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The Interplay Between ICT Skills, Employability, and Entrepreneurial Intentions Among University Students in South Africa

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Abstract

This study examines the interplay among ICT skills, perceptions of employability, and entrepreneurial intention among university students, focusing on how generic and scarce ICT competencies influence their confidence in employment opportunities and their inclination toward entrepreneurial intentions. Drawing on the Theory of Planned Behaviour, the study explores how digital competencies shape entrepreneurial attitudes, perceived feasibility, and behavioural readiness. A quantitative research approach was adopted, and data were collected using a convenience sampling method from 117 university students enrolled in ICT-related programmes. A reliability analysis, exploratory factor analysis, correlation analysis, regression analysis, and chi-square tests were used to examine the relationships among ICT skills, employability perceptions, and entrepreneurial constructs. Findings reveal that students possess strong generic ICT skills and high self-efficacy, suggesting confidence in their general capabilities and labour market readiness. However, scarce ICT skills were found to be unevenly distributed across departments and campuses, indicating disparities in access to advanced technical training. Regression results show that both generic ICT skills ($\beta = 0.27$, $p < 0.01$) and scarce ICT skills ($\beta = 0.34$, $p < 0.001$) significantly predict employability ($R^2 = 0.29$), while generic ($\beta = 0.29$, $p < 0.01$) and scarce ICT skills ($\beta = 0.46$, $p < 0.001$) significantly influence perceived feasibility ($R^2 = 0.41$). Furthermore, employability ($\beta = 0.31$, $p < 0.01$) and perceived feasibility ($\beta = 0.25$, $p < 0.05$) significantly predict entrepreneurial intention ($R^2 = 0.27$). The results also show strong entrepreneurial desirability among students, yet perceived feasibility remains comparatively low, highlighting a gap between entrepreneurial aspiration and perceived capability. Importantly, advanced ICT competencies strengthen students' confidence in their ability to pursue entrepreneurial activities. The study concludes that strengthening scarce ICT competencies, experiential entrepreneurship education, and industry collaboration within higher education institutions is essential for enhancing graduate employability and entrepreneurial potential in South Africa.

Keywords: ICT skills; employability; entrepreneurial intention; entrepreneurship education; digital competence; higher education

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1. Introduction

The persistent shortage of critical skills has remained a dominant theme in the skills development and labour market discourse in South Africa. High unemployment remains one of the most severe socio-economic challenges, particularly among youth and graduates in South Africa [1,2]. A striking paradox within the South African labour market is the coexistence of graduate unemployment alongside reported shortages of specialised Information and Communication Technology (ICT) skills [3,4]. Universities continue to produce graduates from ICT-related programmes, yet employers frequently report difficulties in recruiting candidates with the required competencies [5]. This contradiction raises important questions regarding the relevance, depth, and alignment of ICT training with industry expectations. The issue is not merely the number of graduates entering the labour market, but the quality, applicability, and industry-readiness of their skills. The mismatch between supply and demand suggests that structural weaknesses exist in higher education curricula, skills development frameworks, and employability preparation mechanisms.

ICT professionals are employed across diverse sectors of the economy, and employers require a complex combination of technical expertise, practical competence, and transferable soft skills [6]. The growing apprehension about the declining pool of technologically competent graduates capable of meeting industry demands highlights the severity of the ICT skills gap [7,8]. The concern extends beyond technical programming skills to include problem-solving ability, adaptability, communication skills, and the capacity for innovation. The existence of ICT skills shortages alongside unemployed ICT graduates raises critical concerns about whether graduates lack scarce technical competencies, whether generic skills are insufficient, or whether institutional training fails to adequately integrate theory with practical application [9]. Establishing the true magnitude and nature of the skills shortage is further complicated by conflicting reports and inconsistent data regarding the specific skills required in the ICT industry [10]. This complexity necessitates a deeper investigation into how the development of ICT skills relates to employability and broader economic participation.

Beyond employability challenges, South Africa continues to experience relatively low levels of entrepreneurial activity compared to other developing economies [11]. Although entrepreneurship education has been widely promoted as a mechanism for job creation and economic participation, higher education institutions largely remain oriented toward preparing graduates for salaried employment rather than fostering entrepreneurial capabilities [12,13]. This imbalance is particularly concerning in a context characterised by persistent unemployment and slow economic growth [14]. While entrepreneurship has the potential to stimulate innovation, generate employment, and contribute to economic development [15,16], its integration into ICT-related disciplines remains insufficiently explored. Given the growing importance of digital economies, enhancing entrepreneurial intention among ICT students represents a critical pathway for addressing both unemployment and skills shortages.

These challenges are further compounded by historical structural inequalities embedded within South Africa's education system. The legacy of Apartheid has resulted in uneven access to quality education and limited entrepreneurial exposure, particularly within historically disadvantaged institutions [17]. Despite post-Apartheid reforms aimed at improving equity and institutional integration [18], concerns persist regarding graduate readiness, institutional capacity, and employer confidence. Employers often express reservations about graduates from under-resourced institutions, thereby reinforcing labour market inequalities [19]. At the same time, universities operate under significant resource constraints while being expected to produce industry-ready graduates with both technical and entrepreneurial competencies [8,15]. These systemic limitations highlight the need

for a more integrated approach that aligns curriculum design, industry engagement, and entrepreneurial development.

ICT presents a strategic opportunity to drive employment, innovation, and economic competitiveness in South Africa. However, realising this potential requires more than technical skills alone; it demands a deliberate integration of ICT competencies with employability outcomes and entrepreneurial orientation. While existing studies have examined ICT skills and employability independently [20–22], little attention has been paid to how these factors jointly influence entrepreneurial intentions, particularly in the context of structurally constrained higher education systems. This study addresses this gap by examining the interplay between ICT skills, employability, and entrepreneurial intentions among university students, thereby providing a more holistic understanding of how digital competencies can be adopted to enhance both employment prospects and job creation. In doing so, the study contributes to the debates on digital transformation, youth employment, and inclusive economic development in emerging economies.

Against this background, the objective of this study is to examine the interplay among ICT skills, perceptions of employability, and entrepreneurial intention among university students, with particular attention to the role of generic and scarce ICT competencies in shaping students' confidence in employment opportunities and their inclination toward entrepreneurial activity. The study makes a theoretical contribution by extending the Theory of Planned Behaviour through the integration of ICT competencies and employability as key determinants of perceived behavioural control and entrepreneurial intention, and offers an empirical contribution by providing context-specific evidence from South Africa on how different dimensions of ICT skills influence employability and entrepreneurial outcomes. The study addresses three key research questions: (1) How do generic ICT skills influence employability perceptions among university students? (2) How do scarce ICT skills affect students' perceived entrepreneurial feasibility? (3) Does employability perception influence entrepreneurial intention? These questions guide the empirical investigation and support the generation of evidence that can inform curriculum development, institutional strategies, and policy interventions aimed at strengthening ICT competencies, improving graduate employability, and promoting entrepreneurial capacity among ICT students in South Africa.

2. Literature Review

The literature review of this study focused on ICT skills, ICT skills and entrepreneurial development, employability and entrepreneurial intention and entrepreneurship education and reflection.

2.1. ICT Skills and Employability

The rapid digital transformation of the South African economy has elevated Information and Communication Technology (ICT) skills to a central position in determining graduate employability. Employers increasingly expect university graduates to demonstrate digital competence as a fundamental requirement for workforce participation rather than as an added advantage [23,24]. Modern organisations depend on digital systems for communication, data management, innovation, and operational efficiency. As a result, students who possess strong ICT competencies are better equipped to integrate into professional environments and contribute meaningfully to organisational performance. The ability to navigate digital platforms, manage information effectively, and adapt to emerging technologies enhances graduates' readiness for employment in knowledge-driven labour markets.

