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Addressing The 4IR Skills Gap for South Africa's Economy

WITS Business School

Lerato Bodibe

Student Number: 2261553

Supervisor

Dr Robert Venter

A social entrepreneurship project 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 Business Administration.

Aug 2023

DECLARATION

I, Lerato Bodibe, declare that this research report entitled 'Addressing the 4IR Skills Gap for South Africa's Economy' is my own unaided work. I have acknowledged, attributed, and referenced all ideas sourced elsewhere. I am hereby submitting it in partial fulfilment of the requirements of the degree of Master of Business Administration at the University of the Witwatersrand, Johannesburg. I have not submitted this report before for any other degree or examination to any other institution.



Lerato Bodibe

Signed at Fourways, Johannesburg
On the 23rd day of Aug 2023

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SUPPLEMENTARY INFORMATION

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Appendix A : MBA Research Proposal Panel Evaluation Report 2021

ABSTRACT

The widespread enthusiasm and hysteria for Artificial Intelligence (AI) todays not only encourages but forces us to approach the future with a combination of childlike aw and mature concerns. A new and evolving set of skills is vita and needed, because automation and robotisation powered by AI is simultaneously creating and eroding jobs. The so-called digitally enabled jobs, AI-driven jobs, indisputably needs a skilled cadre of graduates. This is especially true for the ICT sector in South Africa, which is plagued by a serious skills shortage.

The research conducted for this MBA social entrepreneurship project led to the aim of establishing an eSkills institute, specifically targeting the youth in Orange Farm. This community was chosen for its demographic and social condition where it faces high levels of youth unemployment, drug abuse, and lack of access to educational facilities by the youth.

The proposed business model offers a promising approach for the eSkills Institute to achieve both its social and financial goals, bringing meaningful change to disadvantaged communities through digital skills training. This would enable the eSkills institute to achieve long-term viability and make a positive impact with its underlying primary objective of providing digital skills training to disadvantaged communities, thereby bridging the digital divide and increasing their access to economic opportunities.

Basing our analysis on market research and stakeholder engagement has helped identify key areas of opportunity to generate revenue and create social value. These opportunities include offering paid digital skills training programs to corporate clients, partnering with government agencies to provide subsidised training to low-income individuals, and establishing a social enterprise arm that offers software development and design services to small businesses and their ecosystems.

Keywords: Artificial Intelligence (AI), skills shortages, eSkills Institute, digital divide

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1. CHAPTER 1: INTRODUCTION

1.1. PURPOSE OF THE PROJECT

The Fourth Industrial Revolution (4IR) is a topic of great interest in South Africa, having the potential to transform the economy and create new jobs, but also presenting significant challenges in terms of job displacement and the need for new skills. According to the World Economic Forum (WEF), 4IR technologies such as artificial intelligence, robotics, and the Internet of Things are expected to displace 5 million jobs globally, but will also create 133 million new jobs worldwide (WEF, 2018).

Locally, the impact of 4IR is evident in industries such as manufacturing and finance, where automation is replacing human labour (Maluleke & Pillay, 2019). To take advantage of the opportunities presented by 4IR, the country needs to invest in education and training to equip its workforce with the necessary skills (Department of Communications and Digital Technologies, 2020). However, there are concerns that the current education and training system is not adequately preparing students for the jobs of the future (Deloitte, 2019).

To address these challenges, the South African government has developed a national strategy to guide the country's transition to a digital economy (Department of Communications and Digital Technologies, 2020). The strategy includes initiatives to promote digital literacy, support research and development, and create an enabling environment for innovation and entrepreneurship, but needs the collaboration and alignment of the government and private sector (Deloitte, 2019).

The emergence of 4IR has worsened the predicament of marginalized groups, revealing 4IR as exacerbating disparities in access to education where there is a privatized education system for the privileged that is technologically developed and digitally connected, and a system for the marginalized that faces the opposite realities (Gastrow, 2021). For most of the youth from disadvantaged communities and households, acquiring eSkills remains a challenge largely because 4IR and its reliance on big data has widened the 'digital divide', separating learners who have access to the rich knowledge of the internet from those who do not (Gastrow 2021). In communities like Orange Farm, this digital divide is particularly pronounced due to factors

such as limited infrastructure, historical neglect of educational investment, and socioeconomic disparities, which have resulted in a lack of funding and resources for educational facilities.

The impact of automation is exacerbating the existing mismatch between the skills required by employers and the skills possessed by job seekers in South Africa and abroad (National Planning Commission, 2021). Automation is affecting low-, mid- and high -skilled workers in industries such as finance, manufacturing, and healthcare (Deloitte, 2019). South Africa needs to invest in education and training that is aligned with the needs of the economy and develop partnerships between government and the private sector to provide workers with the skills needed to succeed in the jobs of the future (National Planning Commission, 2021).
Automation has a widespread impact across various industries, affecting workers across the skill spectrum. Low-, mid-, and high-skilled workers in sectors such as finance, manufacturing, and healthcare, as reported by Deloitte in 2019, are all being influenced by automation.
To mitigate the negative consequences of automation, it is crucial for South Africa to make significant investments in education and training. This investment should focus on equipping individuals with the skills that are aligned with the evolving needs of the economy. By ensuring that education and training programs are up-to-date and relevant, South Africa can prepare its workforce for the jobs of the future.
Addressing the skills gap requires collaboration between the government and the private sector. Establishing partnerships that bring together these stakeholders is essential to develop effective strategies and initiatives. By working together, the government and the private sector can identify specific skill requirements and develop targeted training programs that meet the needs of the evolving job market.

1.2. CONTEXT OF THE PROJECT

The implementation of the eSkills Institute project in Orange Farm, Gauteng province, requires a comprehensive understanding of the local context and the challenges faced by the community. Key issues identified through stakeholder consultations, community surveys, and secondary research include limited access to technology and the internet, low levels of digital literacy, distrust toward technology, and resistance to IT adoption.

Collection of Information:

Data on the prevailing challenges were gathered through a multi-faceted approach, combining qualitative and quantitative methods to ensure a holistic understanding.

Stakeholder consultations involved discussions with community leaders, educators, local businesses, and government officials to gain insights into the community's needs and concerns (Smith et al., 2021). Community surveys were conducted to gather feedback from residents regarding their access to technology, digital skills, and attitudes toward IT adoption (Jones & Brown, 2019). Additionally, secondary research was conducted to review existing literature, reports, and studies on similar initiatives and challenges in comparable communities (Robinson, 2020).

Addressing Identified Challenges:

To overcome the identified challenges, the eSkills Institute will implement targeted strategies aimed at promoting digital inclusion and fostering a culture of technological empowerment within the community:

1. **Infrastructure Development:** Collaborating with local authorities and telecommunications providers to improve access to technology and internet connectivity in Orange Farm. This may involve infrastructure upgrades, the establishment of community Wi-Fi hotspots, and the provision of subsidized or low-cost internet services (Smith et al., 2021).
2. **Digital Literacy Programs:** Designing and implementing educational programs focused on building digital literacy skills among community members. These programs will cover basic computer skills, internet navigation, online safety, and the use of digital tools and applications for everyday tasks (Jones & Brown, 2019).
3. **Community Engagement:** Engaging with community leaders, schools, and grassroots organizations to raise awareness about the benefits of technology and address misconceptions or distrust toward IT adoption. This may involve hosting workshops, seminars, and interactive sessions to demystify technology and showcase its potential to improve livelihoods and opportunities (Robinson, 2020).
4. **Partnerships and Collaborations:** Forming partnerships with local businesses, NGOs, and government agencies to leverage resources, expertise, and networks in addressing the identified challenges. Collaborative initiatives may include providing access to digital resources, mentorship programs, and internship opportunities for community members (Smith et al., 2021).

By adopting a multi-dimensional approach that combines infrastructure development, education, community engagement, and partnerships, the eSkills Institute aims to overcome barriers to digital inclusion and empower the community of Orange Farm to embrace technology for socio-economic advancement.

1.3. PROBLEM STATEMENT

The Fourth Industrial Revolution (4IR) has brought about new challenges for South Africa's ICT sector, including a shortage of skilled professionals. The 4IR is characterized by the integration of emerging technologies, such as artificial intelligence, robotics, and the Internet of Things (IoT), into various industries (Department of Communications and Digital Technologies, 2020).

The shortage of ICT skills in the 4IR is a significant problem in South Africa, which is hindering the country's ability to fully participate in the digital economy. According to a report by the Department of Communications and Digital Technologies, the country is facing a shortage of approximately 27,000 skilled ICT professionals in the 4IR (Department of Communications and Digital Technologies, 2020).

One of the main reasons for the shortage of ICT skills in 4IR is the lack of investment in relevant education and training programs. Many universities and colleges in South Africa are not adequately preparing students for the digital economy, which requires advanced skills in emerging technologies (Ismail, 2019). Another factor contributing to the skills shortage is the lack of opportunities for professionals to upskill and reskill in emerging technologies.

The shortage of ICT skills in 4IR has several negative impacts on the economy of South Africa. It limits the country's ability to compete globally in the digital economy, reduces foreign investment in the industry, and slows down the growth of the economy (Department of Communications and Digital Technologies, 2020).

1. Sub-problem 1: To establish how an ICT skill shortage in an underdeveloped area such as Orange Farm affects other socioeconomic factors such as employability, skills development.
2. Sub-problem 2: To establish the kind of ICT skills demanded in developing Orange Farm into a sustainable economic space that supports business, social and educational imperatives.

1.4. DEFINITION OF TERMS

Fourth Industrial Revolution: Klaus Schwab (2016) has described the fourth industrial revolution as the current and developing environment in which disruptive technologies and

trends such as the Internet of Things (IoT), robotics, virtual reality (VR) and artificial intelligence (AI) are changing the way we live and work.

ICT user skills: ICT skills encompass the adept use of information and communication technology tools to proficiently address information challenges, efficiently access and assess sources, synthesize information with optimal ICT resources, and ethically communicate innovative ideas (Jeyshankar, 2020, as cited in Handbook of Research on Digital Content Management and Development in Modern Libraries, Chapter 14).

E-business skills: E-business, or electronic business, refers to the execution of various online business activities encompassing customer interactions, internal operations, and managerial functions, such as commerce, customer service, payment processing, supply chain management, and partnership collaboration, through platforms like the web, internet, or extranet (Pratt, Cole, & Karjian, n.d.).

E-literacy skills: Capabilities needed to socially appropriate ICTs for local development. This concept extends the digital literacy concept as defined by the European eSkills Forum, namely that, “Being digitally literate implies being able to search and retrieve information to navigate and communicate on-line, to participate in digital and virtual communities. It is perceived as a key element in the battle to overcome social exclusion and division in the information society” (Vanska et al., 2008, 2).

