

DEVELOPMENT PROGRAMMES TO ADDRESS GREEN ECONOMY SKILLS GAPS IN THE SOUTH AFRICAN PETROCHEMICAL INDUSTRY

Rudi Haywood

Student number: 2405557

Student email: 2405557@students.wits.ac.za

Mobile: +27 82 319 4887

**A research proposal 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**

Johannesburg, 2024

DECLARATION

Except as specified in the references and acknowledgments, I, Rudi Haywood, hereby affirm that this Applied Research Project is entirely my own creation. Not for any degree or examination has it been submitted at this university or any other.

Signed at Johannesburg

On the 29th day of February 2024

Ethics Protocol number: WBS/BA2405557/135

ACKNOWLEDGEMENTS

I wish to recognise and sincerely thank:

My Father in Heaven, the One from where my strength comes. Without His hand, none of this is possible.

My beautiful wife Rachel, and amazing sons Landon, Blaine, and Noah, for their support, encouragement, and unconditional love.

To my dad and mom, this is for you.

My supervisor, Dr. Zanele Ndaba, for her generosity in time, knowledge, patience, and authenticity.

My amazing colleagues, all WBS educators and staff.

Index	7
List of Tables	7
List of Figures	8
Abstract	9
1 Introduction	11
1.1 Background	11
1.2 Statement of the problem	13
1.3 Research Objectives	14
1.3.1 Secondary Objective	14
1.3.2 Question	15
1.4 Purpose of the study	15
1.5 Study significance	15
1.6 Delimitations	16
1.7 Operational definitions of terms	17
1.4.1. Skills Development	17
1.4.2. Green Economy	17
1.4.3. Green Skills	17
1.4.4. Skills Gaps	18
1.4.5. Human Capital Theory	18
2 Literature Review	19
2.1 Introduction to the Green Economy	19
2.1.1 Defining The Green Economy	19
2.1.2 The International Green Economy Context	21
2.1.3 The Relationship between the Green Economy and Sustainable Development	22
2.1.4 The Green Economy and Sustainable Development Goals	23
2.1.5 The Green Economy and the Petroleum Sector	24
2.1.6 The Green Economy definition nuances	24
2.1.7 The Green Economy Challenges and Opportunities	25
2.1.8 Related theories and concepts in the Green Economy	26
2.1.9 The Green Economy limitations	26
2.1.10 The South African context in the Green Economy	27
2.2 Introduction to Skills Development	28
2.2.1 Defining Skills Development as a concept	28
2.2.2 Global perspectives on Skills Development	29
2.2.3 The difference between skills development, training, and education	29

2.2.4	Skills Mismatch Concepts	30
2.2.5	Causes and effects of a skills mismatch	30
2.2.6	Analysing Skills Barriers that prevent gaps being addressed	31
2.2.7	Skills gaps closure challenges.....	31
2.2.8	Drivers of skills programmes.....	31
2.2.9	Identifying existing skills gaps in South Africa	32
2.3	Introduction to Skills Programmes in South Africa.....	33
2.3.1	An overview of the SETAs and Skills Development Levy	34
2.3.2	Skills Development Higher education institutions.....	36
2.3.3	Public and private sector interventions in South African skills development.....	36
2.3.4	Barriers to effective Skills Development in the South African context	37
2.3.5	Drivers of skills programmes in South Africa	37
2.3.6	Skills Development in the Petroleum sector.....	38
3	Research Framework	39
3.1	Overview of Human Capital Theory	39
3.2	Evidence supporting Human Capital Theory.....	39
3.3	Limitations of Human Capital Theory	40
3.4	Role of Government Policy.....	40
3.5	Conceptual Framework	41
4	Research Methodology.....	44
4.1	Research paradigm	44
4.2	Research Design	44
4.3	Population.....	45
4.4	Sample	45
4.5	Data collection methods	47
4.6	Research Procedure.....	47
4.6.1	Interview Preparation	48
4.6.2	Scheduling	48
4.6.3	Informed Consent	48
4.6.4	Conducting the interview.....	49
4.6.5	Closing the interview	49
4.6.6	Interview documentation.....	49
4.6.7	Data analysis methods	49
4.7	Techniques	50
4.7.1	Reliability and Validity	50

4.7.2	Transcription Accuracy	50
4.7.3	Coding Consistency	50
4.7.4	Member Checking	51
4.7.5	Validity	51
5	Ethics.....	52
5.1	The Ethics of Data.....	52
5.2	Honesty and Responsibility in Reporting.....	52
6	Research Findings.....	54
6.1	Structure of Findings	54
6.1.1	Data anonymisation.....	54
6.2	Participant Demographics	54
6.3	Introduction	56
6.4	Skills Development Programmes (SDP) Evaluation	57
6.5	Obstacles and Challenges.....	62
6.6	Return on Investment and Talent Development	66
6.7	Skills Mismatch and Industry Impact.....	70
7	Data Analysis	75
8	Recommendations.....	81
8.1	Introduction	81
8.2	Recommendations.....	81
8.3	Limitations and Future Research	82
8.3.1	Limitations	82
8.3.2	Further Research.....	83
9	References	84
10	Appendices.....	120
11	Interview Questionnaire	121

Index

List of Tables

Table 6-1. Participant Experience in Bands	56
Table 6-2. Skills Development Programme emerging sub-themes and codes.	61
Table 6-3. Obstacles and Challenges sub-themes and codes	65
Table 6-4. Return on Investment & Talent development sub-themes and codes.....	69
Table 6-5. Skills Mismatch & Industry Impact sub-themes and codes	73

List of Figures

Figure 1. Conceptual Framework	41
Figure 2. Participant Gender Composition	55
Figure 3. Seniority by Gender	55
Figure 4. Ethnic Composition	56
Figure 5. Global Respondent Rate: Respondents vs. Used in Findings	57
Figure 6. Skills Development: Respondent Sentiment Summary	60
Figure 7. Obstacles and Challenges: Respondent Sentiment Summary	64
Figure 8. Return on Talent Investing: Respondent Sentiment Summary	68
Figure 9. Skills Mismatch and Industry Impact: Respondent Sentiment Summary	72

Abstract

South Africa's petrochemical industry faces a significant skills shortage, limiting its ability to effectively address the emerging challenges of the green economy. This slows the entity's growth and maturation over time. This study looks at Skills Development Programmes (SDPs) in this context and aims to identify the specific flaws in these programmes that limit their effectiveness in addressing critical skill gaps. This study uses qualitative methods, such as in-depth interviews and document analysis, to gain comprehensive insights from experienced professionals in the field. From this perspective, the study investigates current proficiency levels, the effectiveness of existing SDPs, and the actual contribution of these programmes to fostering a sustainable and environmentally friendly business environment.

The study found a significant disparity between the practical application of SDPs and the needs of the green economy. This gap is exacerbated by issues of accessibility and a lack of alignment with strategic goals. Surprisingly, 85% of respondents said that SDPs lacked practical components, while roughly 80% said they were not effectively aligned with the organization's or sector's objectives. This demonstrates the importance of having programmes that are applicable in real-world situations and place a strong emphasis on long-term goals. This study uses Human Capital Theory to demonstrate the importance of education and training in promoting economic growth. This is consistent with the perspectives of Schultz, Becker, and Mincer on the importance of investing in human capital.

The study advocates for a shift in the current approach to make skill development programmes more effective, accessible, and aligned with strategic goals. Collaboration with the private sector is an important recommendation to help individuals gain practical experience and apply their environmentally friendly knowledge in real-world settings. Furthermore, it is recommended that ongoing research be conducted to identify and address emerging skill gaps. These proposed changes aim to address current issues while also facilitating the transition of South Africa's petrochemical industry to a more environmentally friendly and sustainable future, which benefits all stakeholders.

Keywords: Human Capital Theory, Skills Development, Petrochemical Sector, Skills Mismatch, Green Skills

1 Introduction

1.1 Background

South Africa's petroleum industry drives the country's economy. This sector, which formed the basis of South Africa's industrial landscape, was created through legislative action around Sasol (Mondliwa et al., 2021). The nation's petrochemical complex has fueled economic growth and provided raw materials for downstream industries such as construction and steel. Its importance is demonstrated by the fact that it has a significant impact on GDP and employment (Beidari et al., 2017). Programmes that help people learn skills for the petrochemical industry ensure that the industry has a trained workforce that can adapt to changing needs. According to Industry 4.0, industrial engineering courses should focus on big data and human-machine interface skills and consequently, investing in skill development allows petrochemical companies to grow, innovate, and compete more effectively (Maisiri et al., 2019).

Construction is another important industry in South Africa that serves as a fundamental source for employment activity. Construction grows alongside related industries like petrochemicals (Phaladi et al., 2022). This illustrates the relationship between industry growth and that of economic growth. The success of South Africa's steel industry shows the importance of a strong industrial base for economic growth (Tsebe, 2022). Collaboration between the steel, construction, and petrochemical sectors illuminate the complexity of interwoven sectors of the South African economy and the multitude of opportunities available for skill enhancement.

South Africa's petrochemical sector is expanding due to advances in sustainability and clean energy technology. As the country reduces its carbon footprint, industry must use greener energy and technologies (Zhao et al., 2015). Petrochemical clean energy experts are needed for this shift. Industrial skill development in renewable energy, carbon reduction, and sustainable practises is needed to meet global environmental sustainability goals and reduce environmental impact (Chin et al., 2021a). Meng & Sager (2017) say the petrochemical industry affects energy consumption and carbon dioxide emissions. Chou et al. (2019) also argue that the petrochemical industry must take green measures to reduce electricity and carbon emissions. Further studies

emphasise the petrochemical industry's shift to cleaner energy sources and energy reduction to reduce environmental damage (Shinkevich et al., 2021).

Transitioning to a green economy, which emphasises sustainable practices and clean technologies, requires adequate workforce preparation, and skill development programmes play a crucial role in this preparation (Strachan et al., 2023). Over many years, South Africa has implemented a variety of skill development initiatives to support the growth of the green economy. Alwi et al., (2017) posit a general disconnect between sustainable development to those of green skills advancement.

The study examines, specifically, where South Africa's skills development is positioned currently, relative to where it should be in the petrochemical sector. From these, gaps can be identified, and we consider how these gaps affect the transition to a greener economy, and more specifically, green skills. South Africa highlights distinct socioeconomic difficulties that necessitate long-term solutions for effective skill development outcomes (F. Rasool & Botha, 2011). Recognising the potential of the green economy as a driver of equitable growth, the government has made initiatives to design and promote green economy-focused skill development programmes.