ICT skills can be broadly categorised into generic and scarce competencies, each playing a distinct role in shaping employability outcomes. Generic ICT skills include proficiency

in common software applications, digital communication tools, online information retrieval, and basic computational literacy [25]. These foundational skills support productivity, flexibility, and problem-solving in everyday workplace tasks. In contrast, scarce ICT skills refer to specialised technical capabilities such as programming, cybersecurity, data analytics, artificial intelligence, cloud computing, and systems development [26]. These advanced competencies are in high demand due to widespread digital transformation across sectors. Graduates who develop scarce ICT skills often gain a competitive edge in the labour market because they can contribute directly to innovation, system development, and strategic technological solutions.

In light of these limitations, the existing literature remains fragmented in its treatment of ICT skills, often examining their role in employability without adequately accounting for contextual constraints or their broader developmental implications. Empirical studies have largely focused on direct relationships between ICT competencies and employment outcomes, with limited attention given to how different dimensions of ICT skills interact within structurally unequal higher education systems [27,28]. Furthermore, while the importance of advanced digital capabilities has been acknowledged, there is insufficient evidence on how both generic and specialised ICT skills collectively shape graduate outcomes in developing economies such as South Africa [25,26]. In addition, prior research has not adequately examined how ICT skills shape pathways beyond formal employment, particularly regarding entrepreneurial intentions, despite the growing recognition of entrepreneurship as a viable response to unemployment and economic stagnation [11,16]. This study addresses these gaps by adopting an integrated approach that examines the relationship between ICT skills, employability, and entrepreneurial intentions within a single analytical framework.

2.2. ICT Skills and Entrepreneurial Development

Entrepreneurial development among university students increasingly depends on digital competence in contemporary economies shaped by rapid technological innovation [29]. Many emerging entrepreneurial opportunities arise from digital platforms, software solutions, data-driven services, and online marketplaces. In this context, ICT skills enhance students' ability to recognise unmet market needs, conceptualise innovative solutions, and transform ideas into viable business ventures [30]. Digital competence, therefore, extends beyond technical proficiency and becomes a strategic capability that enables the recognition of opportunities and the creation of value [23]. Students who possess a strong understanding of digital systems are better positioned to identify technological gaps in markets and leverage these gaps to develop entrepreneurial initiatives.

Generic ICT skills provide the foundational ability to utilise digital tools for communication, marketing, financial management, and general business coordination [31]. However, the acquisition of scarce and advanced ICT skills such as coding, cybersecurity, data analytics, systems integration, and artificial intelligence significantly broadens entrepreneurial opportunities [32]. These specialised competencies allow students to design, develop, and commercialise digital products and services independently. As a result, the barriers to venture creation are reduced because aspiring entrepreneurs are less dependent on external technical expertise. Students with advanced ICT capabilities can therefore transition from passive consumers of technology to active producers of innovation, effectively transforming technical knowledge into entrepreneurial capital.

Furthermore, ICT competence strengthens students' confidence in initiating and sustaining business ventures. When students perceive themselves as technically capable, they are more likely to view entrepreneurship as attainable rather than risky or unrealistic. In this regard, digital skills influence the practical capacity to launch ventures and also the

psychological readiness to act entrepreneurially [33]. Within the interplay among ICT skills, employability, and entrepreneurial development, digital competence serves as a critical bridge linking technical expertise to business creation [29]. Universities can enhance the employability of graduates while simultaneously empowering them to generate innovative economic opportunities through entrepreneurship and by equipping students with both foundational and advanced ICT skills.

Furthermore, ICT competence enhances students' confidence in initiating and sustaining business ventures by shaping both their technical capability and their perception of entrepreneurial feasibility [33]. While prior studies recognise the role of digital skills in opportunity recognition and venture creation, the literature remains largely descriptive and predominantly emphasises their positive effects, with limited critical engagement regarding contextual constraints and differential impacts [29,30]. In particular, insufficient attention has been given to how distinct dimensions of ICT skills operate within structurally constrained higher education environments, where disparities in access to resources, institutional support, and industry exposure may significantly influence outcomes.

Moreover, existing research often assumes a direct relationship between ICT competence and entrepreneurial outcomes, overlooking the mediating role of employability and the broader systemic conditions that shape students' capacity to translate digital skills into viable ventures [23,33]. This limits a more nuanced understanding of the pathways through which ICT skills contribute to economic participation. To address these gaps, this study adopts an integrated approach by examining the interrelationships among ICT skills, employability, and entrepreneurial intentions within a unified theoretical framework. In doing so, it provides a more analytically grounded and context-sensitive contribution, clarifying how digital competencies simultaneously influence employment readiness and entrepreneurial activity, particularly within the context of higher education in South Africa.

2.3. Employability and Entrepreneurial Intention

Employability refers to a set of skills, knowledge, personal attributes, and perceived capabilities that enable individuals to obtain, maintain, and transition between employment opportunities in a dynamic labour market [34]. Within the framework of the Theory of Planned Behaviour, employability can be understood as closely aligned with perceived behavioural control, as it reflects an individual's belief in their capacity to perform tasks successfully and transverse career pathways. Higher levels of employability enhance an individual's confidence in securing employment or pursuing alternative career options, thereby influencing behavioural intentions. Employability and entrepreneurial intention were traditionally viewed as competing career trajectories, with graduates expected to choose either salaried employment or business creation [35]. Contemporary perspectives, however, increasingly recognise these outcomes as complementary rather than contradictory. Employability extends beyond individual perception and is grounded in established theoretical perspectives such as human capital theory, which emphasises the accumulation of skills and knowledge, and graduate employability models that highlight the integration of competencies, social capital, and contextual awareness [36]. These include communication skills, teamwork, critical thinking, resilience, adaptability, and problem-solving capacity. Graduates who demonstrate high employability typically possess confidence, initiative, and career agency [29]. These same attributes are essential for entrepreneurial behaviour, as venture creation requires the ability to manage uncertainty, mobilise resources, and respond creatively to challenges [37]. In this regard, employability strengthens rather than weakens entrepreneurial potential.

Students who perceive themselves as employable tend to demonstrate greater confidence in navigating complex professional environments and making strategic career

decisions, a capability that can extend to entrepreneurial activity through transferable skills such as adaptability, leadership, and resilience [38]. Although prior studies acknowledge the relationship between employability and entrepreneurial intention, the literature remains largely descriptive and often assumes a direct and uniform linkage between these constructs [35,36]. This perspective overlooks the influence of contextual and structural factors, particularly in developing economies where labour market dynamics, institutional support, and resource availability vary considerably. In addition, limited attention has been given to the role of intermediate capabilities and integrated skill sets in shaping how employability translates into entrepreneurial intention within digitally evolving environments [29,37]. As a result, the mechanisms through which employability fosters entrepreneurial outcomes remain insufficiently theorised. This study addresses this gap by positioning employability as a catalytic mechanism within the relationship between ICT skills and entrepreneurial intentions, thereby offering a more analytically grounded and context-sensitive explanation of how employability enhances both employment readiness and the capacity for entrepreneurial engagement in higher education contexts.

2.4. Entrepreneurship Education and Reflection

Entrepreneurship education plays a central role in shaping students' orientation toward business creation and innovation [39]. According to [40], effective entrepreneurship education goes beyond theoretical instruction by incorporating experiential learning, case-based projects, mentorship, simulation exercises, and engagement with real entrepreneurial ecosystems. Through these structured learning experiences, students gain practical knowledge in opportunity identification, business modelling, financial planning, market analysis, and risk management [41]. Such exposure cultivates entrepreneurial mindsets characterised by creativity, initiative, the recognition of opportunities, and problem-solving capacity. Importantly, entrepreneurship education strengthens students' confidence in their ability to initiate ventures by demystifying the process of starting and managing a business. Within the broader interplay between ICT skills, employability, and entrepreneurial development, entrepreneurship education provides the institutional mechanism through which technical competencies are translated into entrepreneurial capability [40].