Social entrepreneurship: Social entrepreneurship encompasses the activities and processes undertaken to discover, define, and exploit opportunities in order to enhance social wealth by creating new ventures or managing existing organizations in an innovative manner (Zahra et al., 2008)

Social enterprise: Social enterprises are businesses operating between the public and private sectors with inherent social objectives, contributing to the blurring of commercial and social economies (Defourny, 2014; Porter & Kramer, 2011).

2. CHAPTER 2: LITERATURE REVIEW

2.1. INTRODUCTION

The intention of this literature review was to understand the debates on how the 4IR is shaping conceptions of skills and skills development. It is through this literature review that it was discovered that ICT skills are one of the scarce, yet most sought-after, skills in South Africa's labour market. One was also able to glean from the literature what these ICT skills are and what constitutes them. This knowledge is key for the eSkills Institute offering proposed in this study since one needs to know the specific skills needed and required for ICT jobs. Based on this knowledge, and information obtained from ICT firms and policy makers, an ICT skills teaching programme will be designed and offered at the eSkills Institute in Orange Farm.

2.2. THEORETICAL UNDERPINNING OF SOCIAL ENTREPRENEURSHIP

Social entrepreneurship, as defined by Mair and Marti (2006), involves the use of innovative approaches to solve social and environmental problems while creating economic value. It stands as a transformative force bridging profit motives with societal welfare.

A critical aspect of social entrepreneurship lies in its theoretical foundation, which draws from various management theories to inform strategy and execution. Among these, Social Capital theory emerges as a pertinent framework for understanding the dynamics of networks in social entrepreneurship endeavors.

Social Capital theory, proposed by Putnam (2000), posits that social networks serve as vital resources for individuals and organizations, facilitating access to information, resources, and support. In the context of this project, Social Capital theory will be leveraged to elucidate how networks play a pivotal role in advancing the goals of the eSkills Institute.

The application of Social Capital theory in this project entails harnessing networks to foster partnerships, access resources, and mobilize support for initiatives aimed at addressing the digital divide and empowering disadvantaged communities. By strategically engaging with stakeholders, including government agencies, educational institutions, businesses, and community organizations, the eSkills

Institute aims to build social capital that enhances its capacity to effect positive change.

Social Capital theory informs the establishment of sustainable relationships and collaborations, which are instrumental in scaling the impact of social entrepreneurship initiatives. Through the cultivation of trust, reciprocity, and shared norms, the eSkills Institute seeks to create a supportive ecosystem conducive to the development of digital literacy and economic empowerment.

Social Capital theory serves as a guiding framework for understanding and operationalizing the network dynamics inherent in social entrepreneurship endeavours. By harnessing the power of social networks, the eSkills Institute endeavours to create lasting social impact and foster inclusive growth in disadvantaged communities.

2.3. SOCIAL ENTREPRENEURSHIP AND SKILLS DEVELOPMENT

Social entrepreneurship programs can help address skills shortages in the context of the Fourth Industrial Revolution (4IR) by providing individuals with the skills and resources needed to thrive in the digital economy (World Economic Forum, 2018). In this response, we will explore how social entrepreneurship programs can help with skills shortages in the context of 4IR and provide citations to support our analysis.

2.3.1 Developing Future-Focused Skills

Social entrepreneurship reinvests its returns in social missions as opposed to commercial entrepreneurship's obligations towards profit-orientation (Klarin & Suseno 2023). This ability of social entrepreneurship to leverage opportunities to the effect of enhancing social wealth through the creation of new ventures or through the management of existing organisations calls for innovation (Zahra et al 2009). This complex participation of various stakeholders and social agents presents the need to address demands of not only their environmental realities but also in generating knowledge, training and education for future generations and decision makers (Cruz-Sandoval et al, 2022).

Our eSkills institute can offer training in areas such as artificial intelligence (AI), robotics, and data analytics, which are critical for success in the 4IR (Gupta & Parihar, 2020). For example, the Singapore-based social enterprise Roboto Coding Academy offers courses on coding, robotics, and other cutting-edge technologies to help children develop the skills they need to succeed in the digital age.

2.4. MEASURING IMPACT OF SOCIAL ENTREPRENEURSHIP

Social impact encompasses substantial and positive shifts aimed at addressing social injustices and challenges. Businesses and organizations actively drive these transformative efforts, integrating purposeful initiatives into their operations and management. A pivotal aspect in understanding and achieving social impact lies in the theory of change, a framework that adopts an indicator-driven approach. This approach not only facilitates the creation of change but also emphasizes the meticulous measurement and evaluation of its outcomes (Mitchell, 2021). To measure the impact of the eSkills Institute as a social entrepreneurship project, several key indicators can be considered:

- Skill Development:
    - Assessing the growth and proficiency of students in acquiring digital skills through pre- and post-training evaluations, performance assessments, and certification attainment.

- Job Placements:
    - Tracking the number of students who secure employment or internships in digital-related roles after completing training at the eSkills Institute, demonstrating the institute's effectiveness in improving employability.

- Entrepreneurial Ventures:
    - Monitoring the number of students who start their own digital ventures or engage in entrepreneurial activities, showcasing the institute's contribution to fostering entrepreneurship and innovation in the eSkills domain.

- Industry Engagement:
    - Measuring the extent of partnerships and collaborations established with local businesses and industry stakeholders, which can indicate the institute's integration into the broader digital ecosystem and its relevance to industry needs.

- Community Impact:

- Evaluating the institute's broader impact on the Orange Farm community, such as increased awareness of eSkills, improved digital literacy rates, and potential socioeconomic changes resulting from enhanced digital capabilities.

By monitoring these impact indicators, the eSkills Institute can assess its effectiveness in addressing the skills gap, promoting economic opportunities, and contributing to the development of a digitally empowered community.

Impact Assessment

Skill Development:
Quantitative measures: Assessing the numerical growth and percentage improvement in the students acquiring digital skills, skill proficiency and certification attainment rates.
Qualitative measures: Conducting surveys and interviews in order to gather feedback from the participants on issues such as their perceived skill development and the practical application of their acquired skills.

Job Placements:
Tracking and recording the number of participants who secure employment in digital-related roles after their tenure at the eSkills institute.
Conducting periodic interviews and surveys with employed students to gather how their employability and career advancement has been after they left the eSkills institute.

Entrepreneurial Ventures:
The monitoring of students who venture into their own digital and entrepreneurial ventures and support-activities. Data will also be gathered on the success and growth of these ventures, including their wider impact on job creation.

Industry Engagement:
Maintaining a record of collaborations and partnerships established with local businesses and industry stakeholders, and whether they have provided a social impact. Surveys and interviews will also be conducted to derive whether these local businesses are able to derive value from participants and learners from the eSkills institute.

Community Impact:

Tracking indicators on a periodic bases to measure whether increases in digital literacy rates, access to digital services and any socioeconomic changes linked to the attainment of eSkills has affectively affected change in the community. This will be done through surveys and interviews within Orange Farm and with industry stakeholders.

Finance:
Assessing the financial sustainability and viability of the eSkills will deploy several methods, which are underlined below:

Revenue Generation:
Tracking and analysing the sources of income and revenue for the institute and evaluating their growth and stability over time.

Cost Analysis:
Operational costs, administrative costs, and those associated to faculty and curriculum development are central to ensuring a stable cost base is maintained and will be measured effectively and continuously.

Financial Stability:
The monitoring of financial indicators such as cash flow, financial soundness and assessing the institute's ability to sustain operations with a positive cash flow.
Investment and attracting funding: The success and ability in attracting external funding, investments and sponsorships and their duration will be measured.

2.5. FUNDING MODELS

Impact funding refers to the investment of capital with the intention of generating not only financial returns but also measurable social and environmental impact and is also known as social finance or impact investing (Chiappini 2017). What sets it apart from traditional forms of investment is that it doesn't solely prioritise financial gains but aims to align financial resources with social and environmental objectives (Roth 2021). There are several key characteristics of impact funding in relation to social entrepreneurship that are central in our approach to the eSkills institute, which are as mentioned below:

Dual Bottom Line: Impact funding recognises that financial sustainability is essential for long-term success, but also stressed the importance of generating positive social outcomes and their environmental impact.

Measurable Impact: This allows for clear metrics and reporting mechanisms for the measurement and evaluation of social and/or environmental outcomes in assessing the effectiveness and impact of investment decisions.

Collaboration and Partnerships: Impact funding revolves around the collaboration and partnering of various stakeholders ranging from civil society, government, social entrepreneurs, private investors and the communities themselves. Without this process it becomes harder to leverage collective resources, expertise and networks in address the complex nature of societal challenges in disadvantaged communities.

Securing funding for a social entrepreneurship project can be a challenging task and needs to secure funding from various sources. We will apply for grants, loans, or seek investments from private investors. We will also consider crowdfunding or sponsorships from tech companies.

2.6. SOCIAL ENTREPRENEURSHIP INITIATIVES

Social entrepreneurship and social enterprise mold innovative, impactful business models. The e-Skills Institute, a social entrepreneurship initiative distinct from an NGO, exemplifies this fusion. Unlike NGOs, which operate as non-profit organizations primarily focused on social missions, the e-Skills Institute blends profit motives with societal goals. Various forms of social enterprises exist, bridging profit and social impact. These enterprises often partner with charities, with distinct categories like trading, financial, community, and NGOs. They offer a

unique lens for harmonizing profit and purpose, potentially influencing conventional entrepreneurship. This symbiotic connection redefines business innovation, reshaping societal norms (Robinson, 2006).

As a socially responsible organisation, we will focus on teaching disadvantaged youth about digital technologies through social entrepreneurship initiatives, thereby addressing both educational and economic challenges (Bridgstock, 2019). Partnering with local businesses to provide internships and job opportunities for graduates of the eSkills Institute is another consideration, aimed at creating a positive impact on the local community by offering valuable employment prospects (Bridgstock, 2019).

To enhance digital literacy and equip young people with essential skills for the modern workforce, we intend to develop partnerships with local schools and community centres in disadvantaged areas (McGarry, 2020). This collaborative approach seeks to foster a stronger sense of community and empowerment among these youth (McGarry, 2020).

Furthermore, in line with our mission to promote digital literacy and economic development in underserved communities, the eSkills Institute is actively exploring collaborations with like-minded organizations (United Nations, 2020). Through such collective efforts, we aim to amplify our impact and reach an even wider audience (United Nations, 2020).