The South African government has initiated several initiatives related to green economy skills development projects, such as developing policies, establishing long-term goals, and allocating funds (Rogerson, 2008). The National Skills Development Strategy (NSDS), the Green Economy Strategy, and the National Development Plan, among others, have established a policy framework to steer the growth and development of these programmes (Rogerson, 2008). The Departments of Higher Education and Training (DHET) and Trade, Industry, and Competition (DTIC) are government agencies that collaborate with stakeholders such as sector-specific organisations, educational institutions, and non-governmental organisations to ensure that these programmes are well designed, implemented, and monitored (Rogerson, 2008). These extend to sectoral levels which include the petroleum industry.

There are indications however, that these stages have not been exploited to their full potential (Maziriri et al., 2019). The study's purpose is to identify the gaps in these skill-building programmes and determine why it is that South Africa's petroleum sector

is unable to accelerate closing these gaps. This study offers policymakers and others evidence-based suggestions for strengthening skill development initiatives into effective programmes and reducing the green skills deficit.

1.2 Statement of the problem

Skills development is essential to a sustainable and ecologically friendly economy, however, there is a pronounced disconnect on its usefulness and application of existing skills programmes (Mathekga et al., 2022). Existing studies have not adequately addressed existing programme gaps, implementation issues, or the responsibilities of diverse stakeholders in creating change (McCarthy et al., 2016). As a result, a thorough assessment of the strengths and limitations of the various skill development programmes already in place is required.

In South Africa's petrochemical sector, skill development is crucial to a sustainable and environmentally friendly economy in a fast-changing world. This transition is hampered by skill development initiatives' inconsistent application and efficacy (Dey et al., 2020). The sector's ability to implement sustainable practises and adopt clean energy technologies is hindered by this skills gap (Dey et al., 2020). It also hinders environmental protection. Simply identifying skills shortages won't prepare South Africa to lead in the green economy, especially as the world advances rapidly towards sustainability (Vona et al., 2018).

Comprehensive skill development programmes must address this critical need. These initiatives must close the skills gap and anticipate industry needs to ensure long-term sustainability and competitiveness (Al-Asfour & Zhao, 2024). This strategy involves integrating green skills into existing curricula, encouraging industry-educational collaboration, and creating supportive policy frameworks (Al-Asfour & Zhao, 2024). Failure to close the green skills gap risks environmental violations, financial penalties, and missed growth opportunities. It also puts the sector at risk of falling behind international competitors who integrate sustainable practices better (Morris et al., 2020).

Narrowing the petrochemical sector skills gap is vital for South Africa's social, economic, and environmental well-being, not just industry needs. Green economy transition requires innovative and well-designed skill development programmes (Kwauk & Casey, 2022). These programmes empower current and future workers, drive industry innovation, and promote national growth and development in an environmentally friendly manner (Harsini et al., 2020). The industry must also adopt green skills to adapt to changing sustainable practices and technologies and remain competitive globally (Naoum et al., 2020).

Collaboration between academia, industry, and policymakers is essential to training petrochemical workers for sustainability (Srivastava et al., 2023). Eco-design, energy efficiency, renewable energy, and social well-being skills are essential for the workforce (Napathorn, 2022). This focus on green skills aligns with the global agenda for sustainable development, keeping the petrochemical industry competitive, compliant with new regulations, and contributing to South Africa's environmental and developmental goals (Manyati et al., 2024). This integrated approach addresses climate change, resource depletion, and environmental degradation, emphasising the importance of skill development for the petrochemical industry and South Africa.

1.3 Research Objectives

The primary objective is to critically assess and identify Skills Development Programme (SDP) gaps in the South African petrochemical sector that hinder green economy transition and implementation. This requires a detailed analysis of SDPs' alignment with the skills needed to drive industry sustainability and environmental stewardship.

1.3.1 Secondary Objective

The secondary objective of this academic study is to evaluate the skills landscape in the South African petrochemical industry and identify green skills gaps through qualitative research. The study also aims to investigate the effectiveness of existing Skills Development Programmes in meeting the needs of the green economy. Additionally, the study seeks to assess the alignment between Skills Development

Programmes and the strategic goals of transitioning towards a green economy in the petrochemical sector. Based on the findings, the study proposes actionable strategies for restructuring existing Skills Development Programmes or creating new initiatives to address the identified green skills gap. Lastly, the study aims to facilitate long-term compliance by enhancing green skills within the sector, preparing the workforce for sustainability challenges, and ensuring compliance with climate change legislation.

1.3.2 Question

- What are the Skills Development Programmes' weaknesses in addressing skill gaps in South Africa's green economy, in your experience?

1.4 Purpose of the study

This qualitative research, through primary data collection in the form of interviews, seeks to assess the impact of skills gaps within South Africa. Furthermore, how this impedes skills development programme advancement within the petrochemical sector. This case study, outlines the factors that contribute to effectiveness of skills programmes, potential challenges in addressing skills gaps and how to address them in the future.

1.5 Study significance

It would be remis to overstate the significance of the study. It looks at South Africa's petrochemical industry, and this critical component of the country's long-term economic health. The study looks at development programmes that could help this sector's green economy skills gaps programmes and putting them under scrutiny though a case study. It could change how skills development is done, highlighting how important it is for helping the industry meet challenges related to sustainability.

Skill development programmes in the petrochemical industry are vital to industry evolution, ensuring that the workforce is proficient in traditional practises and innovative methods for a green economy. This study highlights the importance of such programmes in closing skills gaps and helping the sector become more sustainable

and eco-friendly. These programmes equip employees with green skills to innovate, boost productivity, and comply with environmental laws, which are essential for the industry's growth and relevance in a fast changing world. Policymakers, educators, and industry stakeholders will benefit from the research's emphasis on the link between skill development initiatives and South Africa's environmental and economic goals.

It gives us a way to improve skill-building programmes that help the petrochemical industry become more environmentally friendly. The results will show South Africa how other countries have dealt with similar issues, which will help them figure out how to get the most out of their investments in human capital in this important area. This research will deepen the discussion about skills development in South Africa's green economy, focusing on the petrochemical sector. The report ushers in a new era of strategic planning and implementation by demonstrating the strong link between skill development programmes and sector innovation and sustainability. It aims to close the skills gap and position the petrochemical industry as a leader in South Africa's transition to a greener, more prosperous future.

1.6 Delimitations

According to the research undertaken by Strietska-Illina (2011) commissioned through the International Labour Organisation (ILO), who define green jobs as those that minimise the harmful impacts on the environment and cut across to meet sustainable levels in sectors such as agriculture, industry, services, and administration. Every employment opportunity has the potential to become "greener" over time, and national definitions of what counts as a green job will differ from country to country and evolve as the transition to a green economy advances (Strietska-Illina, 2011).

It is on this backdrop, that the scope of this research will be limited solely to skills programme gaps within the petrochemical sector in South Africa, with its green economy aspirations. The research will not extend to the broader green economy concept as every industry may need to be researched. The research will sample participants within the petroleum sector, even though this sample may not be entirely representative of the population. In a case study format, it will primarily utilise

qualitative methods, with an emphasis on in-depth interviews to collect primary data, and documentary analysis as primary research method. Consequently, the findings will provide a detailed description of the phenomenon. The research will provide important information which adds to existing literature that will help understand the complex nature of skills gaps in South Africa with the green economy as a foundation.

1.7 Operational definitions of terms

1.4.1. Skills Development

Skills development involves learning and improving essential talents, knowledge, and skills for personal and professional advancement (Oberschmidt et al., 2021). New methods have been developed to teach relevant hard and soft skills, including critical thinking, creativity, collaboration, big data technology and teamwork (Villalba et al., 2018). Developing skills includes finding techniques to assist with review and intervention (Boomsma et al., 1997).

1.4.2. Green Economy

The green economy enhances social well-being and promotes equality while dramatically reducing harmful climate and ecosystem issues (Al Siyabi & AHakro, 2020; Georgeson et al., 2017; Gissin et al., 2018). A clean energy economy reduces greenhouse gas emissions, improves the world, and maximises natural resource usage (Al Siyabi & AHakro, 2020). Both industrialised and emerging nations' growth goals include the green economy (Georgeson et al., 2017). It is an organisational and economic framework for sustainable development that aspires to solve today's major environmental issues, improve economic growth, end poverty, and ensures inclusiveness (Orlovska et al., 2020; Stoiko, 2016) .

1.4.3. Green Skills

Technical, environmental, and digital skills, knowledge, attitudes, and values that enable sustainable growth and decrease the harm that humans cause to the environment through their actions are known as "green economy skills" (Kozlova &

Volkova, 2019). These abilities include the capacity for problem-solving, leadership, team building, and effective job performance (Gowen & Tallon, 2003). Finding a mechanism for workers to acquire the skills they require is a crucial component of the strategy for expanding labour resources in a green economy (Novikova, 2020).

1.4.4. Skills Gaps

Skills gaps are disparities between the skills needed versus the abilities that people already have in the workforce (Carlisle et al., 2021; McKenney & Handley, 2019; Whittaker, 2016). This gap can occur due to technological and population shifts as well as through inadequate training and education (Ghotbifar et al., 2017). The elimination of talent gaps is critical for companies and economies to flourish and progress (Carlisle et al., 2021; Halilbasic, 2021). Investing in training and education, expanding a talent pool, and creating a learner-centred teaching environment are all approaches to bridge the skills gap (Apturkar et al., 2014; Malik & Venkatraman, 2017).

1.4.5. Human Capital Theory

Human Capital Theory considers how much knowledge, skills, and competencies a person possesses and can acquire through education and training (Adriani, 2019; Gadzhiev et al., 2020; Mayilyan & Yedigaryan, 2022). It is an investment in people that helps the economy thrive in a sustainable manner. According to human capital theory, persons with greater education and training are more productive and earn more money (Xu & Gao, 2023; P. Zhang & Hu, 2013). The concept also emphasises the importance of investing in education and training to address skill shortages and increase productivity at work (Bielby & Bielby, 1988; Teixeira, 2009).

2 Literature Review

2.1 Introduction to the Green Economy

The green economy, which is the economy of the future, is growing around the world as countries move towards a more sustainable, low-carbon, and inclusive economy to support long-term financial health, social equity, and environmental stewardship. This review of the literature gives new ideas about the green economy. It talks about how the green economy is defined, how it relates to sustainable development, its challenges and opportunities, and related theories and ideas like the circular economy, eco-innovation, green growth, and corporate social responsibility.