Reflective learning enhances this developmental process by encouraging students to critically evaluate their experiences and internalise the competencies they acquire [42]. Reflection fosters self-awareness, helping students recognise their strengths, identify skill gaps, and align technical expertise with career aspirations [43]. Through structured reflection and evaluation, students integrate ICT competencies into their professional identity and consider how these skills can be applied in both employment and venture-creation contexts [44]. Reflective practices, therefore, bridge the gap between knowledge acquisition and behavioural readiness. When entrepreneurship education is combined with intentional reflection, students are more likely to connect digital competence with entrepreneurial opportunities, strengthening both employability and entrepreneurial intention as part of a coherent developmental pathway [41].

Reflective practices play a critical role in bridging the gap between knowledge acquisition and behavioural readiness by enabling students to internalise skills and align them with career aspirations [43,44]. While the literature recognises the value of entrepreneurship education and reflective learning, it remains largely normative, often emphasising positive outcomes without critically examining their effectiveness across diverse institutional and contextual settings [39,40]. In particular, limited attention has been given to how reflective learning interacts with ICT competencies and employability to shape entrepreneurial intentions in a structured and measurable manner. Existing studies frequently treat entrepreneurship education, reflection, and skill development as isolated constructs,

with insufficient integration of how these elements collectively influence students' readiness for both employment and venture creation [41,42]. This lack of analytical synthesis constrains a deeper understanding of how educational interventions translate into entrepreneurial outcomes, especially within digitally emerging and resource-constrained higher education environments. This study addresses this gap by examining the combined role of entrepreneurship education and reflective learning within the broader relationship between ICT skills, employability, and entrepreneurial intentions, thereby offering a grounded explanation of how structured learning and reflection enhance employability and entrepreneurial capacity.

2.5. Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB) evolved from the Theory of Reasoned Action (TRA), initially developed by Fishbein and Ajzen in the 1960s [45]. TRA proposed that human behaviour is influenced primarily by attitudes and subjective norms. Attitudes reflect an individual's positive or negative evaluation of performing a behaviour, while subjective norms capture perceived social pressure from significant others [46]. Although TRA significantly advanced the understanding of behavioural intention, it did not adequately account for situations in which individuals lacked full control over their actions. To address this limitation, Ajzen introduced the Theory of Planned Behaviour in the late 1980s, incorporating the construct of perceived behavioural control [47,48]. This addition strengthened the framework by recognising that intentions may not translate into action when individuals perceive barriers or insufficient capability. This theory is presented in Figure 1.

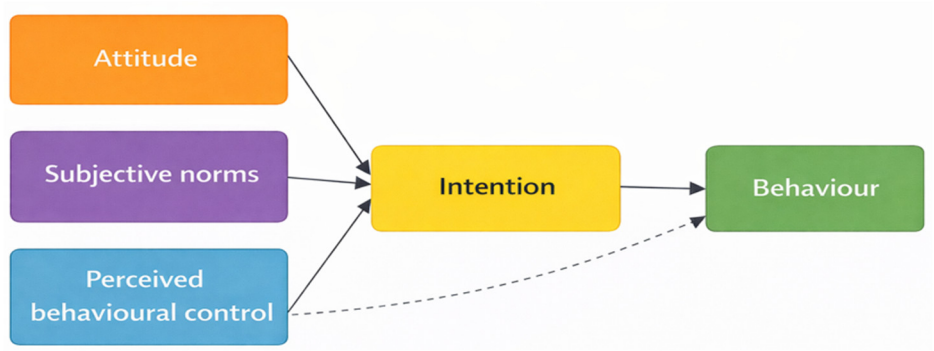


Figure 1. Theory of Planned Behaviour. Source: Adapted from [47].

The TPB posits that behaviour is directly preceded by intention, which is shaped by three core constructs: attitude, subjective norms, and perceived behavioural control [48]. Attitude refers to the degree to which a person evaluates a behaviour favourably or unfavourably. Subjective norms represent the influence of important referents such as peers, mentors, and family members [47]. Perceived behavioural control reflects an individual's assessment of their ability to perform a behaviour successfully, considering internal factors such as skills and self-efficacy, as well as external constraints such as resources and opportunities [47,49]. In the context of this study, ICT skills form an important internal resource that strengthens perceived behavioural control. Students who possess both generic and scarce ICT competencies often feel more capable of navigating digital environments, solving technological problems, and managing tasks associated with modern workplaces or business ventures. This sense of capability increases their confidence in taking action. Perceived feasibility also reflects an important dimension of perceived behavioural control. When students believe that starting and managing a business is realistic and achievable, they develop a stronger sense of control over entrepreneurial outcomes. Higher levels of perceived feasibility therefore reinforce students' belief that they possess the knowl-

edge, skills, and resources required to pursue entrepreneurial opportunities. Together, ICT competencies and perceived feasibility strengthen perceived behavioural control, which ultimately shapes entrepreneurial intention and behaviour.

The TPB is relevant to this study as it explains how attitudes, social influences, and perceived competence shape employability and entrepreneurial intentions within the ICT sector. In contexts characterised by ICT skills shortages, students' perceptions of their technical capability, social encouragement, and evaluation of career pathways significantly influence their intentions. The empirical robustness and broad applicability of TPB across disciplines provide a solid analytical foundation for examining decision-making processes related to employability and entrepreneurship. The study offers insights that can inform educational strategies and policy interventions aimed at strengthening ICT competence, enhancing employability, and fostering entrepreneurial development.

While the Theory of Planned Behaviour provides a strong foundation for understanding the determinants of entrepreneurial intention, the connections between the reviewed constructs and the proposed research model require further clarification to enhance theoretical coherence. Existing applications of TPB in entrepreneurship research tend to focus on attitudes, subjective norms, and perceived behavioural control in isolation, with limited integration of contextual capabilities, such as ICT skills and employability, within this framework [50,51]. In particular, insufficient attention has been given to how ICT competencies function as internal resources that shape perceived behavioural control, and how employability-related attributes influence both attitudes and perceived feasibility in career decision-making processes. Furthermore, prior studies often do not explicitly map the relationships among these constructs within a unified analytical model, thereby limiting the explanatory power of TPB in digitally evolving and structurally constrained environments. This study addresses this limitation by explicitly linking ICT skills, employability, and entrepreneurial intentions within the TPB framework, thereby clarifying the pathways through which digital competence and employability attributes influence behavioural intentions. The study strengthens the theoretical application of TPB and provides a more comprehensive understanding of how students navigate employment and entrepreneurial pathways in the digital economy by integrating these constructs into a coherent model.

Conceptual Framework and Hypotheses Development

This study extends the Theory of Planned Behaviour (TPB) by integrating ICT skills and employability to explain entrepreneurial intentions among university students. The TPB posits that entrepreneurial intention is determined by three key antecedents: attitude toward the behaviour, subjective norms, and perceived behavioural control. While prior studies have applied TPB to entrepreneurship, this study advances the framework by introducing ICT skills and employability as contextually relevant constructs within digital and knowledge-driven economies.