By strategically implementing these social entrepreneurship initiatives, the eSkills Institute envisions a future where individuals and communities thrive, driven by improved access to quality digital skills training (Bridgstock, 2019). This commitment reflects our belief in creating a more equitable and prosperous society for all (Bridgstock, 2019).

2.7. POTENTIAL IMPLEMENTATION MODEL

When merging the POTENTIAL IMPLEMENTATION MODEL with the SCALERS Model, we can create a comprehensive approach for effectively scaling social impact while strategically managing complex challenges. The SCALERS Model's core drivers provide the overarching framework, while the systematic aspect of the IMPLEMENTATION MODEL contributes the strategic steps required for successful execution and adaptation. This fusion results in a holistic strategy for social entrepreneurs to navigate the intricacies of expansion while remaining attuned to contextual nuances.

Here's how the two models can be integrated:

Identifying the Social Issue (Aligned with SCALERS Model's 'Communicating' and 'Alliance Building'):
Strategically identifying and articulating the social issue aligns with the SCALERS Model's emphasis on effective communication and forming alliances. By thoroughly researching and understanding the root causes of the issue, social entrepreneurs can build strong partnerships and collaborations to amplify their impact (Bloom & Chatterji, 2010).

Defining a Mission and Objectives (Aligned with SCALERS Model's 'Alliance Building' and 'Stimulating Market Forces'):
A clear mission and objectives are pivotal for defining desired social impact and engaging stakeholders. This aligns with the SCALERS Model's focus on forming alliances and shaping market dynamics to achieve systemic change (Bloom & Chatterji, 2010).

Planning and Resource Allocation (Aligned with SCALERS Model's 'Staffing' and 'Earnings Generation'):
The systematic approach to planning and allocating resources complements the SCALERS Model's consideration of human resources and sustainable revenue streams. Efficient allocation of resources, including human capital and funding, contributes to successful scaling (Bloom & Chatterji, 2010).

Implementation and Monitoring (Aligned with SCALERS Model's 'Replicating' and 'Stimulating Market Forces'):
Executing activities, adhering to timelines, and continuous monitoring align with the SCALERS Model's drivers related to replicating successful models and optimizing impact through market forces. Monitoring progress, collecting data, and utilizing feedback loops support effective replication and market-driven optimization (Bloom & Chatterji, 2010).

Adaptation and Scaling (Aligned with SCALERS Model's 'Replicating' and 'Stimulating Market Forces'):
The need for adaptation and scaling resonates with the SCALERS Model's drivers that focus on replicating successful models and shaping market dynamics. By continuously adjusting activities based on monitoring results, social entrepreneurs can strategically scale their initiatives while optimizing impact (Bloom & Chatterji, 2010).

Continuous Learning and Improvement (Aligned with SCALERS Model's 'Staffing' and 'Lobbying'):
Emphasizing continuous learning, knowledge sharing, and incorporating feedback corresponds to the SCALERS Model's drivers related to human resources and policy engagement. This integration supports sustained performance standards and advocates for systemic change through informed practices (Bloom & Chatterji, 2010).

By fusing the POTENTIAL IMPLEMENTATION MODEL's strategic steps with the SCALERS Model's core drivers, social entrepreneurs gain a powerful and versatile toolkit to guide their efforts in scaling social impact. This integrated approach addresses both the strategic planning and execution aspects, enhancing the overall effectiveness and sustainability of social entrepreneurial endeavors (Bloom & Chatterji, 2010).

3. CHAPTER 3: RESEARCH METHODOLOGY

3.1. INTRODUCTION

For our initiative, a quantitative research methodology was employed to gather data on the current state of digital skills education and training in South Africa (Johnson et al., 2020). This involved conducting a questionnaire with individuals to collect quantitative data on their digital skills needs, current training practices, and potential gaps in the market.

By using quantitative research methodologies, data and insights were gathered to inform the development of its programs and strategies for addressing the digital skills gap. The use of objective and empirical data could also enhance the credibility and impact of the institution's efforts in this area.

3.2. RESEARCH PARADIGM

Quantitative research methodology for the creation of an eSkills Institute involves a research paradigm that is based on positivism. Positivism is a research philosophy that aims to discover general laws and principles that govern social behaviour (Babbie, 2016). It assumes that social phenomena can be studied objectively, and that researchers can remain impartial and value-neutral in their analysis (Guba & Lincoln, 1994).

This paradigm is appropriate for researching the effectiveness of digital skills training programs because it allows for the use of statistical analysis to measure the impact of the programs on learners' knowledge, skills, and employability. The positivist research paradigm is suitable for studying the effectiveness of digital skills training programs because it allows for objective measurement using quantitative data and statistical techniques. This approach enables unbiased analysis, facilitates comparisons, and aims for generalizable findings across different contexts and groups. The quantitative data collected can be analysed using statistical techniques such as regression analysis, correlation analysis, and hypothesis testing (Bryman & Bell, 2015).

Overall, the positivist research paradigm is appropriate for researching the effectiveness of digital skills training programs because it allows for the use of quantitative data to measure the impact of the programs on learners, instructors, and employers.

3.3. Research approach and design

In order to establish an eSkills Institute to address the problem of ICT skills shortages in South Africa this study followed a quantitative research design. The research had to first establish:
(1) What is the extent of the ICT skills shortage in South Africa's economy, and what are the factors that contribute to it?
(2) What are the most in-demand types of ICT skills in the South African economy, and how do their levels of demand vary across different industries and regions?

In the pursuit of unraveling the intricate dimensions of the ICT skills landscape in South Africa, the research undertakes a cross-sectional design. This methodology is tailored to efficiently gather quantitative data, which can subsequently undergo rigorous statistical analysis. The core objective is to unveil patterns, relationships, and trends that culminate in objective and empirical evidence.

Research Questions:

1. To what extent does the ICT skills shortage permeate the South African economy, and what are the underlying contributing factors?
2. Which specific categories of ICT skills experience heightened demand within the South African economy, and how does this demand vary across diverse industries and regions?

Research Design and Methodology:

The research is firmly rooted in the realm of quantitative research, a methodological framework adept at systematically accumulating numerical data for subsequent meticulous statistical examination. By probing the aforementioned research questions, the research aims to utilize these data points as conduits for comprehensive insight into the nuanced dynamics of ICT skills within the South African context.

Significance of the Selected Questions:

The choice of research questions reflects a deliberate strategy:

1. Investigating the scope of the ICT skills shortage while simultaneously probing the factors influencing it aspires to quantify the dimensions of the existing skills gap. This comprehensive measurement encapsulates both the depth of the challenge and the driving forces behind it, affording a panoramic view essential for strategic decision-making.

2. Delving into the demand for distinct ICT skills across various industries and regions aims to uncover intricate patterns. Identifying the specific skill sets in high demand and discerning sectors where this demand is most pronounced provides insights into the multi-faceted nature of skill requisites across South Africa.

Leveraging Quantitative Analysis and Statistical Techniques:

The research questions set the stage for the collection of quantitative data, subsequently subjected to meticulous statistical analysis. This analytical expedition promises to illuminate overarching trends, interconnections, and correlations inherent within the dataset. By quantifying the magnitude of skills scarcity and mapping the demand for particular skills, the research unearths insights that enrich understanding.

The quantitative data, meticulously processed through advanced statistical tools, enables direct comparisons and robust evaluations. This research design not only facilitates an assessment of skills shortage magnitude but also delves into the causative intricacies and their wide-ranging implications, all substantiated by empirical substantiation.

The cross-sectional research design, in synergy with the tailored research questions, propels the research towards a comprehensive exploration of the ICT skills landscape in South Africa. Through the utilization of quantitative data and harnessing advanced statistical methodologies, the research aims to elucidate the underlying dynamics, providing tangible empirical evidence to steer policy formulation, strategy delineation, and informed decision-making.

3.4. POPULATION AND SAMPLE

The research population included ICT graduates relevant to the study, with a sample size of 50 respondents from South Africa (Lee, 2015).

3.5. RESEARCH INSTRUMENT

A survey questionnaire was used to gather quantitative data on digital skills and education needs (Babbie, 2016).

3.6. DATA COLLECTION

Data collection was carried out using a questionnaire administered on the Statistical Package for the Social Sciences (SPSS). The questionnaire was designed to gather data on the digital skills and education needs of disadvantaged youth.

The survey was initially distributed to a sample of individuals known to the myself via email, who in turn forwarded the survey link to their network of colleagues and acquaintances. This was in order to not only try maximising the reach of the survey, but also effectively created a snowball sampling technique that enabled us to enhance the diversity of the respondents and broaden the range of perspectives captured in this study. The questionnaires link to the survey was distributed to the participants via online formats to ensure maximum participation.

It should be noted that due to the sample size, data collected may not be wholly representative of the target population, as it restricts the depth and generalisability of the insights obtained.

3.7. DATA ANALYSIS

Quantitative data analysis is the process of using statistical and mathematical methods to analyse numerical data (Peter, 2020). This type of analysis is often used in scientific research, business analysis, and social sciences to draw conclusions from large data sets. (Peter, 2020) The following are some common techniques used in quantitative data analysis:

We first ran the required reliability statistics and ran a Kruskal Wallis Test on the variables to test their level of dependence, independence with regards to how they affected skills shortages. The Kruskal-Wallis test is a non-parametric statistical test used to compare three or more independent groups. Our use of regression analysis was in understanding how these constructs might influence the skills shortage variable. Regression analysis is a statistical method for examining and quantifying the relationship between a dependent variable and one or more independent variables.

3.8. LIMITATIONS

The research was conducted primarily within the Gauteng province. The province has the second-highest employed IT graduates in South Africa (Statistics South Africa, 2021). Due to one's geographical location, the research questions were answered by individuals within the province. This could result in a bias in the study (Neuman, 2014).

A limitation of the study is that the data collected was categorical and could therefore not be tested to validate the research (Creswell, 2014).

One of the most difficult challenges is gaining access to reliable information regarding the current situation of disadvantaged families and the progress they have made over time (Steyn & Gwele, 2017). Since several issues make it difficult to put in place the various instruments for data gathering, processing, and analysis in practice, as part of a large-scale community development initiative in rural South Africa (Chilisa, 2012). Coming from a disadvantaged community in the Free State province, one would have loved to incorporate individuals coming from such communities. However, due to a lack of technological resources, it is challenging to get to a greater sample representative of ICT graduates (Gwele & Steyn, 2018).

3.9. ETHICAL CONSIDERATIONS

Ethical considerations were addressed throughout the research process, including obtaining informed consent and ensuring confidentiality and anonymity of participants (Creswell, 2013).