The first part, the green economy is defined in terms of its social, economic, and environmental benefits, and why the Sustainable Development Goals (SDGs) are so important to promoting the green economy. In the second part, the international context of the transition to a green economy and how universities can help people learn green skills to deal with future issues of sustainability. In the third part, research explores how the green economy and sustainability are intertwined. In the fourth section, the dynamics between the green transition and reaching several SDGs. The fifth part comprises varied academic views and ideas about the green economy are shown. This shows how the concept has evolved over time and the role of policy. The last section critically assesses challenges and opportunities of transitioning to an economy that focuses on conservation, sustainability, and job creation. It also discusses related theories, such as the circular economy, eco-innovation, green growth, and corporate social responsibility.

2.1.1 Defining The Green Economy

Dziekański et al., (2022) define the green economy as the development of one that is low in carbon emissions, sustainable, and inclusive. The green economy is the sought after economy of the 21st century as nations shift away from unjust development and towards a more environmentally friendly one (Al Siyabi & AHakro, 2020). The green economy is one that fosters long-term growth as well as improvements in quality of life. Green economy initiatives benefit humanity, communities and the environment

(Dziekański et al., 2022). A sustainable economy is essential to achieving social justice and maintaining environmental harmony (Al Siyabi & AHakro, 2020). The green economy promotes long-term financial health, equitable social structures, and environmentally sound growth to lessen the burden on future generations (Chaaben et al., 2022).

It ensures continued social and environmental advancement. In developed and underdeveloped countries, the green economy emerges as crucial component of the policy framework for sustainable development (Georgeson et al., 2017). This framework has the potential to facilitate the development of societies that are more socially inclusive, efficient with resources, and low in carbon emissions (Georgeson et al., 2017). Despite its potential, the green economy may be defined through several different mechanisms, which has certain limitations of its own (Georgeson et al., 2017).

There is a strong connection between environmental economics and the green economy, but the green economy is more political in its orientation (Zvarych et al., 2023). Since they can be rolled out on a global, national, and local level, the Sustainable Development Goals (SDGs) are an essential part of the green economy (Universitas Tanjungpura Pontianak, Indonesia & Elyta, 2021). Ultimately, the success of the green economy will be determined by the degree to which local communities and governments, along with research institutions and businesses, will work and collaborate together (Alsmadi & Alzoubi, 2022).

Compared to traditional economies, green economies benefit people and the environment. Green infrastructure like mangroves and wetlands and grey infrastructure like roads and bridges can be a win-win for businesses and communities (Sen et al., 2021). The green transition aims to promote economic and social growth while minimising environmental damage and optimising resource utilisation (Zvarych et al., 2023). Green economy-based short-, medium-, and long-term plans can boost the economy and aid people (Movahedian & Norouzi, 2023).

The circular economy can produce jobs in the green economy, making it easier for people to join (Barna et al., 2023). The green economy helps the environment and

long-term growth more than standard policies and norms (Wen, 2022). Useful analysis can be drawn at an economic, cultural, environmental and resource viewpoint as regards the green transition (Shi et al., 2016). Green economy ideas can reduce poverty, make it simpler to live in a healthy and safe environment, and reduce natural resource conflicts, making people feel safer (V. Bondarenko et al., 2023).

Environmental economics underpins the fast-growing green economy (Al Siyabi & AHakro, 2020). Its goals are to protect future generations' development, increase resource efficiency, and improve human well-being and social fairness (Al Siyabi & AHakro, 2020). Green economy evaluation models or indicators are used to accurately analyse the eco-environment and natural resource depletion and adjust economic actions to achieve management goals (Y.-K. Chen & Hsieh, 2010). Recognising unsustainable impacts of natural capital decline and the fundamental returns of environmental management helps implement green economy (L. Zhang et al., 2022).

2.1.2 The International Green Economy Context

The global transition to a green economy is gaining traction. The acquisition of green skills is essential to the facilitation of this transition (Stroud et al., 2014). Numerous nations are implementing policies to revitalise deindustrialized regions, with an emphasis on the development of green competencies (Stroud et al., 2014). Germany's green transition (Energiewende) is a successful example of green policy that has contributed to global climate change objectives and established German industry as a leader in renewable energy technologies (Pegels & Lütkenhorst, 2014).

China has created environmental policies to foster the green transition (Shen et al., 2022). Uganda has built industrial symbiosis and an industrial plan for sustainable growth (Buda & Ricz, 2023). These policies consist of, but are not limited to, monetary policy, fiscal policy, industrial policy, and finance and taxation policy (Jinfang & Shusheng, 2016). The shift to a circular economy has been made easier in the Netherlands because to the implementation of a legislative instrument known as Dutch Green Deals (Van Langen & Passaro, 2021).

There are still skills gaps between those offered and those required for the green transition (Kizu et al., 2018). Universities should aid in green skills transitions, and in so doing, integrate multiple perspectives from diverse groups and cultures to manage future issues of sustainability (Zacchia et al., 2022). Technical and vocational education and training (TVET) contributes to green economic reorganisation by formulating effective strategies for the development of green skills (Pavlova, 2014). Universities can also work with businesses to create training programmes for green skills and internship and job opportunities for students (Pavlova, 2019). In concrete terms, green industry policies that work and university programmes that help the environment can help move countries toward a more sustainable future.

2.1.3 The Relationship between the Green Economy and Sustainable Development

Kellenberg (2012) draws a comparison of the green economy a comprehensive economic ecosystem that protects the environment and supports long-term growth by using natural resources and reducing waste and pollution. Several studies have investigated how the green economy and sustainability work hand in hand. Dogaru (2021) and Yildirim & Yildirim (2020) have explored how green economy and sustainable growth are related. Orlovska et al., (2020) posit that you can draw green economy correlations by looking at green growth against that of sustainability.

Though complementary, the green economy and sustainable development may conflict. Sustainable or "green" economy sectors often compete for finite resources and land. Biofuel production may convert food-producing land, which harms food security. Renewable energy infrastructure may harm biodiversity and ecological services. An integrated approach that includes social, economic, and environmental sustainability is needed to overcome these trade-offs.

All stakeholders—governments, enterprises, civic society, and local communities—must participate in decision-making. Additionally, policies and regulations should encourage sustainable practises and minimise environmental and social harm(Vargas-Hernández, 2020). Adamowicz (2022) references key relationships in

the green economy and green growth in Europe, globally and how they relate to the idea and goals of sustainable development.

2.1.4 The Green Economy and Sustainable Development Goals

The Green Economy and the Sustainable Development Goals (SDGs) are inextricably intertwined. This is true for several research papers, including that of Juan (2020), Vassileva (2022), Zamyatina et al., (2022), Kuvalin et al., (2019), Mun et al., (2022), Masduqie et al., (2021), Anugrah et al., (2022) and Naidoo et al., (2021). These studies have paid attention to several SDGs, such as SDG1, eradicating poverty; SDG7, ensuring access to sustainable energy; SDG10, reducing inequality, and SDG12 attaining sustainable production and consumption.

The SDGs related to energy and the environment are directly and indirectly affected by consuming green energy (Rasoulinezhad & Taghizadeh-Hesary, 2022). Through the SDGs, the idea of a "green economy" may be put into place on a national, regional, and worldwide level (Elyta et al., 2021). Evidence shows that the economic, social, and environmental goals of SDGs are linked to the different parts of green finance (Zheng et al., 2021). Public procurement is also used to reach broader policy goals that align with the SDGs, such as promoting a circular and green economy, encouraging innovation, helping small and medium-sized businesses, promoting ethical behaviour and responsible business conduct (OECD, 2023).

Li et al., (2016) describes Sustainable Development of Green Space (SDGS) as an integrated green system which is underpinned the environment factors and the social economy. Sustainable SDGS are the coordinated growth of the social economy, environment, and urban green system (Chaaben et al., 2022). Green economy indicators from different models that focus on green economy and green growth are used to figure out how SDGs relate to natural resources (Wu et al., 2018). The SDGs were announced by the United Nations. They include economic growth, quality of life, education for human resources, infrastructure, fair distribution of resources, development of green energy, and a sustainable environment (Wu et al., 2018).

2.1.5 The Green Economy and the Petroleum Sector

The global petroleum industry and the green economy are two concepts that have gained traction. The petroleum sector on the other hand, is important to the global economy, but it also a source of harmful greenhouse gases (Gaurina-Medjimurec, 2015). Climate change activists, business and ordinary citizens are becoming more aware of the need to reduce the earths rising average temperature (Aleksandrov et al., 2022). Researchers Gaisina et al., (2022) and Chen et al., (2020), argue that the shift to renewable energy and international trade disputes are causing new issues for the petroleum market.

Setyadi (2019) discovered that green supply chain measures helped oil and gas companies be more sustainable. Aleksandrov et al., (2022) also investigated the application of green financing and digitization in Russia's oil and gas business, while Atay & Kocman (2023) investigated the use of green management in the petroleum industry. Non-ionic polyacrylamide (PAM) and partially hydrolysed polyacrylamide (HPAM) are also used by oil firms to extract more oil from the ground (Chen et al., 2012). It is becoming increasingly vital to replace the unsustainable hydrocarbon economy with a green and environmentally friendly carbohydrate economy (Miller et al., 2020).

2.1.6 The Green Economy definition nuances

Several terminologies have characterised the green economy, which has continued the international dialogue. Scholars argue that the green economy is natural, wide-reaching and uses renewable resources and reduces waste and pollution to reduce environmental hazards and encourage sustainable growth (Morgera & Savaresi, 2013). Other researchers have emphasised the need to transition seamlessly, which includes greenhouse gas emissions elimination strategies and promoting renewable energy sources (Paduraru & Ţurcanu, 2022). Some academics have also discussed the importance of the bioeconomy, which refer to biological resources being exploited in a sustainable manner for food and energy production (Birner, 2018; Caprotti & Bailey, 2014).

Smentyna & Fialkovska (2019) argue numerous definitions of the green economy exist, everyone agrees that it is both a challenge and an opportunity for economic growth, job creation, and improved environmental and social outcomes. The various definitions of the "green economy" indicate how the concept has evolved over time and the variations between them, which aid in policy formulation and implementation.

2.1.7 The Green Economy Challenges and Opportunities

The green economy presents both challenges and opportunities. Some of the issues are the necessity to invest heavily in green technologies, the likelihood of job losses in established industries, and the need for policies to be consistent and cut across sectors (Wang, 2022). The green economy must also balance expected profits with costs of green efforts and reconcile economic returns with environmental conservation (Adamowicz, 2022). However, the green economy provides opportunities for economic growth, employment creation, and environmental and social gains (Dogaru, 2021).