In this framework, ICT skills, encompassing both generic and advanced digital competencies, are conceptualised as a critical enabler of perceived behavioural control, as they enhance students' confidence in identifying opportunities, accessing information, and performing entrepreneurial tasks. ICT competencies may also indirectly shape attitudes toward entrepreneurship by exposing students to digital innovation and self-employment opportunities. Furthermore, employability is positioned as a mediating construct that reflects students' work readiness, adaptability, and problem-solving capabilities. Within the TPB lens, employability reinforces both perceived behavioural control (through increased self-efficacy) and attitude toward entrepreneurship (through perceived feasibility and desirability of entrepreneurial careers).

Although subjective norms are not directly measured in this study, they are implicitly reflected in the institutional and educational environment that shapes students' exposure to ICT and entrepreneurial thinking. Thus, the proposed framework focuses primarily on the interaction between perceived behavioural control and attitude, operationalised through ICT skills and employability, in predicting entrepreneurial intentions. This approach provides a contextually grounded extension of TPB, particularly within the higher education setting. Figure 2 presents the conceptual framework of the study.

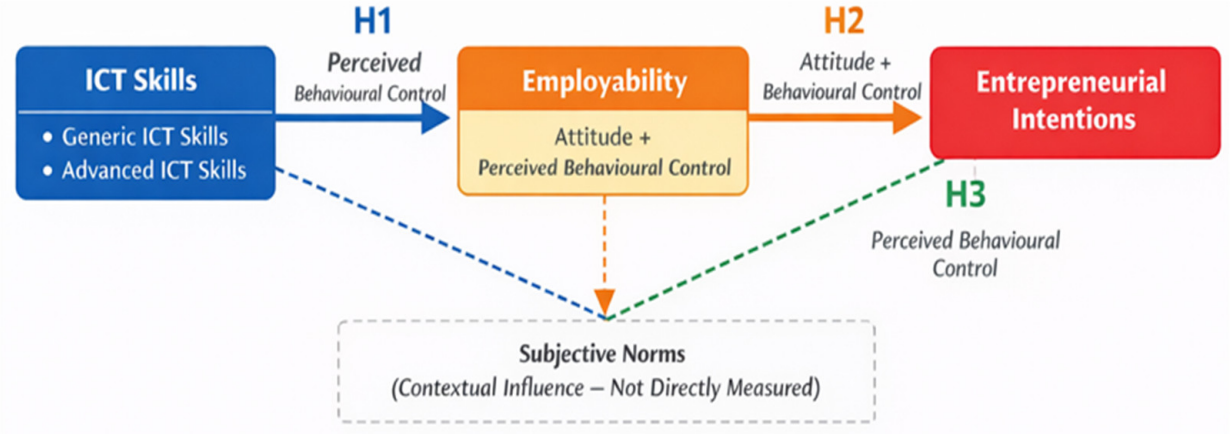


Figure 2. Conceptual framework of the study. Source: Developed by the authors.

Based on this theoretical grounding, the study proposes that ICT skills enhance employability, thereby strengthening entrepreneurial intentions. ICT skills are also expected to directly influence entrepreneurial intentions by increasing students' confidence to engage in entrepreneurial activities. Accordingly, the following hypotheses are proposed:

- H1: ICT skills have a positive and significant effect on employability.
- H2: Employability has a positive and significant effect on entrepreneurial intentions.
- H3: ICT skills have a positive and significant effect on entrepreneurial intentions.

These hypotheses provide an analytically grounded extension of the TPB by demonstrating how digital competencies and employability jointly shape entrepreneurial intentions through mechanisms associated with perceived behavioural control and attitude.

3. Methodology

This study employed a quantitative cross-sectional research design to examine the relationships among ICT skills, employability perceptions, and entrepreneurial development among university students. The cross-sectional approach enabled the capture of students' perceptions, competencies, and entrepreneurial orientations at a single point in time. Data were collected using structured, self-administered questionnaires distributed to students enrolled in ICT-related programmes across three campuses of a South African university.

The target population comprised approximately 350 ICT students across the three campuses. A non-probability convenience sampling approach was adopted, whereby students who were readily accessible and willing to participate were invited to complete the survey. To ensure some level of diversity, efforts were made to include participants from all three campuses, resulting in 180 distributed questionnaires. Of these, 117 usable responses were obtained and retained for analysis, representing a 65% response rate, which is considered acceptable for survey-based studies [52]. While the multi-campus approach enhances contextual diversity, the use of convenience sampling limits the generalisability of the findings. As such, the results should be interpreted within the context of the sampled population and not assumed to represent all university students.

The questionnaire was self-developed for the purpose of this study but was informed by established constructs and measurement approaches from prior research on ICT skills, employability, and entrepreneurial intention [20]. Items were adapted to ensure content validity and contextual relevance to the higher education environment. The instrument utilised Likert-type scales to ensure consistency, comparability, and reliability of responses. Prior to data collection, the questionnaire was reviewed to ensure clarity, coherence, and alignment with the study constructs, and minor refinements were made to improve readability and comprehension.

To address potential common method bias, procedural remedies were implemented, including ensuring respondent anonymity and reducing evaluation apprehension. In addition, Harman's single-factor test was conducted, and the results indicated that no single factor accounted for the majority of the variance, suggesting that common method bias was not a significant concern in this study.

3.1. Measures

The study measured constructs related to ICT competencies, employability, and entrepreneurial development. ICT competencies were categorised into Generic ICT Skills and Scarce ICT Skills. Generic ICT skills included foundational digital capabilities such as software use, digital communication, and information management, while scarce ICT skills captured advanced competencies such as programming, cybersecurity, systems development, and data analytics.

Employability was operationalised as students' perceived readiness and confidence to obtain and sustain employment after graduation. Entrepreneurial development was measured using constructs aligned with the Theory of Planned Behaviour, including perceived feasibility, entrepreneurial intention, and propensity to act. Perceived feasibility assessed students' confidence in starting and managing a business, while entrepreneurial intention captured their willingness to pursue entrepreneurship as a career. Propensity to act reflected behavioural readiness to initiate entrepreneurial activities. Additional constructs such as entrepreneurship education and reflective evaluation were included to capture students' exposure to entrepreneurial learning and their ability to align competencies with future career goals.

3.2. Data Analysis

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS version 29). Reliability analysis was first performed using Cronbach's alpha to assess internal consistency, with coefficients exceeding the recommended threshold of 0.70 indicating acceptable reliability. Exploratory Factor Analysis (EFA) was then conducted to examine the dimensional structure of the constructs, supported by the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity.

Spearman correlation analysis was used to assess the strength and direction of relationships among variables, given the ordinal nature of Likert-scale data and the potential for non-normality. Chi-square tests were also conducted to examine associations between demographic variables and key constructs.

To further examine the structural relationships, multiple regression analysis was employed. Regression analysis was deemed appropriate due to its robustness in estimating predictive relationships with moderate sample sizes. With a sample of 117 respondents, the study meets established guidelines suggesting that sample sizes exceeding 50 plus the number of predictors are sufficient for regression analysis. Compared to more complex techniques such as Structural Equation Modelling, which typically require larger samples,

regression analysis provides a more suitable and methodologically sound approach for the present study.

3.3. Reliability and Validity

Reliability was assessed using Cronbach's alpha, with all constructs achieving coefficients above 0.70, indicating satisfactory internal consistency. Construct validity was evaluated using Exploratory Factor Analysis. The KMO measure exceeded the recommended threshold of 0.60, and Bartlett's Test of Sphericity was statistically significant, confirming the suitability of the data for factor analysis.

Rotated component matrices indicated that items loaded appropriately on their respective constructs with minimal cross-loadings. The use of EFA was appropriate given the exploratory nature of the study and the need to refine construct dimensionality within a context-specific setting. Confirmatory Factor Analysis (CFA) was not employed due to the moderate sample size and the absence of a fully established measurement model. These procedures provided evidence of convergent and discriminant validity.

