirect Effect **= (Path a x Path b)**		**0.0616**		**-0.0417 to 0.1709**
	Total Direct Effect **= Path c**		**0.198**	**0.6356**	
	Total effect of Female TRM on TI through ATT (Direct effect + Indirect effect)		**0.2596**		
Model 2: Hypothesis 3(b)					
Path a	Female TRM>TSE	0.1085	0.2580	<0.001	
Path b	TSE>TI		0.1594	0.0750	
Path c	Female TRM>TSE>TI				
	Total Indirect effect		***0.0411***		***-0.0112 to 0.0938***

	= (Path a x Path b)				
	Total Direct effect = Path c		***0.0403***	***0.5642***	
	Total effect of Female TRM on TI through TSE (Direct effect + Indirect effect)		**0.0814**		
Model 3: Hypothesis 4(a)					
Path a	ND>ATT	0.0172	0.1268	0.1136	
Path b	ATT>TI		0.9420	0.001	
Path c	ND>ATT>TI				
	Total Indirect effect **= (Path a x Path b)**		**0.1197**		**-0.0276 to 0.2809**
	Total Direct effect **= Path c**		**-0.0219**	**0.7177**	
	Total effect of ND on TI through ATT (Direct effect + Indirect effect)		**0.0832**		

Model 4: Hypothesis 4(b)					
Path a	ND>Female TRM	0.1266	0.5151	<0.001	
Path b	Female TRM>TI		0.0657	0.2061	
Path c	ND>Female TRM>TI				
	Total Indirect effect **= (Path a x Path b)**		**0.0338**		**-0.0391 to 0.1290**
	Total Direct effect **= Path c**		**0.0640**	**0.5349**	
	Total effect of ND on TI (Direct effect + Indirect effect)		**0.0978**		

Step 3: Test the mediation assumptions and mediation and present the mediation results.

Hypothesis 3(a)

Table 25: Assumption testing for Hypothesis 3(a)

Hypothesis 3(a)	Conditions	Assumption Results

Assumption 1	A significant relationship between Female TRM and ATT.	Condition not met. P =0.2363 (p>0.05)
Assumption 2	There is a significant relationship between ATT and TI.	Condition met. P <0.001 (p<0.05)
Assumption 3	A significant relationship between Female TRM and TI.	Condition not met. P = 0.6356 (p >0.05)

Results of the assumption testing for hypothesis 3(a) in Table 23 show that the relationship between Female TRM and ATT is not significant with a p-value of 0.2363, which is above the ($p<0.05$) significance standard. However, Female TRM has a positive relationship with ATT with a coefficient beta $\beta = 0.0657$. Since the influence is not significant, it can be suggested that Female TRM does not have a significant relationship on ATT and, therefore, assumption 1 was not met. Assumption 2 was the only assumption whose condition was met. The results showed that ATT has a significant positive relationship with TI with a p-value less than 0.05 ($p<0.001$) and a coefficient beta of 0.9384. For every unit increase of ATT, there is a 93.84% increase in TI. Assumption 3 was tested, and the results showed that the direct relationship between Female TRM and TI is a not significant, weak positive relationship with a p-value of 0.6356 and coefficient beta of 0.198.

The mediation effects were then tested using the direct and indirect effects shown in Table 22. The total direct effect of Female TRM on TI is a coefficient beta ($\beta = 0.198$) and statistically not significant with a p-value of 0.6356. The total indirect effects of Female TRM on TI through MV are positive with a coefficient beta ($\beta = 0.616$) but statistically not significant with a bootstrap CI that includes a zero, therefore indicating no significant mediation.

According to Baron and Kenny's (1986) approach, because assumptions 1 and 3 were not met and the indirect effects were not significant, there is no evidence of mediation by ATT in the relationship between Female TRM and TI. There was evidence that ATT significantly predicts TI by 93.84%.

Hypothesis 3(b)

Table 26: Assumption testing for Hypothesis 3(b)

Hypothesis 3(b)	**Conditions**	**Assumption Results**
Assumption 1	A significant relationship between Female TRM and TSE.	Condition met. $p < 0.001$ ($p < 0.05$)
Assumption 2	There is a significant relationship between TSE and TI.	Condition not met. $P = 0.0750$ ($p > 0.05$)
Assumption 3	A significant relationship between Female TRM and TI.	Condition not met. $P = 0.5642$ ($p > 0.05$)

Results from assumption testing in Table 24 show that the only assumption whose condition was met was Assumption 1 with a p-value less than 0.05. The relationship between Female TRM and TSE is positive and weak, with a coefficient beta ($\beta = 0.2580$). There is a 25.8% increase in TSE for every unit increase of Female TRM. Assumption 2 was tested, and the results showed that the relationship between TSE and TI is not significant, with a p-value greater than 0.05 ($p = 0.0750$). Assumption 3 was lastly tested. The findings showed that the relationship between Female TRM and TI is not significant, with a p-value of 0.5642.

Mediation effects were tested, and they showed that the direct effect of Female TRM on TI is a very weak positive relationship with a coefficient beta (β = 0.0403) and p-value of 0.5642. The indirect effect through TSE showed a coefficient beta (β = 0.0411) with a confidence interval that includes a zero, suggesting that the indirect effect is not statistically significant.

According to Baron and Kenny's (1986) approach, because assumptions 2 and 3 were not met and the indirect effects were not significant, there was no evidence of mediation by TSE in the relationship between Female TRM and TI. There was evidence that Female TRM significantly predicts TSE by 25.8%.

4.7.1 Results of Hypothesis 3

H3: Female Technopreneur role models positively influence technopreneurial intentions through (3a) attitude towards technopreneurship and (3b) technopreneurial self-efficacy among female technology students in South Africa

Mediation analysis was run on PROCESS Macro in SPSS to test hypothesis 3 (a). After assumption testing and testing for mediation effects, the results showed that mediation was not supported. Female technopreneur role models do not have a significant direct influence on technopreneurial intention nor an indirect influence on technopreneurial intention through Attitude towards technopreneurship. Attitude towards technopreneurship is a significant predictor of technopreneurial intention, suggesting that a positive attitude towards technopreneurship strongly influences technopreneurial intention.

Mediation analysis was run on PROCESS Macro in SPSS to test hypothesis 3 (b). After assumption testing and testing for mediation effects, the results showed no evidence of mediation. Female technopreneur role models do not have a significant direct influence on technopreneurial intention nor an indirect influence on technopreneurial intention through Technopreneurial self-efficacy. Female technopreneur role models significantly influence technopreneurial self-efficacy, even though it does not translate to increased technopreneurial intention.

Hypothesis 4(a)

Table 27: Assumption testing for Hypothesis 4(a)

Hypothesis 4(a)	**Conditions**	**Assumption Results**
Assumption 1	There is a significant relationship between ND and ATT.	Condition not met. P = 0.1136 (p>0.05)
Assumption 2	There is a significant relationship between ATT and TI.	Condition met. P <0.001
Assumption 3	There is a significant relationship between ND and TI.	Condition not met. P = 0.7177 (p >0.05)

Results from assumption testing in Table 25 show that the only assumption whose condition was met was Assumption 2 with a p-value less than 0.05 ($p<0.001$), indicating a significant relationship. The relationship between ATT and TI has consistently been shown to be a positive significant relationship with a coefficient beta (β =0.9420). For every unit increase of ATT, there is a 94.2% increase in TI. Assumption 1 testing showed that the relationship between ND and ATT is a positive weak relationship with a coefficient beta (β = 0.1268); however, it is statistically not significant with a p-value of 0.1136, which is above the significance standard of 0.05. Assumption 3 was tested, and the findings showed that the relationship between ND and TI is not significant, with a p-value of 0.5642. The relationship also proved to be a very weak negative relationship with a coefficient beta (β = -0.0363).

Mediation effects were tested, and they showed that the direct effect of ND on TI is a very weak negative relationship with a coefficient beta (β = -0.0219) and p-value of 0.7177. The indirect effect through ATT showed a coefficient beta (β = 0.1197) with a confidence interval that includes a zero, indicating that the indirect effect is not statistically significant.

According to Baron and Kenny's (1986) approach, because assumptions 1 and 3 were not met and the indirect effects were not significant, there was no evidence of mediation by ATT in the relationship between ND and TI. There was evidence that ATT significantly predicts TI by 94.2%.