The green economy can assist achieving long-term development goals such as eliminating poverty, ensuring everyone has access to clean energy, and making production and consumption as environmentally friendly as possible (Albekov et al., 2017). It is also possible to develop green skills which focus on improving the lives of the most vulnerable (Kwauk & Casey, 2022). By encouraging conservation, the green economy can also assist to safeguard nature and improve people's health and happiness (S. Bondarenko et al., 2020).

Developing countries are confronted with issues such as high unemployment, poverty, and inequality (Nethengwe, 2022). They must also address challenges such as energy security and climate change. Elimam (2023) posits that there is also the possibility that these countries lack the necessary infrastructure and technologies to transition to a green economy. However, there are alternatives for developing countries to avoid old methods of agriculture and instead rely on sustainable technologies (Elimam, 2023).

Developed countries may face issues such as corporations that refuse to change and political opposition (Morgera & Savaresi, 2013). Even though many developed nations

already have the infrastructure and technologies required to transition to a green economy, they may also have the advantage of leading the development and use of green products (Peccianti, 2021).

2.1.8 Related theories and concepts in the Green Economy

The circular economy, eco-innovation, green growth, and corporate social responsibility are all firmly linked to the green economy (Sadik-Zada & Gatto, 2023; Vence & Pereira, 2018). The circular economy encourages the reuse and recycling of commodities to extend their lifespan (Caprian et al., 2023). The circular economy is enabled through eco-innovation (Vence & Pereira, 2018). Green growth fosters both environmental and economic sustainability (Sadik-Zada & Gatto, 2023). Corporate social responsibility focuses on business ethics and sustainability (Gooijer, 2022).

The circular economy pushes back against regulatory, institutional, economic, financial, investment, market, technological, informational, and cultural barriers (Dzwigo et al., 2021). "Green" logistics are used in the circular economy (Caprian et al., 2023). Circular economies have been implemented by countries (Wahyuningrum et al., 2021). Thus, connecting the green economy to other ideas and concepts is critical for developing environmentally friendly and sustainable practises across a variety of businesses.

2.1.9 The Green Economy limitations

Some used to define the green economy have limitations. Lack of a clear, global definition of the green economy might cause uncertainty and inconsistencies in its implementation (Caprotti & Bailey, 2014). Reliance on regulatory, organisational, economic, financial, informational, communication, budgetary, and tax processes may not work in all settings (Bilokon, 2022). Technological innovation and renewable energy are crucial to the green economy, yet they may not solve all environmental issues (Wang et al., 2022).

Green economic transitions are spatially complicated, and governance and transition logics and mechanisms must be critically assessed (Caprotti & Bailey, 2014). Green

credit systems and carbon emissions trading are needed to sustain the green economy (Jin & Hunter, 2013). Politics, culture, and society can also stifle green development, but synergy can overcome these barriers (Xiaoxiao, 2016).

2.1.10 The South African context in the Green Economy

Due to South Africa's high unemployment rate and carbon footprint, the importance of the green economy is amplified (Borel-Saladin & Turok, 2013). Changes ranging from slight to drastic will be made to existing jobs, and some carbon-intensive jobs will be eliminated, as the economy undergoes its transformation towards ecological sustainability (Sharpe & Martinez-Fernandez, 2021). Key to the "economy of the future" is the implementation of innovative projects utilising alternate forms of energy (S. Bondarenko et al., 2020).

The International Labour Organisation highlights three critical areas potentially crippling South Africa's transition to a green economy namely (Strietska-Ilina, 2011):

- The pressures to decarbonise the economy considering it is ranked 8th in the world from a per capita emissions point of view.
- Has an abundant and centralised coal-based economy.
- A general lack of critical skills in several sectors with a particular shortage of engineers, technicians and human resource and training professionals (Strietska-Ilina, 2011).

The governments Medium Term Strategic framework 2009-2014 prioritised two strategic areas namely the development of skills and secondly, sustainable human resource frameworks to user in green jobs (Strietska-Ilina, 2011). The World Bank (2022) report reaffirmed the ILO points several years later adding that a low-carbon transition, climate-resilience and a supportive just transition to save jobs are crucial to an equitable green transition.

South Africa has the capacity to harness green skills and shift the current skills shortage but faces significant challenges. These formidable obstacles counterbalance the potential for new opportunities and expansion. South Africa's economy has and continues to experience protracted growth and worsening unemployment rates,

especially among the youth (Oluwajodu et al., 2015). The International Labour Organization (ILO) stresses the significance of enhancing the skills of South Africa's labour force in order to address the dual challenge of ensuring the continued viability of the economic system and protecting the environment (International Labour Organisation, 2018).

The International Energy Agency (2022), found that renewable energy sector in South Africa grew by 24 percent in 2019, indicating a positive trend toward the adoption of green energy. In concrete terms, South Africa can fully realize the potential of the green economy, only if substantial progress is made in the nation's workforce development. To support the IEA, ILO recommends the implementation of tailored skills policies and targeted training programmes to equip the working population with the necessary skills for a successful transition to an environmentally sustainable economy (International Labour Organisation, 2018).

2.2 Introduction to Skills Development

The next section begins by providing the broad, conceptual framework and definition which underpins skills development. Thereafter, a global perspective is covered through literature. It becomes important to differentiate between skills, education, and training therefore this follows the global perspective. The department of employment & labour attribute skills mismatch as a major challenge in skills development objectives and these concepts are articulated through research. Together with some examples of causes and effects. Finally, barriers to Skills programmes as well as drivers are further explored through the literature.

2.2.1 Defining Skills Development as a concept

The cultivation of skills requires a wide variety of approaches and frameworks. Blackmore (1999) has a broad conception of what constitutes "skills development," which includes study in the business world into "soft skills," research in cognitive psychology on superior performance, and research in education on transferrable abilities. Shtaltovna (2021) positions definitions of skills as well as the frameworks that are used to evaluate academic and professional skill development. There is further

need for greater development in the areas of skill definition, assessment, and reflection (Shawcross & Ridgman, 2012).

2.2.2 Global perspectives on Skills Development

Globalisation has made skills development more global. In Nigeria, and many other countries, the state plays an active role in developing skills (Jiboku, 2021). To find solutions to the problem of skills development, global efforts and a predictive frameworks sustained development of the youth have been developed (Telukdarie et al., 2022).

Sustainability and sustainable development play a role in policies and practices concerning skills (Crawford-Lee & Wall, 2018). In Europe, career management is emphasised through policy and practice (Sharlanova, 2021). A multi-pronged and comprehensive approach in dealing with global skills issues has become increasingly important.

2.2.3 The difference between skills development, training, and education

Education, training, and skills are all closely linked and should not be confused with one another (Quiñones, 1995). Formal and informal education can be the catalyst through which wisdom, competence, and morals are acquired (Zen Fatro et al., 2019). It takes time to hone in on intellectual abilities and they become more effective and more prepared for a wide range of careers as a result (Gruber et al., 2013). Training is a condensed procedure that focuses on the development of abilities that are specific to a job (Hassan et al., 2011). It is centred on enhancing one's performance on the work.

Training and education are both components of the process of developing skills, i.e., Skills development (Suutari & Viitala, 2008). Talents are either acquired, or improved upon when you have them, so that job prospects can be increased. Skills can be taught through multiple channels including schools, and businesses. Education helps enhance a person's cognitive abilities, whereas training helps build skills that are

unique to a career (Leroux & Lafleur, 1995). Education and training make a person more employable and consequently, improves job opportunities.

2.2.4 Skills Mismatch Concepts

The skills mismatch or gap can be described as the conflict between the needs of workers and the demands of businesses. The Department of Employment & Labour recognises that several issues arise from skills mismatch including occupations in high demand (OIHD), as well as over and underqualified workers (Rasool, 2021). When a worker has more, or less education than is required, this is referred to as vertical mismatch (McGuinness et al., 2018). When an employee lacks job-related skills, this is referred to as horizontal mismatch (Salas-Velasco, 2021). McGuinness et al., (2018) examines the literature on skill mismatch and offers future study directions. Tsiklashvili & Poladashvili (2021) suggests the possibility of a skills mismatch when total supply and demand match in numbers differ in position, title or skillset. Vertical mismatches, talent gaps, skill shortages, enrolment strategies, horizontal mismatches, and skills obsolescence are all examples of mismatches. Houston (2005) argues that skills and geographical mismatches worsen the skills demand versus supply issue. He observes that the term "skills mismatch" is used in economics literature as well as national and global education and labour market agendas (Houston, 2005). Research explores the relationship between skill mismatch dimensions which include magnitude, measurement, and implications for company returns, productivity levels and job satisfaction (Amiti & Freund, 2008).

2.2.5 Causes and effects of a skills mismatch

When its causes and effects are taken into consideration, skills mismatch has an impact on individuals, employers, and communities at large (McGuinness et al., 2018). Mismatches between skills and jobs can be caused by factors such as globalisation, population expansion, technology, and inadequate education and training (Tsiklashvili & Poladashvili, 2021). The mismatch of skills leads to reduced compensation, decreased productivity, decreased work satisfaction, and increased unemployment (Maltseva, 2019). Studies have also shown that a mismatch in skills can have diverse effects on an employee's level of satisfaction in their employment, and that ignoring a

mismatch in skills can lead to incorrect judgements about the facts (McGuinness et al., 2018). Both subjective and objective skill mismatches can have an impact on employee happiness (Nieto et al., 2015). Skill mismatches across regions and industries can sometimes be explained by deficiencies in the sub-national level of skill development (Senkrua, 2021).

2.2.6 Analysing Skills Barriers that prevent gaps being addressed

People that participate in training programmes are more productive, feel safer and are more employable as a result (Gruber et al., 2013). Stoner & Milner (2010) talked about the obstacles that students have when it comes to learning their subjects and acquiring skills that are job-ready. According to Afroze et al., (2015) found that women run businesses face unique hurdles on the path to financial success. The political and social context in South Africa exacerbates programme implementation. Liulienė & Metiūnienė (2009) emphasise the need for learners to develop metacognitive skills, and in parallel, Flurey et al., (2019) argue the importance of younger people developing mentorship, feedback, and facilitation skills to cope with barriers.

2.2.7 Skills gaps closure challenges

A plethora of factors contribute to the difficulty in closing skills gaps. According to several research papers, people's lack of information and abilities pose a serious learning problem (Bradley & James, 2019; Conger, 2013; Prabhashwara et al., 2022; Samaniego et al., 2022). A lack of assistance leads to misapprehension and low self-esteem (Samaniego et al., 2022). Too few training programmes meet the needs of both students and industry (Melnichuk et al., 2017). The function of public policy in reducing these barriers is understudied in the entrepreneurial literature (Gupta, 2013).