3.4. Ethical Considerations

Ethical approval for the study was obtained from the Faculty of Economics and Management Sciences, North-West University, South Africa (NWU-00570-22-A4). Participation was voluntary, and respondents were informed about the purpose of the study, confidentiality of responses, and their right to withdraw at any stage without penalty. Informed consent was obtained prior to data collection, and anonymity was maintained by excluding identifiable information. Data were securely stored and used solely for academic purposes.

4. Presentation of Research Results

This section presents the results obtained from the questionnaires administered to the ICT students in the three campuses.

4.1. Biographical Information of Respondents

A total of 150 questionnaires were distributed across three campuses (Mafikeng, Potchefstroom, and Vaal Triangle) to students who enrolled in Information Systems, Computer Sciences, and related ICT programmes. Of these, 117 completed responses were received, yielding a response rate of 78%, which is considered statistically adequate for drawing valid conclusions [51]. The demographic profile provides essential contextual grounding for interpreting ICT competencies, perceptions of employability, and entrepreneurial orientation. The demographic composition is summarised in Table 1 below.

The demographic profile presented in Table 1 shows that the gender distribution is relatively balanced, with a slight male majority (52.7%), reflecting broader global trends in ICT-related fields and potentially influencing confidence in scarce ICT skills and risk-taking in entrepreneurship. Most respondents (64.5%) are aged 18–25, indicating that the sample largely consists of students in the early stages of their careers, whose perceptions of employability and entrepreneurial feasibility are still developing. A smaller proportion of mature students (31.8% aged 26–35) adds diversity in experience and career clarity, which may shape entrepreneurial intentions differently. The racial composition is predominantly Black African (75.9%), reflecting transformation within South African higher education and highlighting the importance of ICT skills development for historically marginalised groups. Regarding campus distribution, 40% of the respondents were from the Mahikeng campus, 35% from the Potchefstroom campus, and 25% from the Vaal campus, reflecting participation across the three institutional locations included in the study. In terms of faculty representation, the majority of respondents (71.4%) were drawn from the Faculty of Natural and Agricultural Sciences, where ICT-related programmes are primarily offered, while

28.6% came from the Faculty of Economic and Management Sciences, thereby introducing a cross-disciplinary perspective on entrepreneurship. The sample represents a young, ICT-oriented, and demographically transformed student population, providing an appropriate context for examining how ICT competencies influence perceptions of employability and entrepreneurial intention among university students.

Table 1. Demographic information of the respondents.

Variable	Category	Percentage (%)
Gender	Male	53
	Female	44
	Prefer not to say	3
Age Group	18–25	65
	26–35	32
	36–45	2
	46+	1
Race	Black African	76
	Coloured	12
	White	11
	Asian	1
Campus	Mahikeng	40
	Potchefstroom	35
	Vaal	25
Faculty	Faculty of Natural and Agricultural Science (FNAS)	72
	Faculty of Economics and Management Science (FEMS)	28

4.2. Reliability and Exploratory Factor Analysis

Before examining the relationships among the study variables, reliability and construct validity were assessed. Cronbach's alpha values for all constructs exceeded the acceptable threshold of 0.70, indicating satisfactory internal consistency. Exploratory Factor Analysis (EFA) was conducted for multidimensional constructs.

Prior to examining the relationships among the study variables, the reliability and construct validity of the measurement scales were assessed. Cronbach's alpha values for all constructs exceeded the recommended threshold of 0.70, indicating satisfactory internal consistency across the scales. To further evaluate construct validity, Exploratory Factor Analysis (EFA) was conducted for multidimensional constructs, given the exploratory nature of the study and the moderate sample size.

Table 2 presents the EFA results. The Kaiser–Meyer–Olkin (KMO) values for Generic ICT Skills (0.877), Scarce ICT Skills (0.803), and Entrepreneurship Education (0.785) all exceeded the acceptable threshold of 0.60, confirming sampling adequacy. Bartlett's Test of Sphericity was statistically significant ($p < 0.001$) for all constructs, indicating that the correlation matrices were suitable for factor analysis.

The EFA results reveal that ICT competencies and entrepreneurship education are inherently multidimensional. Generic ICT skills were decomposed into two factors, while scarce ICT skills produced three distinct factors. Entrepreneurship education similarly yielded two underlying dimensions. These factors explained substantial proportions of variance (above 70% across constructs), indicating strong structural validity and suggesting that students' digital competencies and entrepreneurial learning experiences are not uniform but consist of layered and differentiated capabilities.

Table 2. EFA summary for multidimensional constructs.

Construct	KMO	Bartlett's Test (p)	Factors Extracted	Variance Explained
Generic ICT Skills	0.877	<0.001	2	72.74%
Scarce ICT Skills	0.803	<0.001	3	74.24%
Entrepreneurship Education	0.785	<0.001	2	77.38%

All KMO values in Table 2 exceeded 0.60 and Bartlett's Test was significant, confirming suitability for factor analysis. The results reveal that ICT competencies and entrepreneurship education are multidimensional constructs.

Post-EFA reliability analysis, presented in Table 3, confirms the internal consistency of the refined constructs. All extracted factors achieved Cronbach's alpha values ranging from 0.787 to 0.907, indicating acceptable to excellent reliability. This reinforces the robustness of the measurement model and supports the use of these constructs in subsequent analyses.

Table 3. Post-EFA reliability of refined constructs.

Refined Construct	Cronbach's α	Interpretation
Generic ICT Skills—Factor 1	0.880	Good
Generic ICT Skills—Factor 2	0.907	Excellent
Scarce ICT Skills—Factor 1	0.791	Acceptable
Scarce ICT Skills—Factor 2	0.787	Acceptable
Scarce ICT Skills—Factor 3	0.862	Good
Entrepreneurship Education—Factor 1	0.846	Good
Entrepreneurship Education—Factor 2	0.830	Good

4.3. Descriptive Analysis of Core Constructs

To contextualise the relational findings, aggregate agreement levels across key constructs were examined. Table 4 presents the aggregate agreement levels across constructs.

Table 4. Aggregate agreement levels across constructs.

Construct	Agreement (%)	Disagreement (%)	Neutral (%)
Career Development Learning	50.4	48.8	0.9
Self-Efficacy	82.0	5.1	12.8
Employability	72.6	24.0	3.4
Perceived Desirability	74.2	5.1	20.5
Propensity to Act	75.2	6.0	18.8
Perceived Feasibility	41.9	33.4	24.8
Entrepreneurial Intent	63.2	16.2	20.5

The descriptive results presented in Table 4 indicate that students demonstrate high levels of self-efficacy (82.0%) and employability perceptions (72.6%), suggesting strong confidence in their abilities and readiness for the labour market. Entrepreneurial attitudes are also positive, with perceived desirability (74.2%) and propensity to act (75.2%) showing high agreement levels. However, perceived feasibility is considerably lower (41.9%),

indicating that although many students are interested in entrepreneurship and willing to take action, they remain uncertain about their ability to successfully establish a business. This gap between entrepreneurial desirability and feasibility may be attributed to several factors. First, while students may possess positive attitudes toward entrepreneurship, they may lack access to critical resources such as funding, mentorship, and practical business experience, which are essential for translating intentions into action. Second, limited exposure to entrepreneurial ecosystems, including incubation hubs, industry networks, and real-world venture creation opportunities, may constrain students' confidence in their ability to operationalise business ideas. Third, structural and institutional challenges within the South African context, such as unequal access to advanced ICT infrastructure and variations in curriculum delivery across campuses, may further reinforce perceptions of low feasibility. Entrepreneurial intent (63.2%) reflects moderate commitment toward pursuing entrepreneurship as a career path, while career development learning shows nearly equal agreement (50.4%) and disagreement (48.8%), suggesting mixed perceptions among students. The results portray a student population that is confident in its employability and entrepreneurial aspirations but faces structural, experiential, and resource-related barriers in translating entrepreneurial interest into practical feasibility.