Hypothesis 4(b)

Table 28: Assumption testing for Hypothesis 4(b)

Hypothesis 4(b)	**Conditions**	**Assumption Results**
Assumption 1	A significant relationship between ND and Female TRM.	Condition met. P <0.001 (p<0.05)
Assumption 2	A significant relationship between Female TRM and TI.	Condition not met. P<0.2061 (p>0.05)
Assumption 3	There is a significant relationship between ND and TI.	Condition not met. P = 0.5349 (p>0.05)

Results from assumption testing in Table 26 show that the only assumption whose condition was met was Assumption 1 with a p-value less than 0.05 ($p<0.001$), thereby showing the significance of the relationship. The relationship between ND and Female TRM is a positive moderate relationship with a coefficient beta ($\beta = 0.5151$). For every unit increase of ND, there is a 51.51% increase in Female TRM. Assumption 2 was tested, and the results showed that the relationship between Female TRM and TI is not significant, with a p-value greater than 0.05 ($p = 0.2061$). Assumption 3 was tested, and the findings showed that the relationship between ND and TI is not significant, with a p-value of 0.5349.

Mediation effects were tested, and they showed that the direct effect of ND on TI is a very weak positive relationship with a coefficient beta (β = 0.0640) and p-value of 0.5349. The indirect effect through Female TRM showed a coefficient beta (β = 0.0338) with a confidence interval that includes a zero, suggesting that the indirect effect is not statistically significant.

According to Baron and Kenny's (1986) approach, because assumptions 2 and 3 were not met and the indirect effects were not significant, there was no evidence of mediation by Female TRM in the relationship between ND and TI. There was evidence that ND significantly predicts Female TRM by 51.51%.

4.7.2 Results of Hypothesis 4

Hypothesis 4: Positive perceptions of the normative institutional environment have a positive effect on technopreneurial intentions as mediated by attitude towards technopreneurship (H4a) and subjective norms: knowledge of female role models (H4b) among South African female tech students

Mediation analysis was run on PROCESS Macro in SPSS to test hypothesis 4 (a), and after assumption testing and testing for mediation effects, the results showed that mediation was not supported. A positive perception of Normative Dimensions does not have a significant direct influence on technopreneurial intention nor an indirect influence on technopreneurial intention through Attitude towards technopreneurship. Attitude towards technopreneurship is consistently a significant predictor of technopreneurial intention and suggests that a positive attitude leads to higher technopreneurial intentions.

Mediation analysis was run on PROCESS Macro in SPSS to test hypothesis 4 (b), and after assumption testing and testing for mediation effects, the results showed that mediation was not supported. A positive perception of the normative dimension does not significantly influence technopreneurial intention nor indirectly influence technopreneurial intention through Female technopreneur role models. A positive perception of the normative dimension significantly predicts subjective norms: knowledge of female technopreneur role models suggests that positive perceptions strongly influence the knowledge of female technopreneur role models.

4.8 Chapter Summary

The chapter began by presenting the descriptive statistics and showing the sample characteristics of demographics. The demographics revealed that most participants were from the province of Gauteng in South Africa and of black ethnicity. The demographics also showed that the final sample used for statistical analysis was 147. Data analysis followed, starting with validity testing, which revealed that the data was suitable for factor analysis, and five factors were extracted and retained for further analysis. The researcher then continued with reliability testing, which showed that the scales used in the study were very reliable, with Cronbach alpha scores above 0.8. Once the validity and reliability tests had passed, the researcher presented the descriptive statistics of the continuous variables used for correlation and regression analysis and found the normal distribution of data.

Correlation analysis was then done using Pearson's coefficient matrix, revealing that the variables were correlated but had no evidence of multicollinearity. The regression assumptions were tested before regression analysis could be performed, and all of them passed. The results of the hierarchical regression analysis were then interpreted, and Hypotheses 1 and 2 were easily tested during this process. Mediation analysis was performed to test hypotheses 3 and 4, and the results found no evidence of mediators in either hypothesis. A summary of the hypotheses is shown in Table 30 below:

Table 29: Summary of Hypotheses

Hypotheses	Description	Beta (β)	p-value	Supported or Not Supported
1	*Attitude towards technopreneurship positively influences technopreneurial intentions among female*	0.774	<0.001	Supported

	technology students in South Africa			
2	*Technopreneurial Self-efficacy positively influences technopreneurial intentions among female technology students in South Africa*	0.023	0.695	Not Supported
3(a)	*Female Technopreneur role models positively influence technopreneurial intentions through (3a) attitude towards technopreneurship among female technology students in South Africa*	0.2596		Not supported
3(b)	*Female Technopreneur role models positively influence technopreneurial intentions through (3b) technopreneurial self-efficacy among female technology students in South Africa*	0.0814		Not Supported

4(a)	*Positive perceptions of the normative institutional environment positively affect technopreneurial intentions among South African female tech students through their attitude towards technopreneurship.*	0.0832		Not Supported.
4(b)	*Positive perceptions of the normative institutional environment have a positive effect on technopreneurial intentions as mediated by subjective norms: knowledge of female role models (H4b) among South African female tech students*	0.0978		Not Supported

In conclusion, the results in Table 27 showed whether the different hypotheses were supported or not supported by the analysis performed in Chapter 4. A positive attitude towards technopreneurship was the most influential factor in increasing technopreneurial intentions among South African technology students. Subjective norms: Female technopreneurial role models were found to significantly influence increasing technopreneurial self-efficacy but not directly/indirectly influencing technopreneurial intention. The positive perception of

normative dimensions was found to have a positive significant influence on increasing subjective norms: knowledge of female technopreneur role models. Lastly, Hypotheses 2, 3 and 4 were not supported by the statistical analysis, whilst Hypothesis 1 was supported.

CHAPTER 5: DISCUSSION OF RESULTS

5.1 Introduction

This chapter provides an in-depth discussion of the results presented in Chapter 4 by connecting the empirical findings with the relevant theoretical literature. The goal is to understand the findings and how they relate to existing knowledge. The discussion begins with the demographic profile of the study participants, highlighting trends and patterns that provide context for understanding the broader findings. Next, the chapter delves into the study's hypotheses, systematically comparing the empirical results with the theoretical expectations. It compares the results with the theories' predictions, showing where they match or differ. This helps explain why specific outcomes occurred, using ideas from the literature to provide a better understanding. Finally, the chapter concludes by synthesising the key takeaways and drawing conclusions about the proposed hypotheses.

5.2 Discussion pertaining to the Demographic Profile Results

The study's main objective was to investigate the influence female tech entrepreneurs as role models have on the technopreneurial intentions of female technology students in South Africa.

The results from the 147 respondents' sample for data analysis revealed that most of the respondents were from Gauteng province (75.5%) and were Black by ethnicity (91.2%). This finding is most likely attributed to the fact that the two organisations from which the sample was taken are non-profit coding/technology education organisations mainly based in the Gauteng province. Statistics SA shows that Gauteng holds the largest share of the population compared to other provinces (Stats SA, 2024).

The finding that most respondents are Black is likely due to the broader context that historically disadvantaged Black individuals represent the most significant demographic attending GirlCode and WeThinkCode in South Africa (WeThinkCode, 2023; GirlCode, 2024). This result is similar to previous research studies done in South Africa, where the demographic profile of respondents is mostly

Black by ethnicity (Malebana & Mothibi, 2023; Msimango-Galawe & Mazonde, 2021; Galawe, 2017). This is mainly explained by the demographic makeup of South Africa, where the dominant population group is Black Africans at 81.4% (South African Government, 2022).

Therefore, the demographic profile results of respondents represent, in a way, the population at large in South Africa and, therefore, generalise findings in the South African context in this research study. There was, however, a limited response from the rest of the South African provinces and other races representative of South Africa. Therefore, this could be a limitation addressed in further research on female technopreneurship intentions among female technology students in South Africa.

Empirical results showed that the contextual elements—specifically, respondents from the Gauteng province and identifying as Black by ethnicity—did not significantly affect technopreneurial intention. This may be attributed to the fact that most respondents share similar contextual backgrounds, and therefore, the lack of variance may have reduced the observable effect on technopreneurial intention (Creswell & Creswell, 2018, p. 155). This result contradicts the findings of a similar study by Koe et al. (2023), where contextual elements significantly and positively influenced technopreneurs' intentions. This may be because the two studies were done in different countries, and the context differs in each country or region. Practically, further research can be done to add to the South African context about technopreneurial intention to have a more like-for-like comparison.

5.3 Discussion pertaining to Hypotheses

The following section will then discuss the study's findings compared to the findings in theory and what the study hypothesised.

5.3.1 Attitude Towards Technopreneurship and Technopreneurial Intentions

Hypothesis 1(''H1) read as follows: 'Attitude towards technopreneurship positively influences technopreneurial intentions among female technology students in South Africa'

The objective of H1 was to investigate the level of influence that attitude towards technopreneurship has on technopreneurial intention among female technology students in South Africa. A literature review was done to hypothesise the relationship that attitude towards technopreneurship has with technopreneurial intention, and it was hypothesised to be a positive influential relationship. The female technology students were then surveyed on a 7-point Likert scale, which questioned their attitude towards technopreneurship and technopreneurial intentions. This data was then analysed using regression analysis to assess the results of the relationship hypothesised.