2.2.8 Drivers of skills programmes

Skills projects teach specialised skills and safe behaviours, encourage safety programming, and teach people how to drive safely (Wellner et al., 1966). The South African government posit technology, occupation change, and climate change as key enablers of skills programmes in a 2021 report (Rasool, 2021). The goal of the

commercial construction industry is to design and compare new and current training programmes, increase professional abilities, and enable training providers to make high-quality products (Studer & Kemkar, 2012). Before employing robotics on children, doctors must finish basic and clinical training (Onan et al., 2018). Soft skill training can assist university students in obtaining employment (Assan & Nalutaaya, 2018). Throughout training and practicing, clinicians act out on patients while being monitored (Rash, 2008) . Leadership development fosters intellectual and social leadership characteristics, but the long-term effects differ (Getha-Taylor et al., 2015).

Workshops on acceptable education and resistance skills have been investigated in the context of teen drug use and misuse (Blum, 1997). To execute social and emotional skill development courses, teachers must get training and coaching as part of their initial and ongoing education (Zlatić & Luković, 2020). Finally, to thrive in public health management training, field managers must have cross-cutting skills in prioritisation, planning, and problem-solving (McEwan et al., 2001). These arguments highlight the need and critical nature for industry- and person-specific training as drivers for building skills.

2.2.9 Identifying existing skills gaps in South Africa

The local petrochemical industry is beleaguered by inadequate policies, strategies, and strategic plans to address technical skill shortages, skill waste, and poor workplace human capital (Kikasu, 2021). Two decades ago, the South African Systems Development Industry needed information systems graduates from the University of Cape Town (Scott et al., 2002). The need to enhance STEM education, provide good training for new recruits, and be transparent about employers' expectations causes skills, training gaps and mismatches between occupations and job searchers in developing nations like Kenya (Meta, 2022). Developed nations are experiencing a widening digital skills and usage disparity (Bek & Aygun, 2016) . Rapid technological advancement and sustainability necessitate the availability of more skilled individuals than now exist (Braun et al., 2022). The tourism industry is short on skilled personnel and changes pay structures to compensate for this challenge (Carlisle et al., 2021).

Horwitz (2013), examines the nature of the skills gap, the factors that make it difficult to retain skills, HR strategies for managing talent, and policy issues. In his findings, South Africa lacks intermediate and some high-level skills. The author provides an analytical framework that examines how different emerging markets are developing. Further analysis characterises rapidly evolving South African occupational and skills labour market, as well as the obstacles to skill formation and retention, and the measures taken to address these problems (Horwitz, 2013).

A skilled labour shortage is threatening South Africa's economy and global competitiveness (F. Rasool & Botha, 2011). This shortage of skilled labour influences a wide range of industries, including engineering, which must now identify the skills required for Industry 4.0. The lack of skilled labour in the construction sector has negatively impacted work quality (Windapo, 2016). Furthermore, a substantial number of trained medical professionals are leaving the country in search of employment abroad, which is detrimental to the health industry (Labonté et al., 2015).

There is also a severe teacher shortage, with an estimated demand of 15,090 new teachers in 2008 (De Villiers & Books, 2009). The South African government established Sector Education and Training Authorities (SETAs), to help develop training, improve skills transformation, alleviate poverty, expand employment opportunities, and achieve employment equity standards (Mateus et al., 2014). The skills crisis is worsened by the lack of systems to study the gaps between recent graduates and job market needs (Della Tamin et al., 2019).

South Africa's transition to a low-carbon economy is hampered poorly trained and skilled energy industry employees. Skills gaps stifle rapid advancement in alternate and cleaner forms of energy production in this industry. The oil and gas industry struggles to recruit and retain skilled workers due to the energy industry's skilled worker shortage (Dickey et al., 2011). Several government training and professional development programmes have been developed to address the energy sector's critical skills gap (International Energy Agency, 2022).

2.3 Introduction to Skills Programmes in South Africa

South African policies and programmes have promoted skills development. The National Skills Development Strategy (NSDS), in place since 2001, but revised and improved on numerous occasions since then, is widely regarded as one of the most important policies (Horwitz, 2013). The National Skills Development Strategy seeks to close the gaps by improving education and training nationwide.

The National Skills Development Strategy emphasises providing funding for skill development programmes, promoting lifelong learning, and encouraging partnerships between the government, the private sector, and educational institutions (Ndedi, 2013). Successful government-Business Process Outsourcing (BPO) collaboration in South Africa has become a benchmark globally and contributes to this industry (Rajagopaul et al., 2020). This result of which has seen domestic and international businesses begin to establish call centres in the country, resulting in the creation thousands of jobs. Funding opportunities for employee training in the BPO industry have become available through the National Skills Development Strategy.

Other initiatives, in addition to the National Skills Development Strategy, include the Skills Development Levies Act, which requires employers to contribute to a fund for skill development (Fitong Ketchiwou et al., 2022). This responsibility is also shared by Sector Education and Training Authorities (SETAs), which oversee developing and implementing programmes to improve skills in specific industries (Prinsloo & Lategan, 2005). For instance, the Construction SETA has launched a programme to help women advance their careers in the construction industry by providing training and professional development opportunities (The Mail & Guardian, 2020). These initiatives have improved skill development in South Africa, but more investment and educational system reform are needed.

2.3.1 An overview of the SETAs and Skills Development Levy

In 2000, the South African government established Sector Education and Training Authorities (SETAs) to address a skills gap that was impeding economic growth and job creation (Mateus et al., 2014). SETAs are responsible for developing and implementing sector-specific plans for skills development, promoting learning programmes, and offering grants to employers to support skills development (Turner

et al., 2013). SETAs have been granted expansive decision-making authority to facilitate the successful implementation of these initiatives.

Nonetheless, the effectiveness of SETAs has been called into question, and their use of funds to promote education and training outcomes has previously been investigated (Turner et al., 2013). The tourism industry continues to struggle with education and skill training, which has a negative impact on youth employment and development, despite the establishment of a SETA. The lack of employment opportunities in the government health care sector is also concerning (Elkonin & Sandison, 2006). SETAs have implemented initiatives to encourage youth entrepreneurship in response to this situation. They also provide reporting on skills gaps across the 21 SETAs, as required by the Department of Higher Education and Training. They established 5 skills gaps Management & Leadership skills, Computer skills, Technical skills, Communication skills and customer service skills as the broad pillars of challenges (Rasool, 2021). These initiatives are hindered by obstacles such as policy development, operational, and instructional difficulties (Ndedi, 2013). Therefore, additional efforts are required to ensure that SETAs can effectively and efficiently achieve their objectives. The 1998 Skills Development Act created the Chemical industry Education and Training Authority (CHIETA) to help South Africa's chemical industry train its personnel (Ellis & Steyn, 2014). The authority develops training with industry players to boost productivity and competitiveness. CHIETA funds, monitors, and ensures that the field has enough skilled people to build South Africa's economy (Ellis & Steyn, 2014). This is the SETA through which focus will be paid at sectoral level within the petrochemical environment.

South Africa's 2000 Skills Development Levy (SDL) was part of the 1999 Skills Development Levies Act. The levy-grant scheme encouraged employees in the private and governmental sectors to get on-the-job training (Otieno & Ochieng, 2018). The concept was rendered ineffectual due to the public sector's money and management. Corporate South Africa have the means and incentives to assist the country improve. Legislative frameworks were developed through the "National Qualifications Framework Act", "Skills Development Act", and "Skills Development Levies Act" (Otieno & Ochieng, 2018). The SDL is used in the government's White Paper

Education and Training to assist South African firms with skill issues (Otieno & Ochieng, 2018).

2.3.2 Skills Development Higher education institutions

Success and failure in South Africa's globalisation of higher education have been ventilated through research (Kishun, 2007). International students can provide essential skills to South Africa (Aloyo & Wentzel, 2011). Because of curriculum formulation and shifting issues, higher education institutions struggle to teach skills (Ramonyai et al., 2022; Tandlich et al., 2018; Winberg et al., 2014). There is a thought leadership suggesting community involvement to assist in the transformation of South African universities (Nicolaides & Austin, 2022). The direct and indirect benefits of higher education on GDP and employment in South Africa have been examined at length (Pouris & Inglesi-Lotz, 2017). Alumni feedback is deemed invaluable for South African institutions and colleges to improve their courses and qualifications (Joubert & Hay, 2022). In support of these institutions, the Skills Development Act and Skills Development Levies Act were developed and are managed through the country's skills development system (Lee & Davison, 2018).

2.3.3 Public and private sector interventions in South African skills development

Recent research examined how the public and private sectors can help South Africans better. Interventions by the private sector have supported economic growth, increased sector competitiveness, and encouraged regional unity and development (Gakusi et al., 2015). Hospitals and clinics in South Africa have been mapping available data on antimicrobial stewardship initiatives, according to the country's antimicrobial resistance plan (Chetty et al., 2019).

The public sector's finances and administration reduce the effectiveness of the levy-grant arrangement (Paterson, 2005). From a Black Economic Empowerment (BEE) point of view, laws were amended to enhance the number of black African women managers in the private sector (Matotoka & Odeku, 2018). Accountants and that industry continues to assist small firms in better managing their finances (Kirsten &

Fourie, 2012). Previously disadvantaged South Africans groups have had opportunities to participate and have benefitted from private sector resources (Tsotsotso et al., 2017). To this end, South Africa's growth is dependent on the private sector's ability to meet skill requirements and by doing so, governmental and private sectors will continue to back skill development initiatives (Akoojee & Arends, 2009).

2.3.4 Barriers to effective Skills Development in the South African context

Several studies have shown that South African skill development is hampered, firstly low skill levels have been identified as a fundamental impediment to attaining a strategic advantage in the global economy (Allais, 2011). Skills development at its basic objectives in South Africa should improve administrative needs, networking opportunities, and work experience (Telukdarie et al., 2022). South Africa's competitive intelligence is poor, which limits its overall performance and ability to compete (Strauss & du Toit, 2010). The overall skill acquisition of South African built environment specialists is similarly understudied (Ebekozi et al., 2022). More than a decade ago, education and skills feature among seven "Priorities for Intervention" as identified by South Africa's Accelerated and Shared Growth Initiative (Maumbe & van Wyk, 2011). Some businesses have taken an integrated approach, holistic approach to engineering skill shortages (Hall & Sandelands, 2009). South African skill development suffers from a lack of a learning programme management and assessment scale (Tshilongamulenzhe et al., 2013). Finally, municipal skills development strategies are difficult to implement, which is attributed to South Africa's skills shortage (Davids & Esau, 2012).