4.4. Correlation Analysis

A Pearson correlation analysis was conducted in Table 5 to examine the relationships among the key study variables, including employability, perceived desirability, propensity to act, perceived feasibility, entrepreneurial intent, and the dimensions of generic and scarce IT skills. The table presents the strength and direction of these relationships, with asterisks indicating statistically significant correlations (* $p < 0.05$; ** $p < 0.01$).

Table 5. Correlation Analysis of the study.

Variables	1	2	3	4	5	6	7	8	9	10
1. Employability	1									
2. Perceived Desirability	0.177	1								
3. Propensity to Act	0.194 *	0.572 **	1							
4. Perceived Feasibility	0.122	0.095	0.347 **	1						
5. Entrepreneurial Intent	0.341 **	0.094	0.093	0.173	1					
6. Generic IT Skills 1	0.159	0.028	0.143	0.353 **	0.164	1				
7. Generic IT Skills 2	0.134	−0.020	0.118	0.321 **	0.231 *	0.638 **	1			
8. Scarce IT Skills 1	0.086	0.073	0.166	0.308 **	0.048	0.265 **	0.089	1		
9. Scarce IT Skills 2	0.153	0.064	0.141	0.493 **	0.021	0.391 **	0.229 *	0.396 **	1	
10. Scarce IT Skills 3	0.284 **	0.009	0.061	0.441 **	0.190 *	0.330 **	0.273 **	0.431 **	0.581 **	1

Note: * $p < 0.05$; ** $p < 0.01$.

A strong positive relationship is observed between perceived desirability and propensity to act in Table 5 (r = 0.572, $p < 0.01$), indicating that favourable attitudes toward entrepreneurship significantly enhance behavioural readiness. Similarly, perceived feasibility is positively associated with propensity to act (r = 0.347, $p < 0.01$), suggesting that confidence in entrepreneurial capability contributes to action-oriented behaviour.

At the factor level, scarce ICT skills demonstrate differentiated effects. In particular, Scarce ICT Skills Factor 2 shows the strongest relationship with perceived feasibility (r = 0.493, $p < 0.01$), followed by Factor 3 (r = 0.441, $p < 0.01$). This indicates that certain advanced ICT competencies are more influential in shaping students' confidence in their ability to engage in entrepreneurial activities. In contrast, Scarce ICT Skills Factor 1 shows a

weaker relationship (r = 0.308, $p < 0.01$), suggesting variability in the influence of different advanced skill types.

Generic ICT skills also exhibit moderate associations with perceived feasibility, with Factor 1 (r = 0.353, $p < 0.01$) and Factor 2 (r = 0.321, $p < 0.01$) indicating that foundational digital competencies contribute to entrepreneurial confidence, albeit less strongly than advanced ICT skills.

In relation to entrepreneurial intention, employability shows a moderate positive relationship (r = 0.341, $p < 0.01$), while Scarce ICT Skills Factor 3 demonstrates a smaller but significant association (r = 0.190, $p < 0.05$). This suggests that specialised ICT competencies may play a role in shaping entrepreneurial aspirations, although their influence is less direct compared to employability.

The factor-level analysis highlights that ICT competencies are not homogeneous, with different dimensions exerting varying levels of influence on employability, perceived feasibility, and entrepreneurial intention. These findings show the importance of distinguishing between types of ICT skills when examining their role in entrepreneurial development.

4.5. Regression Analysis: Predictive Relationships Among Core Constructs

To examine the predictive relationships among ICT competencies, employability, perceived feasibility, and entrepreneurial intention, multiple regression analysis was conducted. This approach provides a robust alternative to structural modelling by assessing the direct influence of independent variables on dependent outcomes while maintaining statistical rigor.

Three regression models were estimated in Table 6. The first model examined the influence of ICT competencies (generic and scarce ICT skills) on employability. The second model assessed the effect of ICT competencies on perceived feasibility. The third model evaluated the extent to which employability and perceived feasibility predict entrepreneurial intention. The regression models were extended to include demographic control variables, including gender, age, faculty, campus, and race, to account for potential confounding effects.

The results provide moderate support for the proposed hypotheses after accounting for demographic control variables. H1 is supported, as both generic ICT skills ($\beta = 0.27$, $p < 0.01$) and scarce ICT skills ($\beta = 0.34$, $p < 0.001$) significantly predict employability in Model 1. The stronger effect of scarce ICT skills suggests that advanced digital competencies play a more influential role in shaping students' perceptions of labour market readiness. The inclusion of control variables shows that faculty ($\beta = 0.12$, $p < 0.05$) also has a significant, albeit smaller, effect, indicating that institutional context contributes to employability outcomes alongside ICT competencies. H2 is also supported, with both generic ICT skills ($\beta = 0.29$, $p < 0.01$) and scarce ICT skills ($\beta = 0.46$, $p < 0.001$) significantly influencing perceived feasibility in Model 2. The comparatively larger coefficient for scarce ICT skills reinforces the importance of specialised digital capabilities in enhancing students' confidence in their ability to undertake entrepreneurial activities. Among the control variables, campus ($\beta = 0.14$, $p < 0.05$) shows a significant effect, suggesting that differences in institutional resources, infrastructure, and exposure to innovation ecosystems may shape students' perceptions of feasibility. H3 is supported in Model 3, as both employability ($\beta = 0.31$, $p < 0.01$) and perceived feasibility ($\beta = 0.25$, $p < 0.05$) significantly predict entrepreneurial intention. These findings indicate that students' confidence in their employability, as well as their perceived capability to start a business, are important drivers of entrepreneurial intention. The control variable race ($\beta = 0.11$, $p < 0.05$) also shows a marginally significant effect, highlighting the potential influence of socio-economic and structural factors in shaping entrepreneurial outcomes. The findings reinforce the argument that ICT competencies act

as important enablers of both employability and entrepreneurial readiness. However, the results al-so demonstrate that their effects operate alongside institutional and demographic influences rather than in isolation. The stronger and more consistent influence of scarce ICT skills across Models 1 and 2 aligns with prior research emphasising the increasing importance of advanced digital capabilities in knowledge-driven economies. At the same time, the differentiation between generic and scarce ICT skills provides a more nuanced understanding of digital competence, showing that not all ICT skills contribute equally to employability and entrepreneurial outcomes.

Table 6. Regression Results.