The results show a very strong, significant positive relationship between attitude towards technopreneurship and technopreneurial intention among female technology students in South Africa. The results show that the level of influence that attitude towards technopreneurship has on technopreneurial intention is 77.4%, which is statistically significant. This means that when technology students increase their positive attitude towards technopreneurship, their desire to start their technology venture is increased by 77.4%. This shows that attitude towards technopreneurship has a significant influence on technopreneurial intentions amongst female technology students.

These findings are similar to those from the research study done in North West, South Africa, by Pheaha and Schachtebeck (2020), which found that attitude towards entrepreneurship has a significant and positive relationship with entrepreneurial intention among women. This study may have been done in a different province in South Africa, focusing on entrepreneurship rather than specifically technopreneurship; however, the results showed the same finding that attitudes towards the behaviour significantly influence intentions (Pheaha & Schachtebeck, 2020). Across a variety of previous studies, the findings agreed with this research study's findings that attitudes explain more than 50% of variances in intentions (Ajzen, 1987; Liñán & Chen, 2009; Linan et al., 2011; Krueger et al., 2000; Amofah & Saladrigues, 2022). In South Africa, the findings were also confirmed in the study by Malebana and Swanepoel (2019).

This may be theoretically attributed to the adapted view from the Theory of Planned Behaviour that states that technopreneurial intention develops from the attitude the individuals hold about becoming a technopreneur or starting a technology business (Krueger & Carsrud, 1993). The finding can also be attributed to the view that a positive attitude toward starting a tech business significantly influences

technopreneurial intentions, mainly because historically, female technopreneurship is not the most celebrated or attractive career for women (Kovaleva et al., 2023). Because tech businesses are historically considered men's clubs, they must be perceived as desirable and attractive to women to increase their desire to be technopreneurs (Kovaleva et al., 2023).

This finding supports the initial Hypothesis 1 that attitude towards technopreneurship positively influences technopreneurial intention among female technology students in South Africa. Based on these findings, it can be concluded that the intention to start a new technology business strongly depends on the woman's positive perception of the attractiveness of creating a tech venture.

The practical implications of Hypothesis 1's findings suggest that policymakers, educators, program developers, and venture builders should focus on enhancing the desirability and appeal of technopreneurship to women to boost their intentions to establish new tech ventures.

5.3.2 Technopreneurial Self-efficacy and Technopreneurial Intention

Hypothesis 2 ('H2') read as follows: 'Technopreneurial self-efficacy positively influences technopreneurial intentions among female technology students in South Africa'

The objective of H2 was to investigate the level to which technopreneurial self-efficacy influences technopreneurial intention among South African female technology students. A literature review was conducted to formulate the hypothesis that technopreneurial self-efficacy positively influences technopreneurial intention. To test this, female technology students completed a survey using a 7-point Likert scale, assessing their perceptions of both technopreneurial self-efficacy and intention. The collected data was analysed through regression analysis to evaluate the hypothesised relationship.

The results show a positive, very weak relationship between technopreneurial self-efficacy and technopreneurial intention among female technology students in South Africa. The results show that the level of influence that technopreneurial self-efficacy has on technopreneurial intention is 2.3%, but statistically not significant. The statistical insignificance means that this research study did not

have enough evidence to confidently support a significant relationship between technopreneurial self-efficacy and technopreneurial intentions among female technology students in South Africa (Pallant, 2016). This study shows that technopreneurial self-efficacy does not play a significant role in increasing technopreneurial intentions among female technology students. This implies that despite female technology students having a degree of confidence in their abilities to start a tech business, this does not influence their intention to start a tech business. There may still be a relationship between technopreneurial self-efficacy and technopreneurial self-efficacy, but this influence was not strong enough to be confirmed by this study.

The findings of hypothesis 2 are contradictory to several studies done on technopreneurial intention that found a significant contribution of self-efficacy on shifting technopreneurial intentions (Koe et al., 2021; Soomro & Shah, 2020; Salhieh & Al-Abdallat, 2022; Hoque et al., 2017; Machmud et al., 2020). What is, however, consistent with the findings of this study is that technopreneurial self-efficacy has a positive relationship with technopreneurial intention (Machmud et al., 2020; Soomro & Shah, 2020; Salhieh & Al-Abdallat, 2022; Hoque et al., 2017). This contradictory finding may be attributed to the different contexts that the studies were conducted in, considering that the mentioned studies were conducted in different countries like Indonesia, Malaysia, Saudi Arabia, and Dubai, and, therefore, the different findings.

In South Africa, the findings also confirmed that perceived self-efficacy explained the most variance in the entrepreneurial intention of respondents in the Limpopo and Eastern Cape provinces in a research study by Malebana and Swanepoel (2019). In another South African study done by Pheaha and Schachtebeck (2020), it was found that entrepreneurial self-efficacy has the most significant influence on entrepreneurial intention, which is not the case with the findings from this research study, which focused specifically on technopreneurial intention and technopreneurial self-efficacy. The findings of this research study show that an increase in the positive attitude towards technopreneurship has a greater significant influence on technopreneurial intention than technopreneurial self-efficacy.

The findings on H2 are similar to those from the study done in Malaysia among university students by Koe et al. (2023), which found that computer and internet self-efficacy did not significantly influence technopreneurial intention. This study, however, differed from the current study because it also employed the Theory of Planned Behaviour to hypothesise the relationship between self-efficacy and technopreneurial intention, while this study employed the Social Cognitive Theory to hypothesise the relationship on H2. Another study by Koe et al. (2021), which employed the Social Cognitive Theory similar to this study, found that ICT self-efficacy positively and significantly influences technopreneurial intention.

The findings of this study on H2 contradict the Social Cognitive Theory, which claims that entrepreneurial self-efficacy strongly predicts entrepreneurial intention (Chen, Greene & Crick, 1998). This contradiction may be attributed to the different context of the study, which focuses on technopreneurship and the relationship between technopreneurial self-efficacy and technopreneurial intention among female tech students in South Africa. The results also suggest that while individuals may have confidence in their ability to start a tech business, this does not necessarily translate into a stronger intention. This is because starting a tech business involves many additional factors, such as practical requirements, technology, and specialised knowledge (Dorf & Byers, 2005).

This finding failed to support the initial Hypothesis 2 that technopreneurial self-efficacy positively influences technopreneurial intention among female technology students in South Africa. Based on these findings, it is concluded that the intention to start a new technology business is negligently influenced by female tech students' confidence in their abilities to start a new tech venture in South Africa.

The practical implication suggested by Hypothesis 2's findings is that further research needs to be done with a larger sample size to have sufficient evidence to support Hypothesis 2 and the theory. Educators and program creators can also focus on technopreneurship skills and knowledge, not only employment options for female tech students.

What can also be deducted from the findings of H1 and H2 is that increasing the perceived desirability and feasibility of technopreneurship among female technology students will increase technopreneurial intentions.

5.3.3 Subjective Norms: Female Technopreneurial Role Models and Technopreneurial Intention

Hypothesis 3 ('H3') read as follows: 'Female technopreneur role models have a positive influence on technopreneurial intentions as mediated by attitude towards technopreneurship (H3a) and technopreneurial self-efficacy (H3b) among female technology students in South Africa'

The objective of H3 was to investigate the level of influence that the knowledge of female technopreneur role models has on technopreneurial intentions as mediated by attitude towards technopreneurship and technopreneurial self-efficacy among female technology students in South Africa. A literature review was done to hypothesise the relationship between the knowledge of female technopreneur role models and technopreneurial intention. It was hypothesised to be a positive influential relationship but mediated by the perception of the attitude towards technopreneurship and technopreneurial self-efficacy. The female technology students were then surveyed on a 7-point Likert scale, where they were asked questions on their knowledge of female technopreneur role models, perceptions of their attitude towards technopreneurship, perceptions of technopreneurial self-efficacy and technopreneurial intention. This data was then analysed using hierarchical multiple regression analysis and mediation analysis to assess the relationship results hypothesised.

Hypothesis 3 ('H3a'): 'Female technopreneur role models have a positive influence on technopreneurial intentions as mediated by attitude towards technopreneurship (H3a) among female technology students in South Africa'

The results showed that the relationship between the knowledge of female technopreneur role models and attitude towards technopreneurship is positive and not significant. Knowledge of female technopreneur role models has a 6.57% influence on attitude towards technopreneurship, which is a very weak relationship. This suggests that awareness of female role models does not necessarily change attitudes toward starting a new tech business. These findings may reflect the idea that role models can either make the career choice more appealing, particularly when successful, or serve as a source of discouragement, especially when many have faced failure

(Laviolette et al., 2012). Considering the tech start-up success rate is less than 50%, with 25% closing down the first year, it is no wonder the knowledge of female technopreneur role models is not significantly shifting the desirability of the career (Arinkina, 2023).