2.3.5 Drivers of skills programmes in South Africa

Several studies have been carried out to investigate the factors that contribute to the success of skills training in South Africa. Some of which include investing in infrastructure that could help the country reduce its high unemployment rate, reduce poverty and a decrease shortage of qualified workers (Thwala, 2008). It's possible that business development and incubation programmes in could be beneficial to SMEs on a more consistent scale (Lose & Tengeh, 2016). Collaboration efforts between government, industry, and academia can change the discourse in attempts to increase

its workforce skills and reduce skills mismatch planning (Taylor, 2004). The systemic failure of South Africa's education and training system to generate skilled workers, has caused it to suffer from a skills gap surplus (F. Rasool & Botha, 2011). Training provided almost two decades ago through the public works programmes may also have been beneficial to South Africans (McCord, 2005). Since 1994, South Africa has been working to improve the capabilities of its people, albeit with several drawbacks, progress has been made in parts (Erasmus et al., 2005).

2.3.6 Skills Development in the Petroleum sector

Several studies have demonstrated the significance of skill development in this industry in particular Diedericks et al., (2019) created cathodic protection systems for petrochemical plants in South Africa. Nyawera & Haupt (2020) conducted a survey of a large South African petrochemical company in KwaZulu-Natal to establish, through skills, what constitutes a good process health and safety culture. Shah & Perrotta (1976) argued way back when that South Africa can only profitably produce liquid fuels and petrochemicals from coal and has subsequently been a thriving business for Sasol for decades.

According to Beidari et al., (2017), between 2005 and 2010, chemical and petroleum businesses dominated South Africa's economic landscape through professional local skills. Laseinde and Kanakana (2017) highlight the tenure of automotive exports and the transferable skills which can improve still further in South Africa. Taylor (2004) investigated how skill-building projects in South Africa affect the cooperative model back then. Grobler and Bruyn (2011) were intrigued by the flexible work practices of South Africa's broad business sector. These studies argue great significance of skill programmes for growth and sustainability of a variety of sectors including petrochemicals.

3 Research Framework

3.1 Overview of Human Capital Theory

Economists Theodore Schultz, Gary Becker, and Jacob Mincer conceptualised human capital theory in the 1960s. They argued that education, health, and training could develop human capital, like physical capital (Kozuń-Cieślak, 2020; Sharma & Sahni, 2015). This consequently improves output and contribute to economic advancement. Schultz's study focused on the importance of education and training in human capital growth, whereas Becker's study focused on the role of incentives in human capital investment (Little, 2003). Mincer's study underlined the importance of on-the-job training and experience in human capital development (Sharma & Sahni, 2015).

These economists' efforts have pioneered the way in better understanding the role of human capital in economic growth and development. Human capital theory has been used to explain the relationship between education, health, and economic growth in a range of disciplines, including health and education economics (Grossman, 1999; Teixeira, 2009). Even though human capital theory is widely used, Schultz criticised it in a way that agrees with John Kenneth Galbraith's view that we should not put too much weight on education alone (Chirat & Le Chapelain, 2020; Chirat & Le Chapelain Charlotte, 2019). Human capital theory advancement has enhanced our knowledge of the importance of investing in human capital for economic growth and development.

3.2 Evidence supporting Human Capital Theory

Several studies have successfully demonstrated that investing in human capital and developing the economy go together. For example, a study conducted in Turkey between 1961 and 2011 revealed human capital and economic growth are related (Derviş Boztosun et al., 2016). Similarly, studies conducted in Pakistan revealed that health status is positively related to economic growth (Akram et al., 2008). Furthermore, evidence has demonstrated that investing in human capital leads to significant improvements in the economy. In Nigeria, for example, research led to the discovery human capital investment among street vendors helped the economy expand (Olurinola et al., 2014). Research conducted in Sub-Saharan African countries

revealed that in the long run, human capital and economic growth go hand in hand (Matashu & Skhephe, 2022). Other studies have found a link between human capital and economic growth, and that this link has a significant impact on how a country's economy expands (Sanjoyo, 2019). These findings demonstrate the need of investing in human capital for economic growth and success.

3.3 Limitations of Human Capital Theory

HCT has been widely used to explain how education and more broadly, skills, influence economic growth. Contrastingly, there are some arguments against HCT that claim it does not adequately explain how complex the labour market is. According to Yeung (1997), HCT describes concepts that explain differences in how well economy's function. Additionally, HCT has been criticised for undervaluing the capital of some members of society, which deprives them of the compensation they deserve (Alwani, 2021). Some academics argue that HCT is too limited because it focuses on education and training as the primary determinants of economic growth.

Kang and Mok (2022) argue that HCT has not kept its promise that investing in degrees and credentials will lead to better employment opportunities. According to them, earning a bachelor's degree does not necessarily transform human capital into economic capital, which make it easier to find employment (Kang & Mok, 2022). Brown, Lauder, and Chung (2008) assert that HCT has become a failed revolution, and they propose an alternative theory that reconsiders human capital in the era of intelligent machines. Some scholars argue that HCT places too much emphasis on the individual and disregards social and cultural factors that influence the job market.

Alwani (2021) maintains HCT does not account for the undervaluation of certain individuals' capital, thereby denying them their fair share of economic gains. The widely held view of a global economy based on knowledge and driven by new technologies ignores the social and cultural factors that have an effect on the labour market (Brown et al., 2008).

3.4 Role of Government Policy

Human capital investments, vital to economic growth, are influenced by public policy. Government policies that encourage education, skills development programmes, employment, and health care improve human capital (Ramirez & Nazmi, 2003). Government investments in education and healthcare can boost health, productivity, and economic growth. Government-funded health and education can also reduce poverty and inequality, which boosts human capital growth (Mukherjee & Badola, 2021). Government efficiency affects the labour market, and politicians influence human capital investments (Campbell & Aderinto, 2022). Human capital-boosting public policies, projects, and initiatives can boost a region's economy (Nikolov et al., 2020). In concrete terms, the government policies that promote education, skill development, and health care are critical for a nation's human capital, which drives economic growth.

3.5 Conceptual Framework

The independent variable, Skill Development Programmes, drives development and strengthening of weaknesses in Skills Programmes & Industry Development, i.e., dependent variable, through expansion of human capital, which acts as a mediating variable. Factors such as Technological adoption, industry specific KPI's and a partnership ecosystem may moderate the strength or direction of this association.

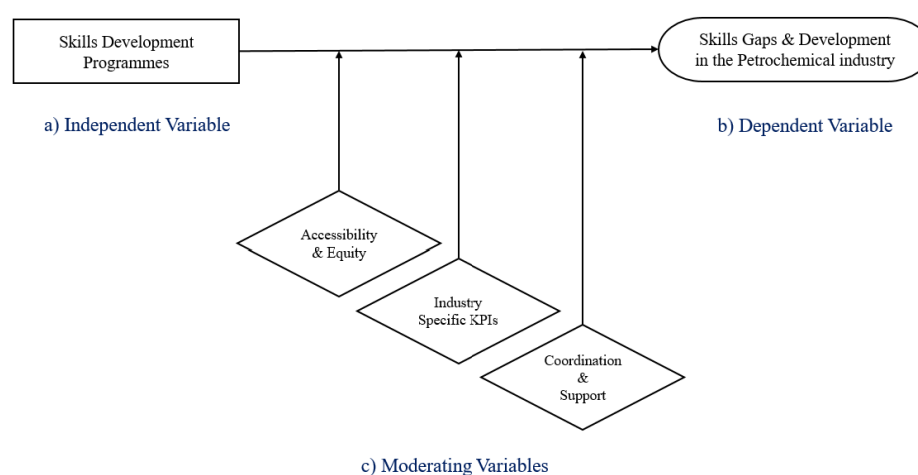


Figure 1. Conceptual Framework

Adapted diagram showing Theoretical Relationship between a) Independent variable, b) Dependent Variable and c) Moderating Variables

a) Independent Variable: Skills Development Programmes in the Petrochemical Industry

In this investigation, "Skills Development Programmes" serve as the independent variable. The researcher is of the view that these programmes have a direct bearing on closing the "green economy" gaps of the to-be state. It is possible that issues concerning to programme accessibility, alignment with organisational objectives, fulfilling rare green skill needs and their practical application can influence the expansion of developed skills within the sector.

b) Dependent Variable: Skills Gaps and Development in the Petrochemical Industry

The rate of expansion toward strengthening of skills programmes are contingent on broader efforts in stakeholder engagement, organisational commitment, and the green economy knowledge base within formal and informal economies.

c) Moderating Variable: - Industry-Specific Skills Readiness and Relevance

One of the factors that helped to moderate the results of this study will be participants' perceptions of why gaps still exist. This variable refers to the opinions of programmes which participants have access to or influence in their managerial roles. They concern the skills mismatch, barriers, alignment, and coordination of green skills training programmes. This impression can be influenced by several factors, each one of which, when changed, can influence how Skills Development Programmes influence the expansion of the green economy. For example, participants who believe and articulate that skill development programmes are relevant to their needs, are practical, and are interweaved with theoretical learnings may be of significant value. These views may extend to issues concerning programme equity, policy and how the industry measures success. These inform the moderator values in Figure 1. above.

d) Mediating Variable: Interventions for Skills Gaps in the Petrochemical Industry

The mediating variables concern how access to the programmes are of firstly, relevance to the sector and organisation under review and secondly, do skills programme and their application have relevance in meeting ambitions to address weaknesses. The focus of the mediating variable, through developing talents, and improving return on human capital could support realignment of programme gaps.

4 Research Methodology

4.1 Research paradigm

Any study's research paradigm reflects the researcher's philosophy and approach (Wimalaratne & Kulatunga, 2022) . The study's constructivist approach has attempted to comprehend participants' views on Skills Development Programmes and green economy growth. The constructivist researcher realised that participants' experiences, beliefs, and values shaped their knowledge (Kayii & Akpomi, 2022) . Open-ended qualitative interview questions allowed participants to communicate their experiences, beliefs, and values while the researcher concentrated on understanding their perspectives.

The study used an interpretive qualitative approach, where the researcher stayed impartial (Chun Tie et al., 2019). Facts informed analysis and drove theory creation. This method ensured that the findings were based on participants' experiences and viewpoints rather than preconceived ideas. Constructivist ethics were also important (Tillman, 2002). From data collection to analysis and dissemination, the researcher preserved participants' privacy, anonymity, and confidentiality. The researcher obtained informed consent from participants and respect individuals' right to withdraw from continuing (Mandava et al., 2012).