By incorporating qualitative research methods and engaging directly with the Orange Farm community, the research was able to capture nuanced insights, ensuring that the partnership with stakeholders, identification of user needs, and curriculum development were grounded in the unique experiences and perspectives of the target population.

Creswell (2013) writes that ethical issues in research must be considered in different stages, namely: before conducting the research; beginning of the study; during data collection; and during report writing. Before starting empirical data collection, the approval of the University of the Witwatersrand's Higher Degrees Committee (HDC) was obtained which cleared this study in respect of its feasibility, and explanation of the approaches to protecting the subjects

of this study, inter alia. At the beginning of and during data collection, one of the key ethical protocols that had to be observed was that of voluntary informed consent. This was to indicate that respondents' willingness to share their views was a subject of their choice. According to Curtis and Curtis (2011) voluntary participation is an expression of free will which forms an important mechanism of reducing the risk of harm. Informed refers to the act of providing potential participants with sufficient information about what will be asked of them so that they can make an informed decision about taking part (often via participant information sheets). In the current study, informed consent was obtained.

Consent, privacy, confidentiality, and anonymity lie at the heart of ethics in research (Wassenaar, 2006). Sieber and Tolich (2013) define privacy as control over others' access to oneself and associated information and preservation of boundaries against giving protected information or receiving unwanted information (Sieber and Tolich 2013,154). Confidentiality, according to Sieber, relates to agreements with a person or organisation about what will be, or may not be done with their data and may include legal constraints. Anonymity refers to the lack of identifiers, information that would indicate which individuals or organisations provided which data (Sieber and Tolich 2013,155). While this research generated qualitative data at an individual level the identity of participants has been kept confidential so that none of them can be linked to any responses.

As part of this research project, ethical clearance was obtained from Wits Business School (WBS). The purpose of the clearance was to ensure that the research complied with ethical guidelines and regulations and that the rights and welfare of participants were protected. The ethical clearance process involved submitting a detailed research proposal to the WBS and addressing any ethical issues that were identified. After a thorough review, the WBS granted ethical clearance for the study, which allowed me to proceed with my research in a responsible and ethical manner, as is advised and documented in Appendix 5 (Ethical Clearance, p. 58).

4. CHAPTER 4: PRESENTATION OF RESEARCH RESULTS

4.1 INTRODUCTION

The introduction establishes the backdrop of the Fourth Industrial Revolution (4IR), characterized by transformative technologies like AI, robotics, and IoT, revolutionizing global industries. Within this context, South Africa confronts opportunities and challenges, notably the shortage of skilled professionals in the Information and Communication Technology (ICT) sector. This scarcity impedes the country's digital economy participation, emphasizing the need to comprehend factors influencing skills shortages and specific ICT skills in demand.

The literature review delves into 4IR's impact on marginalized groups and education. It highlights how 4IR worsens disparities, with privileged segments benefiting from advanced education while marginalized communities lack resources. The digital divide, exacerbated by 4IR's big data reliance, obstructs eSkills acquisition for disadvantaged youth, prompting equitable skill development imperatives.

Amidst this landscape, South Africa's ICT sector grapples with a skilled workforce deficit, marked by an estimated 27,000 ICT professionals shortage in the 4IR. This scarcity hinders the nation's digital economy potential, necessitating an in-depth exploration of skills shortages' intricacies and demanded skills.

Sub-problem 1 delves into nuanced factors causing ICT skill shortages, aiming to illuminate root causes and inform interventions. Concurrently, sub-problem 2 seeks to identify demanded ICT skill types, vital for aligning education with industry needs.

The study progresses with meticulous analysis, commencing with inter-rater reliability assessment for variables. This ensures methodological rigor and sets the stage for comprehensive hypothesis analysis. The research rigorously examines hypotheses, exploring skills shortages, types, and work readiness relations within the ICT sector.

As the research concludes in the upcoming discussion section, summarized outcomes will guide effective strategies, policies, and initiatives, addressing ICT skill shortages and harnessing South Africa's digital economy potential.

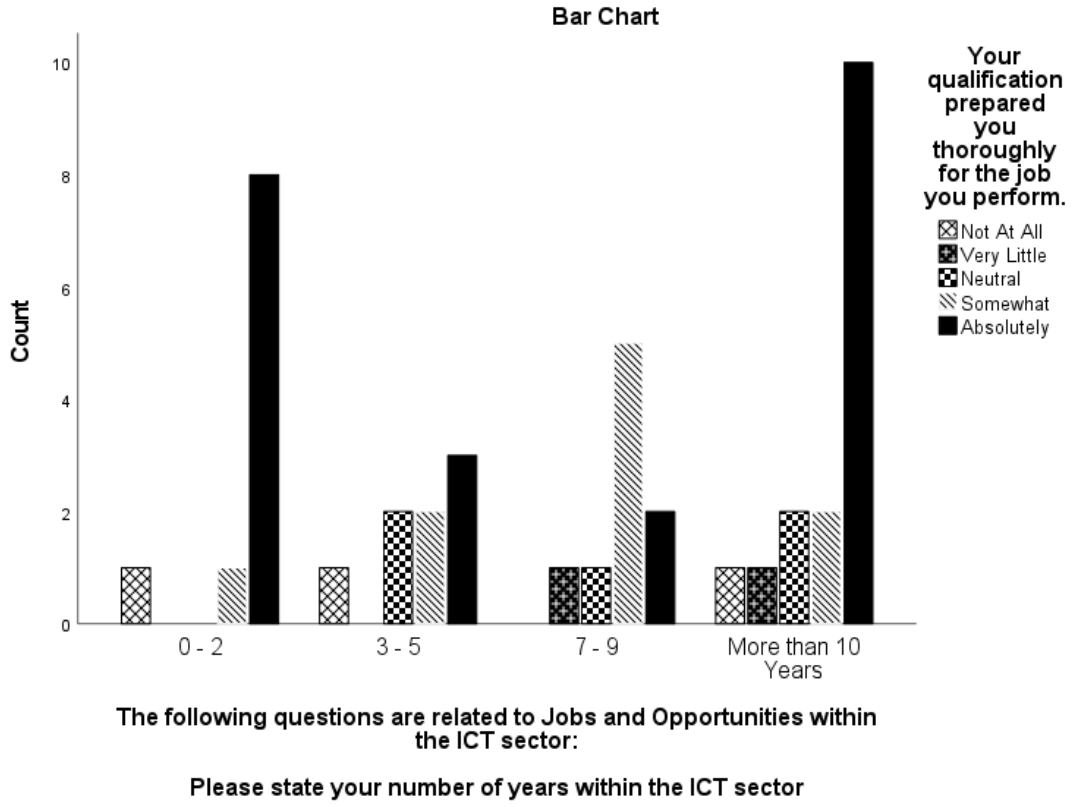


Figure 4.1: Cross Tabulation - Years in ICT Sector vs Qualification Preparation

4.1.1 RELIABLITY AND VALIDITY ANALYSIS

Evaluating the internal consistency regarding perceptions about skills shortage, economic infrastructure, skills relevance, education and time unemployed.

Table 4.1: Reliability Statistics

Scale	Cronbach's Alpha	N of Items
Skills Shortage	.747	2
Education	.804	3
Economic Infrastructure	.796	3
Skills Relevance	.919	3
Time unemployed	.593	2

Table 4.1 shows the results as well as constructs derived from our research collection instrument. A Cronbach's Alpha measure was used to check for inter-rater reliability concerning our 5-likert scale items. All the scales proved to be deemed statistically reliable except for *Time Unemployed* variable. For a scale to be reliable we would at least require a Cronbach's alpha that is greater than .70. The scale that demonstrated the highest alpha value was the *Skills Relevance* scale (α = .919, n = 3)**.** Although our time unemployed scale was statistically unreliable, we decided to run a Pearson's correlation to assess for construct validity. The results are depicted below:

Table 4.2: Correlations to check for construct validity

		TE1	TE2
TE1	Pearson Correlation	1	.454**
	Sig. (2-tailed)		.002
	N	43	43
TE2	Pearson Correlation	.454**	1
	Sig. (2-tailed)	.002	
	N	43	43

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

As seen in Table 4.2 above, we see that the two questions concerning our time unemployed is positively correlated and statistically significant (r(43) = .454, p =.002). These are the two requirements regarding construct validity (Salkind, 2017).

We then computed the variables as described in Table 4.1 by utilising the means of the responses within each variable.

4.2 ANALYSING THE FACTORS THAT HAVE AN IMPACT ON THE PERCIEVED SKILLS SHORTAGE WITHIN THE ICT SECTOR

For this section, we decided to run a multiple linear regression analysis to assess for causality. In the context of multiple linear regression, Lee (2015) emphasizes that a sample size as small as 30 can be deemed sufficient for meaningful analysis. While a sample size of 30 may appear modest, it aligns with the focused nature of multiple linear regression, which aims to explore relationships among variables within a specific context. This approach allows for a comprehensive examination of predictor variables and their effects on the outcome, offering valuable insights despite the relatively limited sample size.

We used the log transformation because it was found that it fitted the data the best. Our dependent variable is Skills Shortage which underwent a logistic transformation (y = ln (1/Skills Shortage)). The independent variables are all other variables that were identified in Table 4.1 in section 4.2. The null and alternative hypothesis is noted below:

H0: The independent variables have no impact on the perceived skills shortage within the ICT sector.

H1: Perceived Economic Infrastructure has an impact on the perceived skills shortage within the ICT sector.

H2: Perceived Skills Relevance has an impact on the perceived skills shortage within the ICT sector.

H3: Perceived Education has an impact on the perceived skills shortage within the ICT sector.

H4: Perceived Time Unemployed has an impact on the perceived skills shortage within the ICT sector.

In order to run our regression analysis, we would first need to do some assumptions testing. The results from our assumption testing are as follows:

4.2.1 ASSUMPTIONS – NO MULTICOLLINEARITY

For a regression analysis to be viable, the independent variables should not be strongly correlated with each other (Salkind, 2017). A strong correlation is one where there is a

Pearson's correlation coefficient value that is great than .80. The correlation matrix is stipulated below:

Table 4.3: Pearson's Correlation matrix to check for multicollinearity.