The mediation results for H3a (Model 1) show a weak positive relationship between the knowledge of female technopreneur role models and technopreneurial intention among female technology students in South Africa. The results show that female technopreneur role models' total influence on technopreneurial intention is 25.96%, which is statistically not significant in this study. This means that the knowledge of female technopreneur role models does not significantly increase technopreneurial intentions among female technology students in South Africa. The relationship between the knowledge of female role models and technopreneurial intention may still exist; however, there was not enough evidence to support the relationship mediated by attitude towards technopreneurship.

The findings of hypothesis 3a failed to support previous studies that found that role models influence intentions by affecting the attitude of the individual towards favouring technopreneurship (Krueger & Carsrud, 1993; Murari & Pathak, 2022; Nowinski & Haddoud, 2019; Karimi et al., 2013; Laviolette et al., 2012).

The findings of this study on Hypothesis 3a contradict the claims of the Theory of Planned Behaviour, which states that antecedents of entrepreneurial intention, including subjective norms, strongly predict entrepreneurial intention. Subjective norms in the form of knowledge of female technopreneur role models were found not to directly or indirectly predict technopreneurial intention based on this study.

This contradiction may stem from the idea that knowledge of female technopreneur role models alone is insufficient to make female tech students view technopreneurship as an appealing path or to shift their entrepreneurial intentions. Technopreneurship may still be seen as undesirable or unattractive to female tech students in South Africa, especially those from disadvantaged backgrounds, who may prefer the security of a steady pay cheque through employment options after completing their studies.

The research findings on hypothesis 3a are supported by a South African study by Malebana and Mothibi (2023), which found that entrepreneurial role models have no significant effect on entrepreneurial intention and its antecedents. Furthermore, BarNir et al. (2011, pp. 283-284) also found that entrepreneurial role models have low explanatory power on entrepreneurial intention and its antecedents (attitude, subjective norms, and perceived behavioural control). This shows that the knowledge of female role models should not be the only intervention to increase technopreneurial intentions among female technology students in South Africa.

The findings fail to support the initial Hypothesis 3a that female technopreneur role models have a positive influence on technopreneurial intention mediated by attitude towards technopreneurship. It can be concluded that female technopreneur role models do not significantly influence female tech students to start their tech businesses. Therefore, more research may be needed to gather enough evidence to support the theory and hypothesis.

The practical implications suggested by the findings of Hypothesis 3a are that the interventions to increase technopreneurial intention may not solely emphasise the increase in the knowledge of female technopreneur role models but also perhaps add more holistic interventions that increase the career's desirability and career security.

Hypothesis 3b ('H3b') reads as follows: 'Female technopreneur role models positively influence technopreneurial intentions through technopreneurial self-efficacy among female technology students in South Africa'

The results show that the relationship between the knowledge of female technopreneur role models and technopreneurial self-efficacy is positive and weak but significant. An increase in the knowledge of female technopreneur role models increases technopreneurial self-efficacy by 25.8%. This means that the knowledge of role models positively shifts an individual's technopreneurial self-efficacy. This may be due to the view that positive vicarious experiences, through role modelling, can enhance an individual's self-efficacy (Bandura, 1977). This can happen when an individual observes positive outcomes from a female technopreneur role model, and the experience shifts their confidence in their abilities to start a new tech business (Bandura, 1977). The finding aligns with Bandura's Social Cognitive

Theory pertaining to the influence of role models on shaping entrepreneurial self-efficacy. These findings lend support to findings in previous research studies, including Fellenhofer (2017), who found that role models increase an individual's self-efficacy through storytelling and entrepreneurship education. Additionally, Laviolette et al. (2012) found that role models favourably impact self-efficacy if students identify with the role models. Considering that once an individual's technopreneurial self-efficacy is increased, the increase in self-efficacy will not lead to a shift in technopreneurial intention, there will be a need to further research the best ways of increasing technopreneurial intentions.

The mediation results in Hypothesis 3b (Model 2) show that there is a positive relationship between the knowledge of female technopreneur role models and technopreneurial intention but not mediated by technopreneurial self-efficacy among female technology students in South Africa. The results show that the total level of influence that female technopreneur role models have on technopreneurial intention is 8.14%, which is statistically not significant. This means that the knowledge of female technopreneur role models does not play a significant role in increasing technopreneurial intentions among female technology students in South Africa. The relationship between the knowledge of female role models and technopreneurial self-efficacy is there; however, there was not enough evidence to support the relationship between knowledge of female technopreneur role models and technopreneurial intention as mediated by technopreneurial self-efficacy.

The findings of Hypothesis 3b failed to support previous studies that found that self-efficacy mediated the relationship between role model exposure and entrepreneurial intentions (Austin & Nauta, 2015; Lent et al., 1994; BarNir et al., 2011; Laviolette et al., 2012; Murari & Pathak, 2021). On the other hand, a study that supported the findings of this study is by Bechtold and Huber (2018), whose findings showed that exposure to female role models boosted entrepreneurial self-efficacy among students. However, the influence on entrepreneurial intentions was less pronounced.

The findings may be influenced by the South African entrepreneurial context, where historical factors have led many businesses to be created out of necessity rather than driven by innovation (OC&C Strategy Consultants, 2018). This suggests that knowledge of and exposure to female technopreneur role models may not be enough to foster technopreneurial intention, even when technopreneurial self-efficacy is high. Other environmental factors—such as a student being the sole breadwinner in their family, being the first to receive a formal education, high initial costs associated with starting a tech business, and the perceived risks for previously disadvantaged individuals—may present significant barriers to the intention to start a new tech business (Opinion, 2023).

This finding fails to support the initial Hypothesis 3b that female technopreneur role models have a positive influence on technopreneurial intention as mediated by technopreneurial self-efficacy among female technology students in South Africa. It can be concluded that female technopreneur role models do not significantly influence female tech students to start their tech businesses; however, they certainly increase a potential technopreneur's self-efficacy.

The practical implications suggested by the findings of Hypothesis 3b are that there needs to be a more holistic approach that considers environmental factors to shift technopreneurial intentions among female technology students apart in addition to female technopreneur role models.

5.3.4 Normative Dimensions on Technopreneurial Intention

Hypothesis 4 ('H4') read as follows: 'Positive perceptions of the normative institutional environment have a positive effect on technopreneurial intentions as mediated by attitude towards technopreneurship (H4a) and subjective norms: knowledge of female role models (H4b)' among South African female tech students.

The objective of H4 was to investigate the effect of the positive perception of the normative institutional environment on technopreneurial intention as mediated by attitude towards technopreneurship and subjective norms: knowledge of female role models. A literature review was done to hypothesise the relationship between the positive perception of the normative institutional environment and technopreneurial intention. It was hypothesised to be a positive effect of the perception of the normative institutional dimension on technopreneurial intention as mediated by attitudes towards technopreneurship and knowledge of female technopreneur role models. The female technology students were then surveyed on a 7-point Likert scale, where they were asked questions on their perception of the normative institutional environment, including questions like ‘’People in this region tend to admire those who start their own technology business greatly’’ and ‘Tech entrepreneurs are admired in this region’. This data was then analysed using hierarchical multiple regression analysis and mediation analysis to assess the results of the hypothesised relationship.

Hypothesis 4a (‘H4a’) read as follows: ‘Positive perceptions of the Normative institutional environment have a positive effect on technopreneurial intention as mediated by attitude towards technopreneurship’ among female technology students in South Africa.

The results show that the effect that positive perception of the normative institutional dimension has on attitude towards technopreneurship is weak, positive, and statistically not significant. These findings indicate that positive perceptions of the social norms around tech entrepreneurship in the South African region increase the individual’s attitude towards technopreneurship by only 12.68%. Previous studies supported the findings of a positive effect that positive perceptions of the normative institutional dimension have on attitudes towards technopreneurship, including Monteiro et al. (2021) and Aloulou (2021). It stands to reason that when societal attitudes toward technopreneurship, risk, and innovation are positive, individuals within that society are likely to share a similarly positive outlook on tech entrepreneurship. These findings confirm this; however, there was not enough evidence to confirm the significant effect of the positive perception of the normative dimension on attitude towards technopreneurship.

The mediation results in Hypothesis 4a (Model 3) reveal a very weak, positive effect of positive perceptions of normative institutional dimensions on technopreneurial intention. Specifically, positive perceptions of normative institutional dimensions show an 8.32% effect

on technopreneurial intention, although this influence is statistically not significant. Furthermore, the attitude towards technopreneurship did not mediate this relationship. This may be due to the notion that positive perceptions of institutional dimensions alone are insufficient to make the career appealing or to influence technopreneurial intentions. Further exploration could focus on the influence of the regulative and cognitive dimensions on technopreneurial intention.