4.2 Research Design

The purpose of this research was to investigate the association between Skills Development Programmes and their perceived gaps or weaknesses within the context of a petrochemical company as a case study. The goal was to gain a better understanding of why skills gaps persist and how Skill Development programmes may be reshaped to consider progress into the Green Economy. While Human Capital Theory may not serve as a direct moderating variable, it does inform the broader context within which the moderating variables operate. HCT played a role in shaping the industry's approach to skills programmes and informs readiness for technological alignment, and collaboration within the petrochemical sector.

4.3 Population

Through a combination of interviews, case studies, and document analysis, the research sought to generate valuable insights and create a comprehensive view of the relationship between skills development programmes, human capital formation, and the growth of the green economy in South Africa. The overarching population objective will help the researcher to establish correlations to respond to the research questions identified.

This study's target population consisted of individuals who have actively participated in the hiring process of employees and have identified the need and criticality of skill development programmes. These included among others, middle, senior business managers as well as Human Resource Managers. These individuals are industry experts working in the Energy Sector and have vested interests in developing people and Skills Development programmes for a purpose.

4.4 Sample

Purposive sampling selected relevant participants to answer research questions. This method of participant selection enabled the selection of participants based on their experiences or roles related to the study's objectives, which ultimately lead to a deeper understanding of the investigated phenomena (Campbell et al., 2020). A total sample of 16 respondents was expected to be sufficient due to saturation, comprising:

- 16 Middle & Senior Business and HR managers within a company in the petrochemical industry

Count	Primary Source	Medium	Expectation
16 <i>Persons</i>	Individuals of the Petrochemical sector	Face to face request, i.e., non-randomised	Online meeting appointment, completion of consent forms, issue

			participant information sheet
--	--	--	----------------------------------

Data saturation in qualitative research served as the foundation for the choice to interview sixteen participants. In qualitative research, through primary data collection, where the main objective is to explore perspectives and deepen understanding rather than generalise findings to a larger population, data saturation is a crucial factor in determining sample size (Carpenter-Song et al., 2020). When more interviews provide little to no new information to advance the study's themes or conceptual framework, it is said to have reached saturation (Saunders et al., 2018).

The sample size of 16 respondents in this particular research setting was carefully selected on the basis of the idea that a smaller, more targeted sample enables a thorough examination of people's experiences, viewpoints, and insights pertinent to the goals of the study. This method works especially well for an Applied Research Project, which prioritises useful, applicable knowledge over theoretical generalizability.

After carefully weighing each of the following factors in a balanced manner, 16 respondents were chosen to place focus on:

Diversity and Representation: Getting a sample that is sufficiently varied to represent a wide range of viewpoints within the intended audience. With 16 participants, the study successfully included people with a range of genders, roles, seniority, experiences, and perspectives relevant to the skills gap in the green economy that exists in the South African petrochemical industry.

Depth Over Breadth: Preferring in-depth, qualitative insights guided the tactical suggestions covering 11 in-depth questions, the number 16 enabled full interaction with every participant. This enabled a thorough investigation of their experiences without compromising the depth of observation, which may have been compromised over a larger cohort (Alam, 2020).

Resource and Time Efficiency: Striking a balance between the breadth of the research and the time and resources that were available in the context of an Applied Research

Project was considered. The optimal sample size for carrying out in-depth interviews and enabling careful data analysis was found to be sixteen.

Precedent in qualitative research: Established research typically involves sample sizes of 15 to 20 participants (Griffith et al., 2017; Lewis, 2015). Especially in studies that aim to achieve a deep contextual understanding within particular industries (Gyllensten et al., 2022).

Evidence of Saturation: By the sixteenth interview, the themes and information reported by the preceding respondents had started to recur, indicating that no new information was to be revealed. The fact that this repetition indicated that data saturation had been reached supports the suitability of the sample size selected for the objectives of the study (Aguboshim, 2021).

In conclusion, the 16 respondents were chosen based on a deliberate process reinforced by the qualitative research approach. With this sample size, data saturation was achieved. Rich data could be interpreted and analysed without going over the practical limits of an MBA Applied Research Project.

4.5 Data collection methods

Participants' semi-structured interviews provided the required primary data and were collected through online digital platforms through interview conducted via Microsoft Teams and recorded the sessions. It must be noted that secondary data was not used. This technique facilitated the collection of detailed and richly descriptive accounts of individuals' experiences, perceptions, and opinions in relation to the research questions (Solikhah, 2018). The research also included case studies of successful skill development programmes to gain a better understanding of best practices and the key factors that have contributed to the success of these programmes in the context of the green economy (Kizu et al., 2018).

4.6 Research Procedure

4.6.1 Interview Preparation

Prior to commencement, it was crucial to verify that all hardware devices and the means of conducting the interview were functional. Since the plan was to schedule online interviews using Microsoft Teams, a reliable internet connection was essential, and a backup link via a mobile Wi-Fi router was available. The researcher arranged with the Business School room availability should the former have been challenging and to have catered for extreme loadshedding events. Additional stationery such as notebooks, pens, pencils, and highlighters further supported the preparation work.

The researcher dedicated sufficient time to familiarize themselves with the interview guide and practiced responding to questions regarding the objectives, procedures, and format the interviews took. To ensure the integrity of the interview process, the following format was adopted:

- Conducted online interviews with a duration not exceeding 1 hour.
- Verified that consent forms have been received before proceeding with data analysis.

4.6.2 Scheduling

The interviews were scheduled through email invites that included the date, time, and duration of the appointment. The email invitation included additional information such as the study's purpose, and respondents were able to propose adjustments to the timetable. Efforts were made to accommodate the desired time slots of the participants while keeping to the overall study timeframe.

4.6.3 Informed Consent

Before the start of the interview, participants were be informed of the goals. The interview request and the informed consent form (ICF) was sent as email attachments. Participants sent this signed form back to acknowledge agreement and participation. In the unlikely event that a minor was to be interviewed, i.e., is under 18 years of age, the ICF would have been sent to their parents or guardians.

4.6.4 Conducting the interview

The researcher asked open-ended questions guided by the questionnaire. Questions were the basis through which the semi-structured interviews took place. This formed the basis of the primary data collection. The goal was to find out about the participant's experiences, opinions, and ideas about the research questions. There was follow-up questions and explanations to make sure that the participant's answers were clear and thorough.

4.6.5 Closing the interview

At the end of the session, participants had an opportunity to ask any questions they deemed were necessary. They were thanked for their time, and told what will be required next if any.

4.6.6 Interview documentation

All interviews were audio-recorded and transcribed verbatim from the recordings. To ensure the participant's privacy and confidentiality, the transcriptions, notes, and other relevant documents were securely stored. Only the researcher and their supervisor have access to the dataset, which has been anonymised.

4.6.7 Data analysis methods

Thematic analysis was used to identify patterns or themes in the qualitative data, analyse them, and then interpret them. The first stage of commencing data analysis was to become acquainted with the information gathered through interviews. The transcripts were read and reread, and notes were required to have found initial codes, which were subsequently classified into bigger topics.

The importance of these themes in relation to the study questions and objectives were then assessed, and any necessary changes were made. Finally, the themes were utilised to narrate the findings and describe the interactions between the variables studied, with a focus on how skills development programmes, skills gaps, barriers,

lack of coordination, and moderating factors contributed to or stifled the expansion of South Africa's green economy.

4.7 Techniques

4.7.1 Reliability and Validity

In qualitative research methods, achieving consistency and stability are vital aspects of reliability (Fletcher, 1999; Morse et al., 2002). Ensuring the study's reliability and accuracy was of paramount importance. Reliability analysis in this study encompassed Transcription Accuracy, Coding Consistency, and Member Verification, which together provided a triangulation approach.

To ensure accurate transcription, it was essential to compare transcriptions to original records, eliminating errors that might have reduced the reliability of the results (Bielinska et al., 2021). Member checking aimed to confirm the accuracy of interview points by returning to participants and reflecting on their input (Morse et al., 2002). This was not used extensively.

4.7.2 Transcription Accuracy

Transcription verification was crucial for addressing reliability concerns. The researcher assessed response transcriptions through recordings to ensure accuracy. Precise transcription of interviews enabled the researcher to understand proposal development challenges by accurately reflecting participants' perceptions. Inaccurate transcriptions, which may have misrepresented responses or introduce bias, would have compromised the validity and trustworthiness of the research results.

4.7.3 Coding Consistency

Coding enabled researchers to evaluate interview responses and, in many cases, established consensus on labels and themes. It must be noted that these formed the basis for the tables presented in the Research Findings chapter and are not to be misinterpreted as secondary data. Assessing participant responses individually further

reduced bias in creating themes for subsequent thematic analysis. A consistent coding plan supported data consistency, which contributed to the study's reliability. Inconsistent coding, on the other hand, may have overlooked crucial points or overemphasize minor issues.

4.7.4 Member Checking

Member checking differs from transcription accuracy in that it produces unique outcomes and facilitates improvement. Participants did not have an option to review preliminary results to confirm their concerns are accurately represented, as direct transcriptions from recordings allowed data to be presented verbatim. This was therefore not necessary in the context of this project.

4.7.5 Validity

When talking about qualitative research, "validity" refers to how well the results describe the thing being studied (Carroll, 2015; Dakin & Areán, 2013). It is a way to measure how plausible and reliable the results of a study are. Also, validity and credibility are often used interchangeably. This shows how well the researcher has reflected the facts of the participants (Cho & Trent, 2006; Whittemore et al., 2001). This study investigated Sampling, Data Quality, and Transferability. After completing Reliability and Validity analysis, Thematic Analysis work could be undertaken.

5 Ethics

The practises of researchers are governed by research ethics. These principles place an emphasis on respecting the dignity, rights, and welfare of study participants while simultaneously conducting exhaustive and objective research.

Several different research ethical frameworks can be found in South Africa. The guidelines established by the University of Witwatersrand are followed by the Wits Business School. The importance of obtaining informed consent, maintaining confidentiality, mitigating risk, and ensuring diversity and social justice in research is emphasised by these frameworks. These frameworks address and prioritise: informed consent, protection of personal information, data storage, interpretation of data, user rights, confidentiality, cybersecurity, and anonymity.

5.1 The Ethics of Data

The ethics of data collection and analysis in South Africa go beyond those of research ethics. When dealing with vulnerable populations, such as those with low incomes, persons with impairments, or members of disadvantaged ethnic or cultural groups, power dynamics are an extremely important aspect to consider.

When it comes to gathering or analysing data on delicate subjects like HIV/AIDS, gender-based violence, or political dissent, sensitivity, respect, and cultural competence are necessary to prevent causing harm or perpetuating stereotypes. The gathering and analysis of data must also safeguard the dignity and privacy of the people who participated in the study, as well as avoid stigmatisation and prejudice.