Model	Dependent Variable	Predictor	β	t-Value	*p*-Value	R^2
Model 1	Employability	Generic ICT Skills	0.27	2.63	<0.01	0.33
		Scarce ICT Skills	0.34	3.41	<0.001	
		Gender	0.05	0.82	>0.05	
		Age	0.07	1.10	>0.05	
		Faculty	0.12	1.98	<0.05	
Model 2	Perceived Feasibility	Generic ICT Skills	0.29	2.72	<0.01	0.45
		Scarce ICT Skills	0.46	4.38	<0.001	
		Gender	0.03	0.51	>0.05	
		Age	0.09	1.45	>0.05	
		Campus	0.14	2.10	<0.05	
Model 3	Entrepreneurial Intention	Employability	0.31	3.02	<0.01	0.31
		Perceived Feasibility	0.25	2.44	<0.05	
		Gender	0.04	0.73	>0.05	
		Age	0.06	1.02	>0.05	
		Race	0.11	1.89	<0.05	

The positive relationship between employability and entrepreneurial intention suggests that employability extends beyond preparation for salaried employment and may enhance students' capacity to pursue entrepreneurial opportunities. This supports perspectives that view employability and entrepreneurship as complementary path-ways. Similarly, the significant effect of perceived feasibility is consistent with the Theory of Planned Behaviour, which emphasises the role of perceived capability in shaping behavioural intentions. Nevertheless, the models' explanatory power (R^2 ranging from 0.31 to 0.45) indicates that the relationships should be interpreted with caution. While ICT skills and employability are important predictors, other factors not included in the models such as access to finance, mentorship, entrepreneurial culture, and institutional support may also play a meaningful role. In the South African context, structural inequalities, disparities in institutional resources, and uneven access to advanced ICT infrastructure may further influence both skill development and entrepreneurial opportunity recognition. The study contributes to the literature by providing an integrative and contextually grounded analysis

of the relationships among ICT skills, employability, and entrepreneurial intention. The study shows how digital skills shape both employment and entrepreneurial pathways within a developing economy context by distinguishing between generic and scarce ICT competencies and incorporating demographic controls.

Multicollinearity diagnostics were assessed using the Variance Inflation Factor (VIF), and all values were below the recommended threshold of 5, indicating that multicollinearity is not a concern. The results show that ICT competencies remain significant predictors even after controlling for demographic characteristics. In Model 1, both generic and scarce ICT skills significantly predict employability, with scarce ICT skills demonstrating a stronger effect. In Model 2, ICT skills significantly predict perceived feasibility, with scarce ICT skills again showing a more pronounced influence. In Model 3, both employability and perceived feasibility significantly predict entrepreneurial intention, confirming their role as key drivers of entrepreneurial outcomes. Among the control variables, faculty, campus, and race show occasional significance, suggesting that institutional and demographic contexts play a supporting role in shaping students' competencies and perceptions.

4.6. Chi-Square Analysis: Significant Demographic Associations

Chi-square tests were conducted in Table 7 to determine whether demographic variables significantly influenced ICT competencies, entrepreneurial cognition, and institutional learning outcomes. Only statistically significant associations ($p < 0.05$) are reported.

Table 7. Significant demographic associations ($p < 0.05$).

Construct	Significant Demographic Variable(s)
Experience Work/Life	Department, Campus
Generic IT Skills 1	Department, Campus
Generic IT Skills 2	Department, Campus
Scarce IT Skills 1	Department
Scarce IT Skills 2	Department, Campus
Scarce IT Skills 3	Race, Department, Campus
Reflection & Evaluation	Race, Department, Campus
Entrepreneurship Education 1	Campus
Entrepreneurship Education 2	Department, Campus
Perceived Desirability	Campus

The chi-square results in Table 7 indicate that department and campus location are key structural factors influencing ICT skills and entrepreneurial development. Departmental affiliation significantly affects both generic and scarce ICT skills, suggesting that competency development varies across academic disciplines. Campus location also shows strong associations with ICT skills, entrepreneurship education exposure, and perceived desirability, reflecting differences in institutional resources, infrastructure, and support systems across campuses. In addition, race is significantly related to advanced ICT skills and reflection and evaluation, pointing to possible disparities in access to higher-level competencies. The findings show that ICT competencies and entrepreneurial attitudes are shaped not only by individual characteristics but also by broader institutional and demographic contexts.

4.7. Synthesis of Analytical Findings

This section presents an integrated summary of the key analytical results derived from the various statistical analyses conducted in the study. Table 8 consolidates the major findings across the measurement, descriptive, correlation, and inferential analyses, highlighting the core patterns related to ICT skills, entrepreneurial perceptions, and institutional influences among the respondents.

Table 8. Integrated Analytical Summary.

Analytical Dimension	Key Finding
Generic ICT Skills	Strong internal reliability and structural cohesion
Scarce ICT Skills	Multidimensional and unevenly distributed across departments and campuses
Self-Efficacy	Very high across respondents
Entrepreneurial Desirability	Strong attitudinal orientation toward entrepreneurship
Perceived Feasibility	Comparatively weak relative to desirability
Institutional Moderation	Campus significantly influences skills and entrepreneurial constructs
Psychological Gap	Desirability (74%) substantially exceeds Feasibility (41.9%)

The integrated analysis in Table 8 indicates that ICT skill development and entrepreneurial formation operate within a layered and institutionally influenced system. While students generally demonstrate strong generic ICT skills and high self-efficacy, advanced or scarce ICT skills are multidimensional and unevenly distributed across departments and campuses, suggesting disparities in access to higher-level technical training. Students also show strong entrepreneurial desirability, but perceived feasibility remains relatively low, creating a clear gap between aspiration and confidence in their ability to start ventures. Institutional factors, particularly the campus context, significantly influence ICT skill development, exposure to entrepreneurship education, and entrepreneurial thinking. The findings highlight a critical need to strengthen advanced ICT competencies, experiential learning opportunities, and entrepreneurship education to close the feasibility gap and improve both employability and entrepreneurial potential among ICT students.

5. Discussion of Research Results

The objective of this study was to examine the interplay among ICT skills, perceptions of employability, and entrepreneurial intention among university students, with particular emphasis on the role of generic and scarce ICT competencies in shaping confidence in employment opportunities and entrepreneurial engagement. The results indicate that students generally possess strong generic ICT skills, suggesting that foundational digital competencies are well established. These skills support workplace readiness by enabling graduates to use productivity software, manage digital information, and communicate effectively through digital platforms [23–25]. However, scarce ICT skills, including advanced technical competencies such as programming, cybersecurity, and data analytics, were found to be multidimensional and unevenly distributed across departments and campuses. This uneven distribution suggests disparities in access to advanced technical training and highlights the shortage of specialised ICT capabilities in South Africa [7,8,26]. While the findings confirm that advanced ICT skills positively influence perceptions of entrepreneurial feasibility, this relationship may also be shaped by additional contextual and experiential factors. For instance, students with prior exposure to technology-driven

projects, internships, or entrepreneurial activities may develop higher confidence in their ability to initiate ventures, independent of formal ICT training [26]. Institutional differences in access to digital infrastructure, innovation hubs, and industry partnerships across campuses, according to [29], may influence both skill acquisition and perceptions of feasibility. These variations highlight that entrepreneurial confidence is a function of technical competence and reflects structural and environmental conditions. The findings suggest that employability enhances entrepreneurial readiness by equipping students with transferable skills such as adaptability, problem-solving, and self-efficacy. This supports emerging perspectives that view employability as a foundation for entrepreneurial action, particularly in uncertain labour markets [53]. However, this relationship may also be influenced by contextual factors such as limited formal employment opportunities, which may push employable graduates toward entrepreneurship as an alternative career pathway. In the South African context, characterised by high youth unemployment and structural inequalities, employability may therefore function both as a driver of opportunity recognition and as a response to constrained labour market conditions [54].

The findings also show that students demonstrate high levels of self-efficacy and relatively strong perceptions of employability, indicating confidence in their ability to participate in the labour market. This supports the view that skill acquisition strengthens individuals' confidence in securing employment and navigating professional environments [27,36]. Moreover, the positive association between employability perceptions and entrepreneurial intention suggests that employability and entrepreneurship should be viewed as complementary rather than competing career pathways. Graduates who possess adaptable competencies such as problem-solving, leadership, and resilience are better positioned to pursue both employment and entrepreneurial opportunities [35,41,55–58].