The findings for Hypothesis 4a diverge from previous research by Monteiro et al. (2021) and Aloulou (2021), both of which demonstrated that institutional dimensions have a positive effect on entrepreneurial intention, with the relationship being fully mediated by perceived desirability (i.e., attitude towards entrepreneurship). These divergent results may stem from the fact that the study used the Theory of Planned Behaviour to hypothesise the claim versus using Shapero's Entrepreneurial Event theory, which speaks mainly to perceived desirability, not attitude, towards entrepreneurship (Krueger, 1993; Shapero & Sokol, 1982). What is also evident is that entrepreneurial intention and technopreneurial intention are different, and therefore, the inference of entrepreneurial concepts versus technopreneurial concepts to hypothesise for this study may output different results.

This finding fails to support the initial Hypothesis 4a, which stated that positive perceptions of normative institutional dimensions have a positive effect on technopreneurial intention among female technology students in South Africa as mediated by attitude towards technopreneurship. The sample in this study may have been too small to output statistically significant results; therefore, further research using a bigger sample size may be helpful in providing sufficient evidence for statistical significance.

The practical implications of Hypothesis 4a suggest that further research is needed, perhaps employing different theories like the SEE theory to hypothesise, test the outcomes, and compare them to the studies that employed the TPB theory. This would ensure diversity of research theory insights and results. It is also clear that there is limited research and few articles on technopreneurial intentions available for comparison. Therefore, to effectively expand technopreneurial intentions in South Africa and in general, more research in

this area is needed. Additionally, exploring the effects of the regulative and cognitive dimensions on technopreneurial intention could provide valuable insights not covered in this study.

Hypothesis 4b ('H4b') reads as follows: 'Positive perceptions of the Normative institutional environment have a positive effect on technopreneurial intentions as mediated by subjective norms: knowledge of female technopreneur role models among female technology students in South Africa

The results show the effect that positive perception of the normative institutional dimension has on subjective norms: knowledge of female role models is strong, positive, and statistically significant. These findings indicate that positive perceptions of normative institutional dimensions have a positive effect of 51.51% on the knowledge of female technopreneur role models among South African female tech students. This means that the positive perception of the social norms around technopreneurship increases the chances of knowing more female technopreneur role models among female tech students in South Africa. This may be directly attributed to the promotion of female role models; sharing success stories in the local region increases the knowledge of this female technopreneur role by 51.51%. These findings tell us to focus more on creating a positive normative institutional dimension in the South African region in order to increase the knowledge of female technopreneur role models. This is quite aligned with previous studies that suggested that role models need to be celebrated more in the media, in books, and in education in South Africa for visibility and representation as role models (GEM, 2022; Chabalala, 2020; Toesland, 2018).

The results indicate that while subjective norms, particularly the knowledge of female role models, account for a 51.51% effect on normative perceptions, the effect of normative dimensions on technopreneurial intention remains positive, very weak, and statistically not significant. Specifically, the mediation analysis in Hypothesis H4b (Model 3) shows a 9.78% positive effect of normative institutional dimensions on technopreneurial intention, though this influence lacks statistical significance. Additionally, the knowledge of female role models did not mediate the effect of positive perceptions of normative dimensions on technopreneurial intention. These

findings align with Urban's (2013) observation that positive perceptions of various institutional profiles correlate positively but not significantly with entrepreneurial intentions.

These findings contrast with Monteiro et al. (2021), which found that positive perceptions of normative institutional dimensions significantly affect subjective norms and, in turn, positively affect entrepreneurial intentions. This may be attributed to the fact that Monteiro et al. (2021) used a different measure for subjective norms, whilst the current study focused specifically on the knowledge of female technopreneur role models as part of subjective norms, therefore outputting different results. An interesting aspect of normative institutional dimensions and subjective norms is that the unique South African context may have hindered the translation of normative perceptions into actionable technopreneurial intentions, unlike in other study contexts.

Ultimately, these findings do not support Hypothesis 4b, which proposed that positive perceptions of normative institutional dimensions positively affect technopreneurial intentions when mediated by knowledge of female role models. It can be concluded that while positive perceptions of normative dimensions can increase awareness of female technopreneurs, they do not necessarily drive technopreneurial intentions.

The practical implications of Hypothesis 4b highlight the need for further research on institutional dimensions and technopreneurship in South Africa, as limited academic material exists to contextualise and compare findings. Additionally, it is crucial to foster a positive local environment that values risk, innovation, and technopreneurship. Promoting female role models in the field can enhance the exposure and knowledge of tech students in South Africa, encouraging more excellent technopreneurial intentions.

5.4 Conclusion

The chapter provided a comprehensive discussion of the research findings regarding the factors that influenced the technopreneurial intentions of female technology students in South Africa. It connected the empirical findings presented in Chapter 4 with existing theoretical frameworks to enhance understanding and relate the outcomes to current knowledge.

The demographic profile of the study participants primarily included individuals from Gauteng province (75.5%) and Black ethnicity (91.2%), which represented the broader population in South Africa, ensuring the generalizability of the findings within the South African context. However, the limited representation from other provinces and ethnicities posed a limitation for future research.

The chapter systematically addressed each hypothesis, comparing empirical results with theoretical predictions.

Hypothesis 1 posited that a positive attitude toward technopreneurship would positively influence technopreneurial intention, and the findings strongly supported this. The researchers found a strong positive relationship, with the attitude toward technopreneurship accounting for 77.4% of the variance in intention. This aligned with the Theory of Planned Behaviour, which suggested that intentions are shaped by attitudes toward the behaviour. The findings indicated that interventions aimed at increasing the desirability of technopreneurship were crucial for boosting entrepreneurial aspirations.

In contrast, Hypothesis 2 suggested that technopreneurial self-efficacy would significantly influence technopreneurial intention, but the findings did not support this. Although technopreneurial self-efficacy demonstrated a positive relationship with technopreneurial intention, it did not significantly influence it. This contradicted the Social Cognitive Theory, which posited a strong predictive relationship between self-efficacy and intention. While previous studies showed a significant role in self-efficacy, the lack of significance in this study suggested that confidence in one's abilities alone might not drive technopreneurial intentions. The complex

interplay of practical requirements, technological knowledge, and specialized skills may have influenced the translation of self-efficacy into intention and action.

The investigation of the influence of female technopreneur role models on technopreneurial intention revealed that the findings did not support Hypothesis 3. While knowledge of role models positively and significantly affected technopreneurial self-efficacy, supporting the Social Cognitive Theory's emphasis on vicarious learning, it did not significantly influence technopreneurial intention, contradicting Hypotheses 3a and 3b. This highlighted the multifaceted nature of role modelling, where exposure alone may not suffice to overcome the perceived challenges and risks associated with technopreneurship, particularly in the context of South Africa.

Lastly, Hypothesis 4, which explored the effects of the perception of the normative institutional environment on technopreneurial intention, was also not supported. While positive perceptions positively influenced knowledge of female technopreneur role models, they did not significantly affect technopreneurial intention, contradicting Hypotheses 4a and 4b. This suggested that, while societal support and positive norms are important, they may not directly translate into increased entrepreneurial activity, especially in a context shaped by historical factors and socioeconomic realities.

In conclusion, this chapter underscored the importance of a holistic approach to promoting female technopreneurship in South Africa. Interventions are needed to address attitudinal factors as well as the practical barriers, contextual challenges, and risk perceptions that influence technopreneurial intentions. Future research should prioritize exploring these contextual factors to develop targeted and effective strategies for fostering female entrepreneurship in the technology sector.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter will focus on concluding the study's findings. It will start with an overview of the study and its main objectives, the process followed to collect and analyse data, and the findings based on the literature. Then, it will discuss the findings of this study in relation to answering the research questions. This will be followed by recommendations for policymakers, educators, and program creators drawn from the findings. Lastly, the chapter will conclude with suggestions for areas of future research.

6.2 Conclusions of the study

The 21st century witnessed a surge in technological advancements that revolutionized how people worked, lived, ate, and connected. This transformation created numerous opportunities for potential entrepreneurs; however, technopreneurship remained predominantly a men's domain, with men primarily founding tech businesses. Although women entered the technopreneurship space, they mostly gravitated toward wholesale and retail sectors, missing out on the substantial profit margins that innovative tech businesses offered for wealth generation and societal impact. This situation highlighted a gender gap in the technopreneurship arena, where women founded only 13.6% of South African tech start-ups compared to 86.4% by men (Disrupt Africa, 2023, p.16). The lack of representation and visibility of female technopreneur role models exacerbated this issue. To address this gap, the GEM Women's Entrepreneurship Report (2022) recommended celebrating female role models to inspire potential technopreneurs to engage in the field. Drawing on similar suggestions from previous literature, the primary objective of this research study was to investigate how female tech entrepreneurs as role models influenced the technopreneurial intentions of female students in South Africa.

The study employed the Theory of Planned Behaviour, Social Cognitive Theory, and Institutional Theory to hypothesize the relationship between female technopreneur role models and technopreneurial intention among female technology students in South Africa. The Theory of Planned Behaviour predicted the level of technopreneurial intention among female tech students, modifying the antecedent attitude to fit the technopreneurship context. The literature consistently demonstrated that attitude toward technopreneurship positively influenced technopreneurial intentions, forming the basis for Hypothesis 1.