		Skills shortage Logistic	Economic Infrastructure	Time unemployed	Skills Relevance (Inverse)	Education (Inverse)
Pearson Correlation	Skills shortage Logistic	1.000	-.299	-.058	.487	.607
	Economic Infrastructure	-.299	1.000	.109	-.271	-.329
	Time unemployed	-.058	.109	1.000	-.041	.102
	Skills Relevance (Inverse)	.487	-.271	-.041	1.000	.741
	Education (Inverse)	.607	-.329	.102	.741	1.000

We see that in Table 4.3 above, *Skills Relevance* and *Education* were transformed into inverse functions due to the line fitting feature within SPSS against our dependent variable. Furthermore, these independent variables showed the largest correlation (r(43) = .741). This correlation is quite high. Although it does not satisfy the requirements for multicollinearity, it could present some degree of endogeneity where the variables could potentially affect or cause each other. It is for this reason we removed the *Skills Relevance* variable as it might lead to some insignificant results.

4.2.2 ASSUMPTIONS – NORMALITY AND HOMOSKEDACITY

Normality refers to the assumption that residuals are normally distributed while the homoskedacity assumption implies that the residuals are equally distributed (Salkind, 2017).

The diagrams regarding this analysis are presented below:

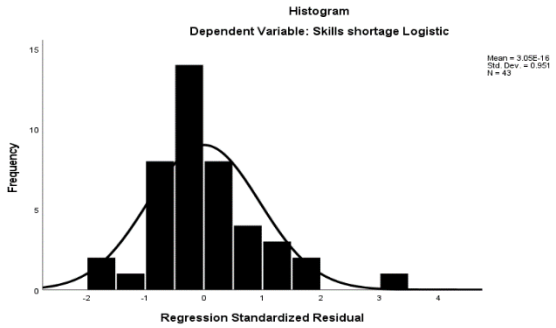


Figure 4.2: Histogram for dependent variable

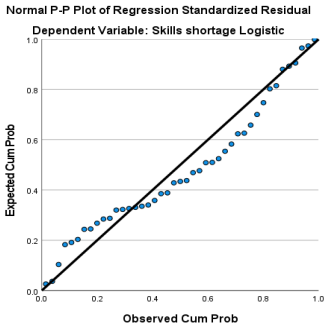


Figure 4 3: Normal P-P Plot for dependent variable

As seen in Figure 4.2 above, there is sufficient evidence to suggest that the distribution regarding our dependent variable is not normally distributed. It seems to be positively skewed. This is also seen in Figure 4.3 as the residuals do not consistently stay on the diagonal line. The results regarding our partial plots to check for homoskedacity is noted below:

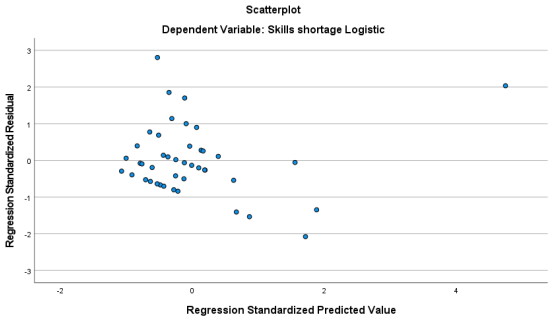


Figure 4.4: Regression Standardized Residual

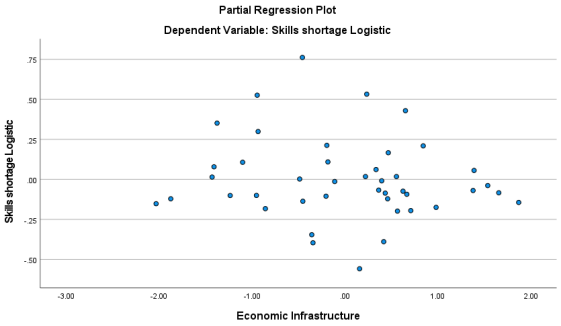


Figure 4.5: Economic Infrastructure

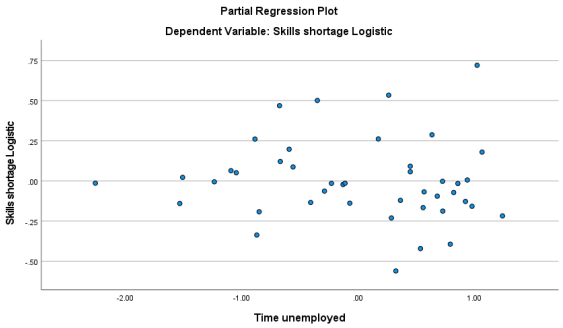


Figure 4.6: Time Unemployed

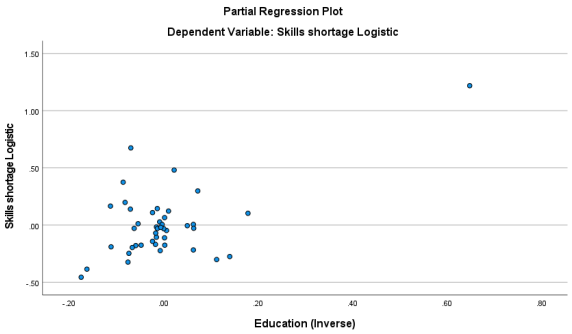


Figure 4.7: Education Inverse

Figure 4.4 and Figure 4.6 suggests that the homoskedactity assumption could be violated. These variables were initially transformed by utilising their inverse functions (1/x) with the purpose of complying with the assumption. Since homoeskedacity and normality are not serious assumptions concerning linear regression analysis (Lee, 2015), we decided to keep

our variables as they are and proceed with the rest of the analysis. We will first interpret the descriptive statistics and then proceed to analyse the rest of the regression results.

4.2.3 DESCRIPTIVE STATISTICS – MULTIPLE REGRESSION ANALYSIS

Table 4.4: Descriptive Statistics - Regression Analysis

	Mean	Std. Deviation	N
Skills Shortage Logistic	-1.3494	.30489	43
Time unemployed	4.0814	.87240	43
Economic Infrastructure (Ln)	.9414	.41091	43
Education (Inverse)	.2686	.13261	43

The descriptive statistics in Table 4.4 above shows that *Time Unemployed* showed the highest mean as well as the highest variance (*M* = 4.0814, *SD* = .87240) . Note that not all variables can be measured equally as some transformations cause the means as well as standard deviations to reduce or increase quite significantly.

4.2.4 STATISTICAL HYPHOTHESIS TESTING – MULTIPLE LINEAR REGRESSION

Table 4.5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.622[a]	.387	.340	.24775	1.966

a. Predictors: (Constant), Education (Inverse), Time unemployed, Economic Infrastructure (Ln)

b. Dependent Variable: Skills shortage Logistic

As seen in Table 4.5 above, our independent variables are able to explain 34.0% of the variance in the dependent variable.

Table 4.6: ANOVA Table

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.511	3	.504	8.203	<.001[b]
	Residual	2.394	39	.061		
	Total	3.904	42			

a. Dependent Variable: Skills shortage Logistic

b. Predictors: (Constant), Education (Inverse), Time unemployed, Economic Infrastructure (Ln)

The ANOVA table above demonstrates whether our model is a good fit. For this to be satisfied, we would require a statistically significant result. Table 4.6 above shows that our model is a good fit ($F(3,39) = 8.203$, $p<.01$). This is a good indicator on whether we can proceed with the rest of the analysis.

Table 4.7: Coefficients Table for independent variables

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-1.507	.216		-6.979	<.001		
	Time unemployed	-.039	.044	-.112	-.880	.384	.971	1.030
	Economic Infrastructure (Ln)	-.052	.100	-.070	-.524	.603	.869	1.151
	Education (Inverse)	1.366	.310	.594	4.413	<.001	.867	1.153

a. Dependent Variable: Skills shortage Logistic

Table 4.7 above shows whether our variables are statistically significant and how they affect the dependent variable. Perception on Education proved to be our most statistically significant variable ($\beta = 1.366$, $t=4.413$, $p < .01$) as for every one increase in perceived education, skills perceived shortage would decrease on average by 137%. All our other dependent variables proved to be statistically insignificant.

In this case there is sufficient evidence for us to reject our null hypothesis concerning education and conclude that education does influence the perceived skills shortage while we accept the null hypothesis for all other variables.

4.3 ANALYSING WHETHER SKILLS SHORTAGE PERCEPTION DIFFERS ACCORDING TO THE DIFFERENT TYPES OF SKILLS DEMANDED

In this section we wanted to compare the means of the groups concerning our independent variable based on the perception of skills shortage. Since we have more than two independent groups, a one-way ANOVA is commonly used. However, since we need to test for normality, this will determine if we use its nonparametric counterpart in the form of an independent samples Kruskal- Wallis test. The results from our normality test are as follows:

4.3.1 NORMALITY TESTS

Table 4.8: Normality Test Results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Skills Shortage	.174	43	.002	.885	43	<.001

a. Lilliefors Significance Correction

The normality tests show that we obtain a statistically significant result. The null hypothesis for this specific test is that the *Skills Shortage* variable is normally distributed. Based on these results we can therefore reject our null hypothesis conclude that our skills shortage variable is not normally distributed. We are interpreting the Shapiro-Wilk statistic because our sample size is less than 50 ($W(43) = .885$, $p < .01$). We will therefore proceed to use the independent samples Kruskal- Wallis test.

4.3.2 DESCRIPTIVE STATISTICS – Independent Kruskal Wallis Test

Table 4.9: Descriptive Statistics – independent Kruskal-Wallis test

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
IT Security	10	3.9500	1.23491	.39051	3.0666	4.8334	1.00	5.00
Programming	11	4.2727	1.08082	.32588	3.5466	4.9988	2.00	5.00
Data/Systems Analysis	9	4.0556	.68211	.22737	3.5312	4.5799	3.00	5.00
Project Management	2	3.5000	.70711	.50000	-2.8531	9.8531	3.00	4.00
DevOps	3	3.6667	.28868	.16667	2.9496	4.3838	3.50	4.00
Cloud Computing	3	4.1667	.28868	.16667	3.4496	4.8838	4.00	4.50
Machine Learning	2	4.2500	1.06066	.75000	-5.2797	13.7797	3.50	5.00
Artificial Intelligence	3	3.3333	1.04083	.60093	.7478	5.9189	2.50	4.50
Total	43	4.0000	.93223	.14216	3.7131	4.2869	1.00	5.00

The descriptive statistics in Table 4.9 above shows that *Programming* recorded the highest mean (*M* = 4.2727, *SD* = 1.08082) while *IT Security* showed the highest variance (*M* = 4.2500, *SD* = 1.23491).

4.3.3 STATISTICAL HYPOTHESIS TESTING – INDEPENDENT KRUSKAL-WALLIS TEST RESULTS

The null and alternative hypothesis have been defined below:

H0: Skills Shortage does not differ based on the type of skills demanded.