Despite these positive outcomes, the study reveals a notable gap between entrepreneurial desirability and perceived feasibility. Many students express favourable attitudes toward entrepreneurship, recognising it as a potential pathway for addressing unemployment and contributing to economic development [59]. However, a significant proportion remain uncertain about their ability to successfully establish and manage a business venture. This finding aligns with the Theory of Planned Behaviour, which suggests that favourable attitudes alone are insufficient for behavioural action if individuals perceive limited capability or control [47,48]. The results further indicate that scarce ICT skills are strongly associated with perceived feasibility, highlighting the importance of advanced digital competencies in strengthening entrepreneurial confidence and enabling opportunity recognition and innovation in knowledge-intensive sectors [29,30,32].

Finally, the analysis highlights the significant role of institutional context, particularly campus location and departmental affiliation, in shaping ICT skill development and entrepreneurial orientation. Differences in infrastructure, curriculum design, faculty expertise, and industry engagement appear to influence students' exposure to advanced technical training and entrepreneurship education [14,19]. The findings therefore emphasise the importance of integrating ICT skills development, employability preparation, and entrepreneurship education through experiential learning approaches such as mentorship, industry collaboration, and real-world entrepreneurial projects [9,26,40,41]. Strengthening these elements may help bridge the gap between entrepreneurial aspiration and perceived capability and enhance both employability and entrepreneurial potential among ICT graduates in South Africa.

The study makes important contributions by demonstrating that ICT competencies function as multidimensional drivers of both employability and entrepreneurial intention. The findings show that both generic ICT skills ($\beta = 0.27$, $p < 0.01$) and scarce ICT skills ($\beta = 0.34$, $p < 0.001$) significantly predict employability, while scarce ICT skills also strongly

influence perceived feasibility (β = 0.46, $p < 0.001$), which in turn predicts entrepreneurial intention (β = 0.25, $p < 0.05$). These results provide strong empirical support for the Theory of Planned Behaviour, particularly the role of perceived behavioural control as a key determinant of intention. In this study, ICT skills function as critical internal resources that enhance students' perceived capability to perform entrepreneurial tasks, thereby strengthening perceived behavioural control. Furthermore, employability (β = 0.31, $p < 0.01$) contributes significantly to entrepreneurial intention, suggesting that employability-related attributes such as confidence, adaptability, and career agency reinforce both attitudinal evaluations and perceptions of feasibility within the TPB.

Theoretical, Practical and Policy Implications

The study contributes to academia by demonstrating that ICT competencies function as multidimensional drivers of both employability and entrepreneurial intention. The findings show that both generic ICT skills and scarce ICT skills significantly predict employability, while scarce ICT skills also strongly influence perceived feasibility, which in turn predicts entrepreneurial intention. These results provide strong empirical support for the Theory of Planned Behaviour, particularly the role of perceived behavioural control as a key determinant of intention. In this study, ICT skills function as critical internal resources that enhance students' perceived capability to perform entrepreneurial tasks, thereby strengthening perceived behavioural control. Furthermore, employability contributes significantly to entrepreneurial intention, suggesting that employability-related attributes such as confidence, adaptability, and career agency reinforce both attitudinal evaluations and perceptions of feasibility within the TPB. The study extends TPB by integrating digital capability and labour market readiness as central determinants of behavioural intention in a digitally evolving economy, demonstrating that ICT competencies and employability jointly shape perceived behavioural control and influence entrepreneurial intention.

From a practical perspective, the findings highlight the need for higher education institutions to prioritise the development of advanced ICT competencies alongside foundational digital skills. While generic ICT skills support basic workplace readiness, the stronger effects of scarce ICT skills on employability and perceived feasibility indicate that specialised competencies such as programming, cybersecurity, and data analytics play a more critical role in enhancing students' perceived behavioural control and readiness for entrepreneurial action. Universities should therefore adopt integrated and experiential learning approaches that combine ICT training with entrepreneurship education through initiatives such as project-based learning, industry collaboration, mentorship, and innovation hubs. The observed gap between entrepreneurial desirability and perceived feasibility suggests that students may hold positive attitudes toward entrepreneurship but lack sufficient perceived control, reinforcing the need for practical exposure and support systems that enable the translation of intention into action.

At the policy level, the study highlights the importance of strengthening national strategies to address digital skills shortages and improve youth employability and entrepreneurship outcomes. The strong predictive role of scarce ICT skills underscores the need for targeted investment in advanced digital training, infrastructure, and curriculum development to enhance perceived behavioural control among graduates. The differences observed across campuses and departments reflect broader structural inequalities that may influence students' access to resources and opportunities, thereby shaping their behavioural intentions within the TPB. Policymakers should therefore prioritise inclusive interventions that expand access to ICT education and entrepreneurial ecosystems. In addition, entrepreneurship policies should move beyond fostering positive attitudes and instead focus on strengthening students' capabilities and perceived feasibility through funding support,

incubation programmes, and access to digital platforms. Such an approach will enhance both perceived behavioural control and actual entrepreneurial engagement, contributing to more inclusive and sustainable development outcomes in South Africa.

6. Recommendations

The findings of this study highlight the need for higher education institutions to strengthen the integration of advanced ICT competencies, employability preparation, and entrepreneurship education within university curricula. Universities should prioritise the development of scarce ICT skills, including programming, cybersecurity, data analytics, and artificial intelligence, through curriculum redesign, practical laboratories, and industry-linked projects. Strengthening collaboration between universities and industry can also improve the relevance of ICT training by ensuring that programmes reflect current labour market demands. In addition, entrepreneurship education should move beyond theoretical instruction and incorporate experiential learning approaches such as innovation labs, mentorship programmes, start-up incubators, and real-world entrepreneurial projects. These initiatives can help bridge the gap between entrepreneurial desirability and perceived feasibility by providing students with the practical exposure needed to transform ideas into viable ventures. Policymakers should also support investment in digital infrastructure and institutional capacity to reduce disparities in ICT skill development across campuses and departments.

7. Limitations

This study is subject to several limitations that should be considered when interpreting the findings. First, the relatively small sample size (n = 117), although adequate for the statistical techniques employed, limits the extent to which the results can be generalised to the broader population of university students. Second, the use of a non-probability convenience sampling approach introduces potential selection bias, as participants were selected based on accessibility rather than random sampling. As a result, the sample may not fully capture the diversity of students across different institutions and socio-economic contexts in South Africa.

Third, the study relies on self-reported data, which may be subject to response bias, including social desirability and the potential overestimation of ICT competencies, employability, and entrepreneurial intentions. Although procedural measures were taken to ensure anonymity, such biases cannot be entirely eliminated. Fourth, the cross-sectional research design limits the ability to establish causal relationships among the variables, as the data reflect associations at a single point in time rather than changes over time.

Taken together, these limitations suggest that the findings should be interpreted with caution. Future research should consider employing larger and more representative samples, as well as longitudinal designs, to enhance the robustness, generalisability, and causal inference of the relationships among ICT skills, employability, and entrepreneurial intention.

8. Conclusions

This study examined the interplay between ICT skills, employability perceptions, and entrepreneurial intention among university students in South Africa. The results demonstrate that while students generally possess strong generic ICT skills, high self-efficacy, and positive attitudes toward entrepreneurship, significant disparities remain in the acquisition of scarce ICT competencies and in students' perceptions of entrepreneurial feasibility. The findings reveal a notable gap between students' entrepreneurial aspirations and their confidence in their ability to successfully establish ventures. Moreover, institutional factors such

as campus context and departmental structure significantly influence ICT skill development and entrepreneurial orientation. The study highlights the importance of adopting an integrated approach that strengthens advanced digital competencies, enhances employability preparation, and promotes practical entrepreneurship education. Addressing these dimensions simultaneously may help improve graduate employment prospects, foster entrepreneurial activity, and support broader economic development in South Africa.

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