Social Cognitive Theory explains how individuals learn behaviours within a social context. The concept of technopreneurial self-efficacy was adapted to illustrate how it shaped technopreneurial intentions. Literature findings confirmed that technopreneurial self-efficacy positively influenced technopreneurial intention, leading to the formulation of Hypothesis 2. The study utilized a modified version of subjective norms, framed as knowledge of female technopreneur role models. Literature indicated that subjective norms influenced intention when mediated by attitudes and self-efficacy, which formed the basis for Hypothesis 3.

Institutional Theory elucidates how individuals' behaviour is influenced by their institutional environment. To incorporate an environmental perspective, this study introduced normative institutional dimensions that highlighted unique South African societal norms. Literature findings suggested that these normative institutional dimensions influenced intentions, mediated by subjective norms and attitudes, establishing the foundation for Hypothesis 4.

Using regression analysis to test the predictability of technopreneurial intention, the empirical results supported Hypothesis 1, confirming that attitude toward technopreneurship positively influenced technopreneurial intentions among female technology students in South Africa. This finding was significant because enhancing female students' attitudes toward tech entrepreneurship could motivate them to pursue tech business ventures. Previous research corroborated this outcome (Laviolette et al., 2012; Urban & Chantson, 2018; Malebana & Swanepoel, 2015).

Empirical results for Hypothesis 2 did not support the hypothesis, concluding that technopreneurial self-efficacy did not significantly influence technopreneurial intention. The statistical insignificance indicated that the sample size was too small to provide sufficient evidence in support of the hypothesis. This finding presented a unique perspective within the technopreneurship context in South Africa, contradicting claims of Social Cognitive Theory regarding the positive influence of self-efficacy on intentions.

Similarly, the results for Hypothesis 3 did not support the hypothesis, indicating that knowledge of female technopreneur role models did not significantly influence technopreneurial intention as mediated by attitudes toward technopreneurship and self-efficacy. However, this knowledge did positively influence an aspiring female technopreneur's self-efficacy. The minimal and statistically insignificant influence of female technopreneur role models on shifting technopreneurial intention among female technology students in South Africa aligned with findings from previous studies (Malebana & Mothibi, 2023; Bechtold & Huber, 2018). Thus, the role model recommendation for addressing the gender gap in technopreneurship within the South African context appeared to have minimal effect on shifting intentions but significantly boosted individual confidence in starting a tech business.

Additionally, the demographic variables of the respondents, predominantly Black and from Gauteng province, did not influence the predictability of technopreneurial intentions among female tech students in South Africa. The empirical results for Hypothesis 4 also did not support the hypothesis, concluding that positive perceptions of South Africa's societal norms regarding tech entrepreneurship did not significantly impact technopreneurial intentions among female technology students. However, these positive perceptions did enhance knowledge of female technopreneur role models among female tech students in South Africa.

The findings of this study provided new insights into the well-known quote, "You have everything you need inside of you to create anything in your life that you desire" (Basevic, 2013). Each aspiring female technopreneur possessed the internal capacity to cultivate a positive attitude toward technopreneurship, driving their intention to start a tech business. The results suggested that external factors—

such as exposure to female technopreneur role models or positive perceptions of the technopreneurial environment—did not significantly influence these intentions. This indicated that intrinsic motivation primarily drove technopreneurial intentions.

6.3 Recommendations

Advancing women's economic participation represented a critical priority, aligning with the goals of South Africa's National Policy Framework for Women's Empowerment and Gender Equality (2002). Increasing women's technopreneurial intentions involved a broader discussion influenced by more factors than those addressed in this study. Consequently, based on the findings, the study proffers the following recommendations for policymakers, educators, and program designers:

- The positive attitude toward tech entrepreneurship indicated that efforts should focus on making technopreneurship more appealing to women. This could boost their intentions to start new tech ventures. Strategies may include mentorship programs, case studies, workshops, tech entrepreneurship courses, soft-skills development, events and conferences, and campaigns to challenge stereotypes.
- **Holistic Approach**: The findings suggested that the knowledge of female technopreneur role models alone did not significantly shift technopreneurial intentions. A more holistic approach was necessary to promote female technopreneurship, which included addressing practical barriers such as funding, mentorship, and networking opportunities for female tech students in South Africa.
- The results showed that knowledge of female technopreneur role models positively influenced self-efficacy. Therefore, celebrating and promoting these role models could effectively increase the self-confidence of aspiring female technopreneurs. Programs aimed specifically at boosting self-confidence would benefit from the insights gained in this research.
- **Fostering Positive Normative Institutions**: While fostering positive normative institutions for female technopreneurship might not directly change technopreneurial intentions, combining these efforts with positive regional perceptions could establish a supportive culture. This could involve highlighting success stories of female technopreneurs, creating alumni networks, and facilitating community dialogues. Additionally, integrating technopreneurship modules into the education system, developing

incentive programs for funding or scholarships for tech students, and actively promoting technopreneurship on popular youth platforms like TikTok, Instagram, Facebook, and YouTube would further strengthen these initiatives

6.4 Suggestions for Further Research

Demographic results revealed a limited survey response from the rest of the South African provinces and other races representative of South Africa. Therefore, this limitation could be addressed in further research on female technopreneurship intentions in South Africa among female technology students. Future research can explore different genders, ethnicities, and neglected provinces in South Africa like the North West, Northern Cape, and Free State.

Empirical results suggest that further research is needed. To predict technopreneurial intention, different theories, like Shapero's Entrepreneurial Event theory, should be employed to hypothesise and test the outcomes if they differ from outcomes where the Theory of Planned Behaviour was employed. This would ensure a diversity of research theory insights and results.

It is also clear that limited research and few articles on technopreneurial intentions are available for comparison. Therefore, to effectively expand technopreneurial intentions in general, more research in this area is needed in South Africa.

Additionally, exploring the effects of the regulative and cognitive dimensions on technopreneurial intention could provide valuable insights not covered in this study.

What was also clear from this study was the limitation of the small sample size, which contributed to the statistically significant results. Therefore, the call would be to replicate the study but with a bigger sample size than 147 to have enough evidence to support the hypotheses.

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APPENDIX A: EMAIL COVER LETTER AND INFORMATION SHEET



COVER LETTER AND INFORMATION SHEET

Dear Student

I am Nokukhanya Ngoma, a student at Wits Business School enrolled for a Master of Management degree in Entrepreneurship and New Venture Creation.

I am researching **female technopreneur role models and technopreneurial intentions among female technology students in South Africa**. This research study aims to investigate the influence that female tech entrepreneurs as role models have on the technopreneurial intentions of female technology students in South Africa.

I would like to **request you to participate by completing this survey**. Please note that participation is **voluntary** and therefore you may choose to participate or opt-out. There are no risks associated with your participation in the survey besides taking 10 -15 minutes of your time. In terms of benefits, the research results will help share knowledge of how to encourage more female tech entrepreneurs in South Africa. Your participation will be kept **anonymous** and no personal identification details will be requested from you.

It should take approximately **10 - 15 minutes to complete**. Please note that the data will be used for **research purposes only** and remain strictly **confidential**. If you are willing to participate, the survey will remain open for the next four weeks.

If you are willing to participate you can click on the link below which will take you to the questionnaire.

https://wits.eu.qualtrics.com/jfe/form/SV_cAOw7D4EDVMXjtY

Please feel free to contact me or my supervisor if you have any concerns or questions

Nokukhanya Ngoma (Student) 084 414 8694
2359817@students.wits.ac.za

Prof Boris Urban (Supervisor) 011 717-3762
Boris.Urban@wits.ac.za

Thank you in advance!

Yours sincerely
Nokukhanya Ngoma
Wits Business School
University of Witwatersrand

APPENDIX B: RESEARCH INSTRUMENT

Title: Female technopreneur role models and technopreneurial intentions among South African female technology students

Survey Flow

Standard: Welcome!!!!!!!!!!!!!!!!!!!!!!!!!! (1 Question)

Standard: CONSENT (1 Question)

Standard: Section A: Demographics (6 Questions)

Standard: Section B: Female Technology Role Models (6 Questions)

Standard: Section C: Technopreneurial Intentions (7 Questions)

Standard: Section D: Technopreneurial Self-Efficacy (4 Questions)

Standard: Section E: Attitude Towards Technopreneurship (7 Questions)

Standard: Section F: Your perception of the Normative Dimension (6 Questions)

Page Break

Start of Block: Welcome!!!!!!!!!!!!!!!!!!!!!!!!!!