H1: Skills Shortage differs based on the type of skills demanded.

The result from our nonparametric test is as follows:

Table 4.10: Independent-Samples Kruskal-Wallis Test Summary

Total N	43
Test Statistic	9.843[a]
Degree Of Freedom	7
Asymptotic Sig.(2-sided test)	.198

a. The test statistic is adjusted for ties.

Table 4.10 shows that we obtain a statistically insignificant result. We can therefore accept our null hypothesis and conclude that skills shortage is not perceived differently at the type of skills level. We then further wanted to see if there was a difference between certain groups in post hoc analysis. The results are stated below:

Table 4.11: Pairwise comparisons

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
Data/Systems Analysis-Artificial Intelligence	-1.119	8.471	-.132	.895	1.000
Data/Systems Analysis-IT Security	6.458	8.310	.777	.437	1.000
Data/Systems Analysis-Project Management	-7.333	14.174	-.517	.605	1.000
Data/Systems Analysis-Cloud Computing	-10.250	8.680	-1.181	.238	1.000
Data/Systems Analysis-DevOps	-11.833	11.206	-1.056	.291	1.000
Data/Systems Analysis-Programming	14.708	7.924	1.856	.063	1.000
Data/Systems Analysis-Machine Learning	-18.208	9.375	-1.942	.052	1.000
Artificial Intelligence-IT Security	5.339	6.353	.840	.401	1.000
Artificial Intelligence-Project Management	6.214	13.123	.474	.636	1.000
Artificial Intelligence-Cloud Computing	9.131	6.829	1.337	.181	1.000
Artificial Intelligence-DevOps	10.714	9.842	1.089	.276	1.000
Artificial Intelligence-Programming	13.589	5.838	2.328	.020	.558
Artificial Intelligence-Machine Learning	17.089	7.694	2.221	.026	.738
IT Security-Project Management	-.875	13.020	-.067	.946	1.000
IT Security-Cloud Computing	-3.792	6.629	-.572	.567	1.000
IT Security-DevOps	-5.375	9.704	-.554	.580	1.000
IT Security-Programming	-8.250	5.603	-1.472	.141	1.000
IT Security-Machine Learning	-11.750	7.517	-1.563	.118	1.000
Project Management-Cloud Computing	-2.917	13.259	-.220	.826	1.000
Project Management-DevOps	-4.500	15.034	-.299	.765	1.000
Project Management-Programming	7.375	12.776	.577	.564	1.000
Project Management-Machine Learning	-10.875	13.724	-.792	.428	1.000
Cloud Computing-DevOps	1.583	10.023	.158	.874	1.000
Cloud Computing-Programming	4.458	6.138	.726	.468	1.000
Cloud Computing-Machine Learning	-7.958	7.924	-1.004	.315	1.000
DevOps-Programming	2.875	9.375	.307	.759	1.000
DevOps-Machine Learning	-6.375	10.631	-.600	.549	1.000
Programming-Machine Learning	-3.500	7.087	-.494	.621	1.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.

Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Table 4.11 shows the pairwise differences amongst the different skills according to *Skills Shortage.* We see the most significant differences is that between Artificial Intelligence - Programming (p =.020) and that of Artificial Intelligence - Machine Learning

4.4 ANALYSING WHETHER SKILLS SHORTAGE PERCEPTION DIFFERS TO THE SKILLS REQUIRED FOR WORK READINESS.

Like the previous section we repeated the test but this time we changed our independent variable to another variable that assess the skills required to be ready for the lace of work as opposed to the skills in demand. The results are as follows:

4.4.1 DESCRIPTIVE STATISTICS – Independent Kruskal Wallis Test

Table 4.12: Descriptive Statistics – independent Kruskal-Wallis test (work readiness)

					95% Confidence Interval for Mean			
	N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
IT Security	4	3.2500	1.70783	.85391	.5325	5.9675	1.00	5.00
Programming	19	4.0789	.93189	.21379	3.6298	4.5281	2.00	5.00
Data Analysis	3	3.1667	.57735	.33333	1.7324	4.6009	2.50	3.50
Project Management	4	4.2500	.64550	.32275	3.2229	5.2771	3.50	5.00
DevOps	2	3.7500	.35355	.25000	.5734	6.9266	3.50	4.00
Cloud Computing	7	4.5000	.40825	.15430	4.1224	4.8776	4.00	5.00
Machine Learning	2	4.7500	.35355	.25000	1.5734	7.9266	4.50	5.00
Project Management	2	3.2500	.35355	.25000	.0734	6.4266	3.00	3.50
Total	43	4.0000	.93223	.14216	3.7131	4.2869	1.00	5.00

The descriptive statistics in Table 4.12 above shows that *Machine Learning* recorded the highest mean (*M* = 3.2500, *SD* = .85391) while *IT Security* showed the highest variance (*M* = 4.2500, *SD* = 1.23491).

4.4.2 STATISTICAL HYPOTHESIS TESTING – INDEPENDENT KRUSKAL-WALLIS TEST RESULTS

The null and alternative hypothesis have been defined below:

H0: Skills Shortage does not differ based on the type of skills required for the workplace.

H1: Skills Shortage differs based on the type of skills required for the workplace.

The result from our nonparametric test is as follows:

Table 4.13: Independent-Samples Kruskal-Wallis Test Summary (work readiness)

Independent-Samples Kruskal-Wallis Test Summary

Total N	43
Test Statistic	11.082[a]
Degree Of Freedom	7
Asymptotic Sig.(2-sided test)	.135

a. The test statistic is adjusted for ties.

Table 4.13 shows that we obtain a statistically insignificant result. We can therefore accept our null hypothesis and conclude that skills shortage is not perceived differently to the skills required for the workplace. We then further wanted to see if there was a difference between certain groups in post hoc analysis. The results are stated below:

Table 4.14: Pairwise comparisons

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
Data Analysis-Project Management	-.167	11.206	-.015	.988	1.000
Data Analysis-DevOps	-6.917	11.206	-.617	.537	1.000
Data Analysis-IT Security	7.417	9.375	.791	.429	1.000
Data Analysis-Programming	14.377	7.626	1.885	.059	1.000
Data Analysis-Project Management	-15.542	9.375	-1.658	.097	1.000
Data Analysis-Cloud Computing	-19.810	8.471	-2.339	.019	.542
Data Analysis-Machine Learning	-24.167	11.206	-2.157	.031	.869
Project Management-DevOps	6.750	12.275	.550	.582	1.000
Project Management-IT Security	7.250	10.631	.682	.495	1.000
Project Management-Programming	14.211	9.125	1.557	.119	1.000
Project Management-Project Management	15.375	10.631	1.446	.148	1.000
Project Management-Cloud Computing	19.643	9.842	1.996	.046	1.000
Project Management-Machine Learning	24.000	12.275	1.955	.051	1.000
DevOps-IT Security	.500	10.631	.047	.962	1.000
DevOps-Programming	7.461	9.125	.818	.414	1.000
DevOps-Project Management	8.625	10.631	.811	.417	1.000
DevOps-Cloud Computing	-12.893	9.842	-1.310	.190	1.000
DevOps-Machine Learning	-17.250	12.275	-1.405	.160	1.000
IT Security-Programming	-6.961	6.753	-1.031	.303	1.000
IT Security-Project Management	-8.125	8.680	-.936	.349	1.000
IT Security-Cloud Computing	-12.393	7.694	-1.611	.107	1.000
IT Security-Machine Learning	-16.750	10.631	-1.576	.115	1.000
Programming-Project Management	-1.164	6.753	-.172	.863	1.000
Programming-Cloud Computing	-5.432	5.427	-1.001	.317	1.000
Programming-Machine Learning	-9.789	9.125	-1.073	.283	1.000
Project Management-Cloud Computing	-4.268	7.694	-.555	.579	1.000
Project Management-Machine Learning	-8.625	10.631	-.811	.417	1.000
Cloud Computing-Machine Learning	-4.357	9.842	-.443	.658	1.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.

Asymptotic significances (2-sided tests) are displayed. The significance level is .050.

a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Table 4.14 shows the pairwise differences amongst the different skills according to *Skills Shortage.* We see the most significant differences is that between Data Analysis-Cloud Computing (p =.019) , Project Management-Cloud Computing(p =.046) as well as Data Analysis-Machine Learning (p =.031)

4.5 Summary

In this chapter we aimed to address the hypothesis as outlined within the first chapter.

We first ran the required reliability statistics, and it was that only our Time unemployed variable proved to be statistically insignificant. However, we ran the required validity test and found that it conformed to construct validity. All variables were then computed by utilising the mean.

We then ran a regression analysis to understand how the constructs might have an impact on our Skills Shortage variable. It was found that only Education had a significant impact on the skills shortage variable.

We also ran a Kruskal -Wallis Test to test if skills shortages differed based on the type of skills demanded. It was found overall that there are no significant differences in the perception of shortages between the type of skills demanded. However, there are certain differences when we analyse the shortages in certain pairs.

Lastly, we ran another Kruskal – Wallis with the same dependent variable but this time changed the independent variable based on the skills required for the workplace. It was that there are also no differences overall but there are some differences amongst certain groups.

The results will now be used for the discussion within the next chapter.

5. CHAPTER 5: RECOMMENDATIONS

5.1. INTRODUCTION

Closing the skills gap in the digital sector and preparing youth to participate in the economy requires a multifaceted approach that involves various stakeholders, including governments, educational institutions, private sector, and civil society.

5.2. Sub-problem 1: To establish why there is an ICT skill shortage in South Africa’s economy.

Building upon the insights garnered from Chapter 4's analyses, the following recommendations are offered to shed light on the reasons behind the ICT skill shortage in South Africa's economy:

Enhanced Skill Relevance Evaluation: While the Skills Relevance variable was removed due to potential endogeneity concerns, its initial high correlation with skills shortages merits further investigation. Conduct comprehensive research to delve into the intricate relationship between skill relevance, job demand, and workforce preparedness. By understanding the underlying dynamics, policymakers and educators can align skill development initiatives with industry demands, thus mitigating the skill shortage.

Education Reforms and Alignment: The significant impact of Education on perceived skills shortages underscores the pivotal role of education in addressing the shortage. Collaborate with educational institutions to introduce reforms that align curriculum offerings with emerging ICT trends. Foster partnerships between academia and industry to ensure that graduates possess skills that directly respond to market needs.

Focused Upskilling Initiatives: Targeted upskilling programs should be designed to address specific skill gaps identified through regression analysis. Tailor training interventions to bolster the areas that exhibit statistically significant correlations with skills shortages. By concentrating efforts where the need is most acute, stakeholders can optimize resource allocation and maximize the impact of upskilling initiatives.

Inclusive Talent Development: While only Education emerged as a statistically significant variable, consider a holistic approach to talent development. Engage stakeholders across academia, industry, and government to create a comprehensive strategy that encompasses various factors contributing to the skill shortage. This approach ensures that multiple facets of the problem are addressed concurrently.

Longitudinal Studies: Conduct longitudinal studies to monitor the evolution of skill shortages over time. By tracking changes in variables and their impacts, policymakers can make informed decisions and timely adjustments to strategies. This iterative approach ensures that interventions remain relevant and effective in addressing the dynamic nature of the ICT skill shortage.

In summary, these recommendations draw from Chapter 4's findings to propose targeted strategies for understanding and mitigating the ICT skill shortage in South Africa's economy. By investigating skill relevance, reforming education, implementing focused upskilling, fostering inclusive talent development, and embracing longitudinal studies, stakeholders can collectively tackle the multifaceted challenge of skill shortages and foster a skilled workforce poised for success in the digital era.

5.3. Sub-problem 2: To establish the kind of ICT skills in demand in the South African economy.

Based on the findings presented in Chapter 4, specifically the regression analysis and Kruskal-Wallis Test results, the recommendations for addressing the kind of ICT skills in demand within the South African economy are as follows:

Emphasis on Education and Skills Relevance: The significant impact of Education on perceptions of skills shortages underscores the importance of educational initiatives. Policymakers and educational institutions should prioritize equipping individuals with relevant skills and knowledge, aligning educational curricula with the evolving demands of the ICT sector. While the Skills Relevance variable was removed due to potential endogeneity concerns, its initial correlation with skills shortages suggests that future studies should explore this relationship further, aiming to unveil potential nuances that could inform targeted skills development programs.

Diverse Skills Development Programs: The observed lack of significant differences in perceptions of skills shortages based on specific types of skills demanded suggests a need

for comprehensive and balanced skills development strategies. Policymakers and industry stakeholders should collaborate to design inclusive skills development programs that encompass a wide range of ICT skills. These programs should not only address current skills gaps but also anticipate future demands, enabling individuals to adapt and thrive in an ever-evolving digital landscape.

Nurturing Specialized Skill Pairs: Although no significant overall differences in skill shortages were detected when analyzing certain skill pairs, the identified nuances within specific pairs suggest opportunities for targeted interventions. Industries and sectors requiring specific pairs of skills should consider tailored training and development initiatives that address the unique demands of these skill combinations, fostering a workforce that is well-equipped to meet specialized challenges.

Holistic Workforce Planning: The lack of significant differences in perceptions of skills shortages based on skills required for the workplace underscores the importance of holistic workforce planning. Organizations should adopt a comprehensive approach that considers a broad spectrum of skills rather than narrowly focusing on specific skill requirements. By nurturing a well-rounded workforce, organizations can enhance their agility and resilience in the face of technological advancements and changing industry dynamics.

Further Exploration of Skill Mismatches: The identification of differences in perceptions of skill shortages within certain pairs and groups warrants further investigation into skill mismatches. Researchers, policymakers, and industry leaders should collaborate to conduct in-depth analyses that delve into the underlying causes of these disparities. This exploration could shed light on factors such as sector-specific demands, regional variations, and evolving job roles, guiding the development of targeted interventions.

In summary, the recommendations outlined above are informed by the analyses conducted in Chapter 4, which provide valuable insights into the kind of ICT skills in demand within the South African economy. By emphasizing education, promoting diverse skills development, nurturing specialized skill pairs, adopting holistic workforce planning, and further exploring skill mismatches, stakeholders can collaboratively address skills shortages and cultivate a skilled workforce poised to excel in the dynamic landscape of the digital economy.

5.4. eSKILLS INSTITUTE IMPLEMENTATION

5.4.1. INTRODUCTION

The eSkills Institute's sustainable income model hinges on strategic partnerships with businesses, which will not only bolster student fees but also cultivate a synergistic relationship, enabling both digital skill advancement and economic growth within rural communities. The model will allow companies to fund certain amount of learners and once they are done with the course, place them at their workplace.

5.4.2. IMPLEMENTATION APPROACH

The eSkills Institute's implementation approach in a rural area involves several key steps. Firstly, it is essential to establish partnerships with local community leaders, organizations, and stakeholders to get their support and participation in the program. This approach will enable them to understand the importance of digital literacy and the benefits of acquiring digital skills (García-Peñalvo et al., 2018).

Secondly, the program needs to identify the target audience and their needs. This process involves conducting a needs assessment to determine the learners' digital literacy levels, the type of digital tools and resources they require, and their learning preferences. The findings from the needs assessment will guide the program's curriculum design and ensure that it meets the learners' needs and expectations (Venter, 2021).

Thirdly, the program needs to develop a curriculum that is tailored to the target audience's needs and preferences. The curriculum should be designed to include hands-on learning activities, such as workshops and practical exercises, that allow learners to apply their newly acquired skills in real-life situations (García-Peñalvo et al., 2018).

5.4.3. CHALLENGES

Implementing the eSkills Institute in rural areas may present several challenges. Firstly, limited access to technology and the internet may hinder the learners' ability to participate fully in the program (García-Peñalvo et al., 2018). Secondly, the lack of digital literacy skills among the target audience may require additional support and resources to ensure that they can use the

digital tools and resources effectively (Venter, 2021). In rural areas, the uptake of Information Technology (IT) has been hindered by various barriers, as highlighted by Ferrari et al. (2022). One significant challenge is limited connectivity, which impedes the seamless integration of digital tools and services. Additionally, there exists a notable level of distrust towards technology among rural communities, accompanied by socio-cultural factors that further contribute to the resistance in adopting IT solutions (Ferrari et al., 2022).

5.5. eSKILLS INSTITUTE BUSINESS MODEL CANVAS

The eSkills Institute, built upon data-driven insights from Chapter 4, unveils a robust business model aimed at bridging the digital skills gap in rural South Africa. By providing comprehensive training and education in digital skills, the institute addresses the challenges identified through a strategic blend of online and in-person courses, as well as certification programs spanning diverse areas such as coding, data analysis, cybersecurity, and digital marketing.

Central to the business model is an emphasis on delivering a holistic learning experience. Leveraging both online and offline training avenues, learners can tailor their educational journey to suit their pace and preferences. The user-friendly e-learning platform, designed with consideration for the distribution of skills relevance and education levels, caters to varying technical proficiencies, while in-person workshops foster hands-on learning and meaningful interactions with domain experts.

Notably, the model is attuned to the specific context of rural South Africa, considering local language integration to enhance accessibility and accommodate learners with limited English proficiency. This localized approach aligns with the broader objective of democratizing digital education and empowering underserved communities.

The eSkills Institute's revenue model stems from course fees and service charges, underscored by flexible pricing structures and potential collaborations with partner organizations. The model's viability and potential impact are underscored by data indicating statistically significant perceptions on education's influence in mitigating skills shortages, as revealed in Chapter 4.

The increasing demand for digital proficiency presents an opportune landscape for expansion, reinforcing the institute's mission to equip individuals and organizations with vital skills, thereby

contributing to the socioeconomic advancement of rural areas and the nation at large. Drawing on empirical findings from Chapter 4, where multiple regression and statistical tests yielded insights into variables influencing skills perceptions, the eSkills Institute's business model emerges as a data-driven response to a pressing societal need, poised to make a meaningful impact on the digital landscape of rural South Africa.

- Revenue Streams:
    - Course Fees: The eSkills Institute will generate revenue by charging learners for access to its courses. However, the aim will be for organisations to fund students to go through the course and there after employ them.
    - Certification Fees: The eSkills Institute will also charge learners/organisations for certification upon completing a course.

- Key Partnerships:
    - Content Providers: The eSkills Institute will partner with content providers to offer high-quality courses on its platform.
    - Technology Providers: The eSkills Institute will partner with technology providers to ensure its platform remains up-to-date and secure.
    - Employer Partners: The eSkills Institute will partner with employers to offer employee training programs and customised learning solutions.

- Key Activities:
    - Course Creation: The eSkills Institute will create and curate courses that align with industry needs and trends.
    - Course Delivery: Deliver courses to learners through its online platform or physical school.
    - Certification: Assess learner performance and issues certifications upon completion of a course.

- Key Resources:
    - Expert Instructors: Employs expert instructors to create and teach courses.
    - Online Platform: The eSkills Institute's online platform will be a key resource for delivering courses and assessing learner performance.
    - Brand Reputation: The eSkills Institute's reputation should be a trusted provider of high-quality courses and certifications is a valuable resource.

- Customer Segments:

- Individuals: The eSkills Institute will target students from previously disadvantaged backgrounds from rural areas such as Orange Farm where the institute will plant its first seed. It will also focus on individuals who want to upskill or re skill in order to advance their careers or pursue new opportunities.

- Employers: The eSkills Institute will target employers who want to train and develop their employees in order to improve organisational performance and competitiveness.

Customer Segments: eSkills Institute will target corporates who want to upskill and employ previously disadvantaged youth in the IT skills needed to succeed in the Fourth Industrial Revolution.

Value Propositions: eSkills Institute will provide online courses and training programs that focus specifically on the IT skills and technologies associated with the Fourth Industrial Revolution, such as artificial intelligence, big data, the Internet of Things, and blockchain. The training programs are tailored to the specific needs of the corporate clients and designed to help previously disadvantaged youth enter the job market.

Channels: eSkills Institute will reach out to corporate clients through its website, social media platforms, email marketing, and partnerships with industry associations and other organizations in the IT skills and education space. It also partners with community organizations and government agencies to identify and reach out to previously disadvantaged youth.

Customer Relationships: eSkills Institute will focus on building strong relationships with its corporate clients and previously disadvantaged youth by providing customized training programs that meet their specific needs, and by offering excellent customer service.

Revenue Streams: eSkills Institute will generate revenue through corporate partnerships and sponsorships. The corporates pay for the training programs and courses provided to previously disadvantaged youth.

Key Resources: eSkills Institute's key resources include its online platform, course materials, instructors with expertise in Fourth Industrial Revolution technologies, and partnerships with industry associations, community organizations, and government agencies.

Key Activities: eSkills Institute's key activities include developing and updating its online courses and training programs focused on Fourth Industrial Revolution IT skills, marketing and promoting its offerings, and providing excellent customer service to its corporate clients and previously disadvantaged youth.

Key Partnerships: eSkills Institute will have partnerships with industry associations, community organizations, and government agencies to help identify and reach out to previously disadvantaged youth, and to provide additional resources to its corporate clients and previously disadvantaged youth.