Dear Participant Aim: The objective of this study is to investigate the influence that female tech entrepreneurs as role models have on the technopreneurial intentions of female technology students in South Africa. Definition: Technopreneurial intention refers to the willingness to start a technology-based business. Important: This survey requires completion from female participants and should not take more than 10-15 minutes of your time. Thank you for answering all the questions honestly.

End of Block: Welcome!!!!!!!!!!!!!!!!!!!!!!!!!!

Start of Block: CONSENT

Please confirm your consent to participate in this research study

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If QID37 = No

End of Block: CONSENT

Start of Block: Section A: Demographics

DESCRIPTION SECTION A: BACKGROUND INFORMATION This section is asking for your background information therefore please answer by selecting the relevant choice. Please note that the questions are strictly for research purposes only.

Please indicate your gender

- ○ Female (1)
- ○ Male (2)
- ○ Non-binary / third gender (3)
- ○ Prefer not to say (4)

Skip To: End of Survey If QID24 = Male

Skip To: End of Survey If QID24 = Non-binary / third gender

Skip To: End of Survey If QID24 = Prefer not to say

Please confirm that you are a technology/coding student

- Yes (1)
- No (2)

Skip To: End of Survey If QID27 = No

Please confirm your self-employment status by selecting the correct option

- I am self-employed in Tech (1)
- I am not self-employed in Tech (2)

Skip To: End of Survey If QID36 = I am self-employed in Tech

Please indicate your province

- ○ Gauteng (1)
- ○ Mpumalanga (2)
- ○ North West (3)
- ○ Limpopo (4)
- ○ Free State (5)
- ○ Eastern Cape (6)
- ○ Northern Cape (7)
- ○ Western Cape (8)
- ○ Kwazulu Natal (9)

Please indicate your ethnic background

- ○ Black (1)
- ○ Coloured (2)
- ○ White (3)
- ○ Indian (4)
- ○ Asian (5)
- ○ Prefer not to say (6)

End of Block: Section A: Demographics

Start of Block: Section B: Female Technology Role Models

DESCRIPTION SECTION B: FEMALE TECH ENTREPRENEURS AS ROLE MODELS Please indicate your level of agreement with the following statements:

1. There is a female tech entrepreneur I am trying to be like in my career pursuits.

- Strongly disagree (1)
- Disagree (2)
- Somewhat disagree (3)
- Neither agree nor disagree (4)
- Somewhat agree (5)
- Agree (6)
- Strongly agree (7)

2. There is a female tech entrepreneurial person particularly inspirational to me in my career path.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

3. In the career path I am pursuing, there is a female tech entrepreneurial person that I admire.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

4. I have a female mentor in my potential tech entrepreneurial career field.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

5. I know a female tech entrepreneur who has a career I would like to pursue.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

End of Block: Section B: Female Technology Role Models

Start of Block: Section C: Technopreneurial Intentions

SECTION C: TECHNOPRENEURIAL INTENTIONS Please indicate your level of agreement with the following statements:

6. I am ready to do anything to be a technopreneur.

- ○ Strongly agree (8)
- ○ Agree (9)
- ○ Somewhat agree (10)
- ○ Neither agree nor disagree (11)
- ○ Somewhat disagree (12)
- ○ Disagree (13)
- ○ Strongly disagree (14)

7. My professional goal is to become a technopreneur.

- ○ Strongly agree (8)
- ○ Agree (9)
- ○ Somewhat agree (10)
- ○ Neither agree nor disagree (11)
- ○ Somewhat disagree (12)
- ○ Disagree (13)
- ○ Strongly disagree (14)

8. I will make every effort to start and run my own technology-based firm.

- ○ Strongly agree (15)
- ○ Agree (16)
- ○ Somewhat agree (17)
- ○ Neither agree nor disagree (18)
- ○ Somewhat disagree (19)
- ○ Disagree (20)
- ○ Strongly disagree (21)

9. I am determined to create a technology-based firm in the future.

- ○ Strongly agree (16)
- ○ Agree (17)
- ○ Somewhat agree (18)
- ○ Neither agree nor disagree (19)
- ○ Somewhat disagree (20)
- ○ Disagree (21)
- ○ Strongly disagree (22)

10. I have very seriously thought of starting a technology-based firm.

- ○ Strongly agree (20)
- ○ Agree (21)
- ○ Somewhat agree (22)
- ○ Neither agree nor disagree (23)
- ○ Somewhat disagree (24)
- ○ Disagree (25)
- ○ Strongly disagree (26)

11. I have the firm intention to start a technology-based firm someday.

- ○ Strongly agree (17)
- ○ Agree (18)
- ○ Somewhat agree (19)
- ○ Neither agree nor disagree (20)
- ○ Somewhat disagree (21)
- ○ Disagree (22)
- ○ Strongly disagree (23)

End of Block: Section C: Technopreneurial Intentions

Start of Block: Section D: Technopreneurial Self-Efficacy

SECTION D: TECHNOPRENEURIAL SELF-EFFICACY Please indicate your level of agreement with the following statements:

12. I have confidence in my ability to: Identify the need for a new tech product.

- ○ Strongly disagree (13)
- ○ Disagree (14)
- ○ Somewhat disagree (15)
- ○ Neither agree nor disagree (16)
- ○ Somewhat agree (17)
- ○ Agree (18)
- ○ Strongly agree (19)

13. I have confidence in my ability to: Brainstorm and come up with a new idea for a tech product or service.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

14. I have confidence in my ability to: Design a new product or service that would satisfy the customer's needs or wants.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Somewhat disagree (3)
- ○ Neither agree nor disagree (4)
- ○ Somewhat agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

End of Block: Section D: Technopreneurial Self-Efficacy

Start of Block: Section E: Attitude Towards Technopreneurship

SECTION E: ATTITUDE TOWARDS TECHNOPRENEURSHIP Please indicate your level of agreement with the following statements:

15. Being a tech entrepreneur implies more advantages than disadvantages to me.

- ○ Strongly agree (13)
- ○ Agree (14)
- ○ Somewhat agree (15)
- ○ Neither agree nor disagree (16)
- ○ Somewhat disagree (17)
- ○ Disagree (18)
- ○ Strongly disagree (19)

16. A career as a tech entrepreneur is totally attractive to me.

- ○ Strongly agree (13)
- ○ Agree (14)
- ○ Somewhat agree (15)
- ○ Neither agree nor disagree (16)
- ○ Somewhat disagree (17)
- ○ Disagree (18)
- ○ Strongly disagree (19)

17. If I had the opportunity and resources, I'd like to start a tech business.

- ○ Strongly agree (8)
- ○ Agree (9)
- ○ Somewhat agree (10)
- ○ Neither agree nor disagree (11)
- ○ Somewhat disagree (12)
- ○ Disagree (13)
- ○ Strongly disagree (14)

18. Amongst various options, I would rather be a tech entrepreneur.

- ○ Strongly agree (8)
- ○ Agree (9)
- ○ Somewhat agree (10)
- ○ Neither agree nor disagree (11)
- ○ Somewhat disagree (12)
- ○ Disagree (13)
- ○ Strongly disagree (14)

19. Being a tech entrepreneur would give me great satisfaction.

- ○ Strongly agree (8)
- ○ Agree (9)
- ○ Somewhat agree (10)
- ○ Neither agree nor disagree (11)
- ○ Somewhat disagree (12)
- ○ Disagree (13)
- ○ Strongly disagree (14)

20. My qualification has contributed positively to my attitude towards becoming a tech entrepreneur.

- ○ Strongly agree (13)
- ○ Agree (14)
- ○ Somewhat agree (15)
- ○ Neither agree nor disagree (16)
- ○ Somewhat disagree (17)
- ○ Disagree (18)
- ○ Strongly disagree (19)

End of Block: Section E: Attitude Towards Technopreneurship

Start of Block: Section F: Your perception of the Normative Dimension

SECTION F: YOUR PERCEPTION OF THE NORMATIVE DIMENSION Please indicate your level of agreement with the following statements:

21. In this region, innovative and creative thinking is viewed as the route to success.

- ○ Strongly disagree (25)
- ○ Disagree (26)
- ○ Somewhat disagree (27)
- ○ Neither agree nor disagree (28)
- ○ Somewhat agree (29)
- ○ Agree (30)
- ○ Strongly agree (31)

22. Tech entrepreneurs are admired in this region.

- ○ Strongly disagree (21)
- ○ Disagree (22)
- ○ Somewhat disagree (23)
- ○ Neither agree nor disagree (24)
- ○ Somewhat agree (25)
- ○ Agree (26)
- ○ Strongly agree (27)

23. People in this region tend to greatly admire those who start their own technology business.

- ○ Strongly disagree (24)
- ○ Disagree (25)
- ○ Somewhat disagree (26)
- ○ Neither agree nor disagree (27)
- ○ Somewhat agree (28)
- ○ Agree (29)
- ○ Strongly agree (30)

24. Turning new ideas into tech businesses is an admired career path in this region.

- ○ Strongly disagree (23)
- ○ Disagree (24)
- ○ Somewhat disagree (25)
- ○ Neither agree nor disagree (26)
- ○ Somewhat agree (27)
- ○ Agree (28)
- ○ Strongly agree (29)

25. In your region, you often come across success stories of tech entrepreneurs in public media.

- ○ Strongly disagree (23)
- ○ Disagree (24)
- ○ Somewhat disagree (25)
- ○ Neither agree nor disagree (26)
- ○ Somewhat agree (27)
- ○ Agree (28)
- ○ Strongly agree (29)

End of Block: Section F: Your perception of the Normative Dimension

APPENDIX C: LETTER REQUESTING PERMISSION FROM WETHINKCODE



University of the Witwatersrand

Wits Business School

Chris McCully

WeThinkCode

132 Jan Smuts Ave,

Parkwood,

Johannesburg, 2193

Dear Mr McCully

Subject: Request for Permission to Conduct Research at WeThinkCode

I hope this email finds you well. My name is Nokukhanya Ngoma, and I am studying for a Master of Management in Entrepreneurship and New Venture Creation at Wits Business School, University of the Witwatersrand. I am writing to request permission to conduct research at WeThinkCode, as part of my Master's Thesis.