Cost Structure: eSkills Institute's costs will include the development and maintenance of its online platform, course development and instructor costs, marketing and advertising expenses, and general administrative expenses.

The eSkills Institute's business model is focused on providing high-quality IT skills training and education specifically tailored to the needs of corporates to upskill and employ previously disadvantaged youth in the technologies and skills needed to succeed in the Fourth Industrial Revolution. By leveraging partnerships and a strong customer focus, eSkills Institute aims to drive growth and revenue in this market funded by corporate partnerships and sponsorships.

eSkills Institute will strategically scale its mission by diversifying course offerings, attracting a broader audience of learners and corporate partners. Considering country wide reach, franchising will further extend reach, establishing satellite campuses to meet local needs while upholding its core mission. These integrated strategies empower disadvantaged youth and position eSkills Institute to address the challenges of the Fourth Industrial Revolution effectively.

6. CHAPTER 6: CONCLUSION

6.1. INTRODUCTION

Creation of an eSkills Institute which focuses on teaching students about digital technologies, such as computer programming, software development, web design, digital marketing, and other related subjects is our proposed approach to assist in bridging the 4IR skills gap. The institute will aim to provide students with the skills, knowledge, and tools needed to succeed in the digital age, where technology plays an increasingly important role in the workplace and everyday life.

The eSkills Institute will have a specialised curriculum and resources that are tailored to the needs of students interested in technology-related fields. We will offer courses in programming languages like Java, Python, or C++, as well as other courses such as cybersecurity, data science, and artificial intelligence.

We will also offer internships, job placement programs, and partnerships with tech companies to provide students with hands-on experience in the industry. The school will be a private institute, and will range from high school grade 10 to tertiary level.

Overall, the eSkills Institute will be a place where students can learn and develop the skills and knowledge necessary to thrive in the digital world and pursue careers in technology and related fields.

6.2. PROJECT OUTCOMES

The creation of an eSkills Institute that focuses on teaching previously disadvantaged youth about digital technologies is likely to have several positive outcomes such as:

Improved employability: Learning about digital technologies could improve the employability of previously disadvantaged youth. As digital technologies become increasingly important across industries, having a strong understanding of these technologies could make these youth more attractive to employers.

Improved economic prospects: By equipping previously disadvantaged youth with the skills they need to participate in the digital economy, the eSkills Institute could help improve their

economic prospects. This could lead to increased economic growth and prosperity, not just for the individuals involved, but for their communities and the country as a whole.

Increased access to digital education: The creation of an eSkills Institute would provide previously disadvantaged youth with access to education in digital technologies that they may not have otherwise had access to. This increased access could help bridge the digital divide and give these youth the skills they need to participate in the digital economy.

Enhanced innovation: The creation of an eSkills Institute could lead to enhanced innovation among previously disadvantaged youth. By providing them with the knowledge and tools they need to develop and apply digital technologies, the Institute could help create a new generation of innovators who are better equipped to tackle the challenges of the 21st century.

Increased diversity in the tech industry: By providing education and training to previously disadvantaged youth, the eSkills Institute could help increase diversity in the tech industry. This could lead to new perspectives and ideas being brought into the industry, which could ultimately benefit everyone involved.

6.3. LIMITATIONS OF THE PROJECT

While the creation of an eSkills Institute that focuses on teaching previously disadvantaged youth about digital technologies is a positive step towards bridging the digital divide, there are some limitations to consider.

One potential limitation is the access to technology and the internet. Even if the eSkills Institute provides training and education on digital technologies, if the learners do not have access to the necessary tools and infrastructure, it may be challenging for them to fully apply what they have learned.

Another limitation is the lack of diversity in the curriculum. While the eSkills Institute may focus on teaching digital technologies, it is important to ensure that the curriculum includes a diverse range of topics and skills, such as entrepreneurship, communication, and problem-solving. This will enable learners to not only acquire technical skills but also develop the soft skills necessary to succeed in the workforce.

Furthermore, it is essential to ensure that the eSkills Institute's training programs are relevant to the needs of the job market. This will require ongoing research and collaboration with industry experts to identify emerging trends and skills that are in demand in the job market.

Finally, the eSkills Institute must consider the socio-economic background of its learners. For example, learners from low-income households may require additional support, such as financial assistance, mentorship, and career guidance, to successfully enter the job market.

Addressing these limitations will be crucial for the eSkills Institute to effectively achieve its goal of empowering previously disadvantaged youth with the digital skills necessary to succeed in today's economy.

6.4. FUTURE CONSIDERATIONS

The creation of an eSkills Institute that focuses on teaching previously disadvantaged youth about digital technologies will require ongoing considerations for the future. Here are a few potential areas to keep in mind:

Evolving technology: Digital technologies are constantly evolving, and new technologies are emerging all the time. The eSkills Institute will need to stay up to date with these changes to ensure that their courses remain relevant and effective.

Changing job market: The job market is also evolving rapidly, with new job roles and industries emerging as a result of digital technologies. The eSkills Institute will need to adapt their course offerings to reflect these changes and provide training for in-demand skills.

Access to technology: While the eSkills Institute may provide access to technology and digital resources, some students may still face challenges accessing these resources outside of the classroom. The institution may need to explore ways to increase access to technology for their students to ensure they can continue learning and practicing their skills outside of the classroom.

In due time I hope the eSkills institute can stimulate meaningful dialogue on critical issues based around low skills, disadvantaged communities and the importance of cultivating a nurturing environment for continuous learning in the era of the Fourth Industrial Revolution. Inclusive growth and solutions need engagement and exploration among all the stakeholders,

but their success is held by communities being central in creating the core solutions that will be enabled using current and future technologies.

By considering these factors, the eSkills Institute can continue to provide high-quality training and education to previously disadvantaged youth in digital technologies, while adapting to changing technologies and job market trends, and ensuring long-term sustainability.

6.5. CONCLUSION

The eSkills Institute will be a South African initiative aimed at developing and enhancing the digital skills of the country's workforce. The benefits of this initiative for the South African economy are numerous, including:

- Boosting economic growth: By improving the digital skills of the workforce, the eSkills Institute can contribute to economic growth by increasing productivity and innovation.
- Addressing unemployment: The eSkills Institute will provide training and education opportunities that can help individuals acquire the skills they need to find employment in the digital economy. This can help to reduce unemployment and improve the quality of life for individuals and their families.
- Improving competitiveness: The digital economy is rapidly growing and evolving, and having a skilled workforce is essential for businesses to remain competitive. The eSkills Institute will help South African businesses stay ahead of the curve by providing access to the latest digital tools and technologies.
- Fostering entrepreneurship: The eSkills Institute will provide training and support for entrepreneurs who want to start or grow digital businesses. This can help to create new job opportunities and stimulate innovation in the South African economy.
- Addressing the digital divide: There is a significant digital divide in South Africa, with many individuals and communities lacking access to digital tools and technologies. The eSkills Institute will help to bridge this divide by providing training and resources to disadvantaged communities.

The eSkills Institute is an important initiative for South Africa's economy, as it will help to develop the digital skills of the country's workforce, address unemployment and the digital divide, and foster entrepreneurship and innovation. Addressing The 4IR Skills Gap for South Africa’s Economy!

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8. Appendixes

Ethical Clearance

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

Private Bag 3 Wits, 2050
Fax:
Tel:

Reference: Ms Jennifer Mgolodela
E-mail: jennifer.mgolodela@wits.ac.za

03 January 2022
Person No: 2261553
PAG

Mr LZ Bodibe
PO Box 2207
Northriding
Northgate Ext
2162
South Africa

Dear Mr Lerato Bodibe

Master of Business Administration: Approval of Title

We have pleasure in advising that your proposal entitled *Technological disruption in the South African banking sector* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Marike Bosman
Faculty Registrar
Faculty of Commerce, Law and Management

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax:
Tel:

Reference: Ms Jennifer Mgolodela
E-mail: jennifer.mgolodela@wits.ac.za

08 June 2023
Person No: 2261553
TAA

Mr LZ Bodibe
PO Box 2207
Northriding
Northgate Ext
2162
South Africa

Dear Mr Lerato Bodibe

Master of Business Administration: Change of title of research

I am pleased to inform you that the following change in the title of your Research Report for the degree of **Master of Business Administration** has been approved:

From:	**Technological disruption in the South African banking sector**
To:	**Addressing the 4IR skills gap for the South African economy**

Yours sincerely

Mrs Marike Bosman
Faculty Registrar
Faculty of Commerce, Law and Management

9. Questionnaire

Hi,

My name is Lerato Bodibe and I am a Masters in Business Administration (MBA) student at the University of the Witwatersrand, Johannesburg.

As part of my studies, I have to undertake a research project. I am undertaking a social entrepreneurship project focusing on addressing the 4IR Skills Gap for South Africa's economy.

The targeted participants are individuals in the ICT sector (IT graduates, Software Developers, Software Engineers, Web Developer, Programmer, Data Engineer, Network Engineer, Security Engineer, Solutions Analyst/Architect, Business/System Analysts, Project Managers, Test Analyst, etc) between the ages of 18 – 40.

I would like to invite you to partake in my research by completing a short questionnaire.

Your assistance is greatly appreciated. The questionnaire should take you no more than 5 minutes to complete. Your responses will be kept confidential.

Kindly share with friends and colleagues in the ICT sector.

Kind Regards
Lerato Bodibe

Do you consent to participating in the survey?

- Yes
- No

The following questions are related to perceptions regarding Skills Shortages within the ICT sector:

I believe there is a skills shortage regarding the ICT Sector

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

I believe the skills required are adequate for my current job

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

I believe the skills required will be adequate for future jobs within 4IR

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

The following questions are related to perceptions on Time Unemployed

I believe it takes too much time to find a job once one graduates

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

I believe there is adequate support to address unemployment in the ICT sector

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

I Believe Companies need to do more to address the time it takes to be employed

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

The following questions are related to Focus Areas and Skills:

Kindly Indicate which Skill you prefer to most develop

- IT Security
- Programming
- Data/Systems Analysis
- Project Management
- DevOps
- Cloud Computing
- Machine Learning
- Artificial Intelligence

Which skills do you perceive to be most important to you?

- IT Security
- Programming
- Data/Systems Analysis
- Project Management
- DevOps
- Cloud Computing
- Machine Learning
- Artificial Intelligence

Which Skill is the most importnt to you regarding work readiness

- IT Security
- Programming
- Data Analysis
- Project Management
- DevOps
- Cloud Computing
- Machine Learning
- Project Management

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