My research focuses on the influence of female technopreneur role models on the technopreneurial intentions of female technology students in South Africa. I believe WeThinkCode is an ideal setting for this study due to the following reasons:

- **Diverse Population:** The diversity of female students at WeThinkCode represents a broad spectrum of technology students across South Africa.
- **Skill Development:** Students at WeThinkCode are actively gaining valuable technology skills, which aligns closely with the concept of becoming a tech founder.

The research will involve distributing an online questionnaire to your female students, which will take approximately 15 minutes to complete. The survey will remain open for a month to gather as many responses as possible.

Participants will be asked to give their consent before participating. Their responses will be treated confidentially, and identities (their names and the name of the organisation) will be anonymous. Individual privacy will be maintained in all published and written data resulting from the study.

The results will be communicated through the research report, and this will be available at the Wits Business School library.

The research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their permission at any time during this project without any penalty. There are no foreseeable risks in participating in this study. The participants will not be paid for this study.

All research data will be used only for the purposes stated above.

I kindly request your permission to proceed with this research. If granted, could you please provide a **written permission letter** on **WeThinkCode's letterhead**, **signed and dated**, specifically **referring to me by name (Nokukhanya Ngoma)** and the **title of my study (Female Technopreneur Role Models and Technopreneurial Intentions among South African Female Technology Students**). The letter should also confirm **permission to distribute the survey to all WeThinkCode female students in 2024, starting September 2024.**

Please let me know if you require any further information. I look forward to your response.

Yours sincerely,

Nokukhanya Ngoma
084 414 8694
2359817@students.wits.ac.za

Prof Boris Urban

011 717 3762

Boris.Urban@wits.ac.za

APPENDIX D: LETTER REQUESTING PERMISSION FROM GIRLCODE



University of the Witwatersrand

Wits Business School

Faith Kuhlase

GirlCode

676 on Gallagher,

Gallagher Ave, Midrand

Dear Faith

Subject: Request for Permission to Conduct Research at GirlCode

I hope this email finds you well. My name is Nokukhanya Ngoma, and I am studying for a Master of Management in Entrepreneurship and New Venture Creation at Wits Business School, University of the Witwatersrand. I am writing to request permission to conduct research at GirlCode, as part of my Master's Thesis.

My research focuses on the influence of female technopreneur role models on the technopreneurial intentions of female technology students in South Africa. I believe GirlCode is an ideal setting for this study due to the following reasons:

- **Founded by a Woman:** As a female-founded organisation, GirlCode provides a relatable context for participants, who can easily identify with inspirational women tech founders.
- **Diverse Population:** The diversity of female students at GirlCode represents a broad spectrum of technology students across South Africa.
- **Skill Development:** Students at GirlCode are actively gaining valuable technology skills, which aligns closely with the concept of becoming a tech founder.

The research will involve distributing an online questionnaire to your female students, which will take approximately 15 minutes to complete. The survey will remain open for a month to gather as many responses as possible.

Participants will be asked to give their consent before participating. Their responses will be treated confidentially, and identities (their names and the name of the organisation) will be anonymous. Individual privacy will be maintained in all published and written data resulting from the study.

The results will be communicated through the research report, and this will be available at the Wits Business School library.

The research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their permission at any time during this project without any penalty. There are no foreseeable risks in participating in this study. The participants will not be paid for this study.

All research data will be used only for the purposes stated above.

I kindly request your permission to proceed with this research. If granted, could you please provide a **written permission letter** on **GirlCode's letterhead**, **signed and dated**, specifically **referring to me by name (Nokukhanya Ngoma)** and the **title of my study (Female Technopreneur Role Models and Technopreneurial Intentions among South African Female Technology Students**). The letter should also confirm **permission to distribute the survey to all GirlCode students within the year 2024, starting September 2024.**

Please let me know if you require any further information. I look forward to your response.

Yours sincerely,

Nokukhanya Ngoma
084 414 8694
2359817@students.wits.ac.za

Prof Boris Urban

011 717 3762

Boris.Urban@wits.ac.za

APPENDIX E: ETHICS CLEARANCE CERTIFICATE



Graduate School of Business Administration

University of the Witwatersrand, Johannesburg

Wits Business School Ethics Committee

Constituted under the University Human Research Ethics Committee (Non-Medical)

Ethics Clearance Certificate

Ethics protocol number: WBS/EN2359817/597

This certificate is only valid with a legitimate ethics protocol number and signed by the Researcher (below).

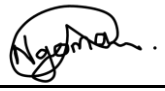
This certificate is only valid if accompanied by formal permission from the relevant stakeholder(s).

Project title	Female technopreneur role models and technopreneurial intentions among South African female technology students
Investigator / Researcher	Miss Nokukhanya Ngoma
Nature of Project	MM in Entrepr & New Venture Creation
Decision of the Committee	Approved, provided stakeholders and participants are guaranteed anonymity and confidentiality.
Issue Date of Certificate	14/08/2024
Expiry date	Date of submission of the project / research report
Chairperson	Dr Ayanda Magida ☎ +27 11 717 3953 ayanda.magida@wits.ac.za

Declaration by Researcher

One copy must be signed by the Researcher and returned to the Chairperson of the Wits Business School Ethics Committee.

I fully understand the conditions under which I am authorized to carry out the abovementioned research and i guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I undertake to resubmit the protocol to the Committee.



Signature

Date: 16/08/2024

APPENDIX F: PERMISSION LETTER FROM WETHINKCODE



We Think Code NPC

WeThinkCode_ Training Academy

Nokukhanya Ngoma

2 St Davids Pl &, St Andrew Rd,

Parktown,

Johannesburg,

2193

Subject: Permission to Conduct Research at WeThinkCode_

Dear Ms. Nokukhanya,

We are pleased to grant you permission to conduct research at WeThinkCode_ in support of your study on the influence of female technopreneur role models on the technopreneurial intentions of female technology students in South Africa.

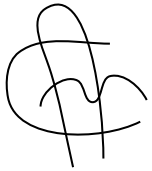
We believe that WeThinkCode_ offers a unique and diverse population of female students who represent a broad spectrum of technology learners across the country. The skill development our students engage in aligns closely with the objectives of your research, particularly in fostering the potential for them to become tech founders.

STRICTLY PRIVATE & CONFIDENTIAL
We Think Code Holdings NPC
Reg. No. 2015/147088/08
Managing Director: Nyaradzai Samushonga

We consent to your distribution of an online questionnaire to female students across WeThinkCode_ campuses, starting in September 2024, provided that the students willingly consent to participate in answering the questions.

Please feel free to reach out if you need any further information or assistance.

Yours sincerely,



Christopher McCully 079 465 0011

chris@wethinkcode.co.za

3 September 2024

APPENDIX G: PERMISSION LETTER FROM GIRLCODE

GirlCode 676 on Gallagher, Gallagher Ave
Block B, 2nd Floor Halfway House
Midrand
1685

05 September 2024

Nokukhanya Ngoma
2 St Davids Pl &, St Andrew Rd, Parktown,
Johannesburg, 2193

RE: Permission to Conduct Research at GirlCode

Dear Ms. Nokukhanya Ngoma,

We are pleased to grant you permission to conduct research at **GirlCode** in support of your study titled:

Female Technopreneur Role Models and Technopreneurial Intentions Among South African Female Technology Students.

We consent to your distribution of an online questionnaire to female students across GirlCode, starting in **September 2024**, provided that the students willingly consent to participate in answering the questions.

Please feel free to reach out if you need any further information or assistance. Yours sincerely,

Faith Kuhlase

082 589 3024/010 109 3148

faithk@girlcode.co.za

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BBBEE Level 1 Black Female owned organisation