5.2 Honesty and Responsibility in Reporting

The reporting and dissemination of findings adhered to ethical standards. This includes being honest about the limitations and biases of the research, giving credit to the people who participated in the research, and not trying to sensationalise findings. It also required taking into consideration how the communities that we explore may be

affected by the research and taking steps to mitigate any unintended consequences that may arise.

Ethics are critical important to any research endeavour, and moreover because of the prevalence of power dynamics, marginalisation, and historical injustice. By adhering to the most stringent ethical standards, the researcher ensured that research and reporting was responsible, rigorous, consistent, and courteous.

6 Research Findings

6.1 Structure of Findings

After conducting interviews through Microsoft Teams, a transcribing process was completed. The dataset was cleaned and prepared by this technique. To ensure that only transcript data pertaining to the questions or topics could be reviewed, it was necessary to eliminate duplicates.

Every question and response transcript were checked to identify any newly arising codes. The prevalence, consistency, and importance of these primary codes were considered when creating these documents in Microsoft Excel and Word. After multiple revisions and document updates, a final set of codes could be determined.

The deductive technique was used to establish codes through literature research, which directed the discovery and production of the codebook. A second coding phase was initiated to enhance the initial codes and link them to broader themes.

6.1.1 Data anonymisation

Respondent IDs were assigned and used before the transcribed application procedure in MS Word or Excel. This removed potential prejudice while also ensuring that ethics and confidentiality were preserved in accordance with university practice and respondents' agreement. All data collected was viewed through the viewpoint of anonymity. This resulted in a richer experience as some of the codes and motifs developed. It must be highlighted that for this case study to have been conducted, a binding, legal undertaking had to be guaranteed to ensure confidentiality of the individuals and the company. On meeting these criteria, the company agreed to participate in this case study.

6.2 Participant Demographics

The participant group, albeit being somewhat small, was comprised of individuals with a wide range of experiences and made substantial contributions to this study. An overwhelming majority of the participants have been employed by their company for several decades, as seen by the average length of time they have been working in the industry. There were only two of the sixteen participants who had any kind of exposure to the green economy, either through their strategic or technical talents. **Figures 2 and 3** show the makeup of gender split and management seniority by gender. It is worth mentioning that the study sample included 63% senior management. These are those who manage huge teams of 4 to 6 direct reports and up to 35 indirect subordinates per senior portfolio. As a result, their organisational impact in this study has been beneficial to hiring and company managers. **Figure 3** depicts the ethnic breakdown, while Table 1 shows the years of experience per participant ID and their range and respecting the need to protect their identities. Notably, more than 80% of respondents have at least 15 years of experience.

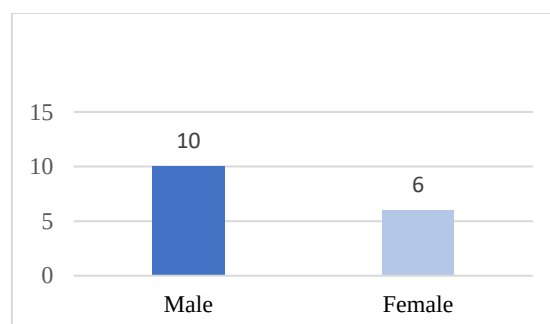


Figure 2. Participant Gender Composition

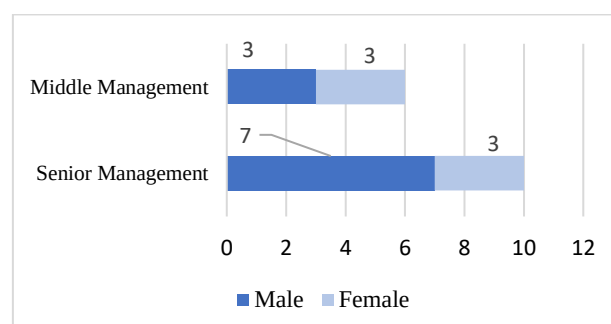


Figure 3. Seniority by Gender

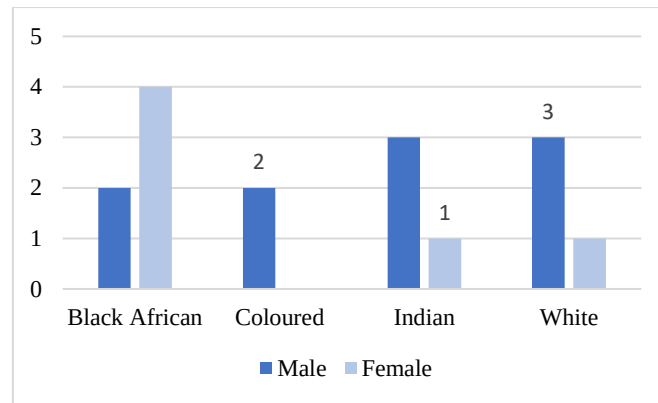


Figure 4. Ethnic Composition

Participants IDs	Range - Experience in Sector	Proportion Experience as %
P3	<5	6%
P4	>5 <10	6%
-	>10 <15	0%
P1, P2, P10, P11, P15	>15 <20	31%
P5, P6, P9, P12, P13, P16	>20 <30	38%
P7, P8, P14	>30	19%

Table 6-1. Participant Experience in Bands

6.3 Introduction

As a reflection of the overarching research question: “What are the Skills Development Programmes' weaknesses in addressing skill gaps in South Africa's green economy, in your experience?”, this section presents the findings of experienced petrochemical staff, associated with sub-themes that have emerged. The degree to which respondents' propensity with a question resonated with them or not, has been determined by the sentiment afforded in each response. These were identifiable as positive, neutral or negative. The seniority, gender, and age distribution of the participants spans a broad spectrum, including middle management with limited experience in the green economy and senior officials boasting more than three decades of specialised knowledge. The views and excerpts cover the following themes: Skills Development Programme (SPD) Evaluation, Obstacles and

Challenges, Return on Investment and Talent Development and finally, Skills Mismatch and Industry Impact.

The contrast between a male professional with over 30 years of experience and a female professional with 16 years of experience in the sector underscores the significance of bridging skill gaps and constructing a resilient workforce capable of guiding the economy towards a more sustainable future. This chapter presents an analysis of the challenges, viewpoints, and potential advantages associated with a skills development framework that is suitable for the participants' limited to moderate familiarity with the green economy.

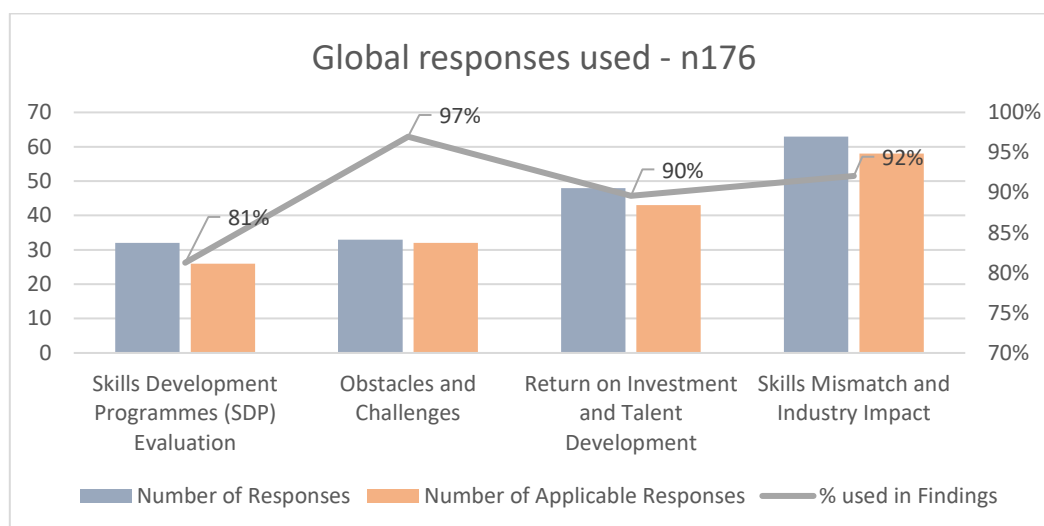


Figure 5. Global Respondent Rate: Respondents vs. Used in Findings

6.4 Skills Development Programmes (SDP) Evaluation

This section synthesises the participants' thoughts on Skills Development Programmes (SDP), with a focus on integrating green skills into sector and organisational policy. Qualitative research, from the respondent perspective has revealed major concerns, giving light on the incongruity between present SDP practices and the changing workforce requirements. Three sub-themes emerged from the findings, programme effectiveness, meeting requirements within SDP and shortcomings of skills programmes. The questions guided these findings and emphasised the degree of agreement or disagreement to them followed by **Table 2:**

Skills Development Programme & Codes, with additional excerpts supporting this section. A summary of the respondent sentiment informs the findings.

Questions one to three of the Interview questionnaire:

- *Your view on Skills Development Programmes (SDP)?*
- *Are your requirements for green skills and specifically within SDP being met?*
- *Are your green skills needs included in an SDP for this sector?*

Findings

Regarding practicality, a common concern expressed by nearly 85% of participants is the lack of practical application and immediate relevance of SDPs to their daily job functions. This, with a view to longer term career advancement. For example, Participant 16 expressed frustration with the connection between programme content and workplace application, highlighting, "...they're not practical enough for me...needs to have a practical element to it...needs to be relevant to our workplace application". This perspective highlights a fundamental gap in matching SDP outputs to actual work requirements and operational needs.

When accessibility is considered, 70% of the respondents expressed concern regarding the limited availability of growth opportunities connected with SDP accessibility. These chances usually target a certain segment of the organisation, without taking into account the entire workforce base. Participant 14 expressed dissatisfaction with the fact that "...proper money, proper streamlining, and proper alignment to job grades...people are starting to take note of it," implying that there is a disparity in the distribution of funds which caters for SDP funding vehicles across employee segments.

If we consider integration into organisational strategy, views of SDPs against the sector strategy emerged, with nearly 80% of respondents indicating that there was a misalignment between SDPs and the overarching strategic aims of their organisation, as well as the sector in general. The most significant characteristic that was negatively impacted was the pace of acquiring green skills. Participant 12 observed that "...we're

not even putting funding aside... around the green economy as a whole" which demonstrates an apparent strategic oversight in the allocation of resources for the development of skills important to sustainability.

75% of respondents, with an emphasis on sector concerns and sustainability, believe that the current SDPs fail to adequately address the critical need for green skills to navigate the transition to sustainable energy solutions. The statement made by Participant 13, which is perceptive in nature, "I think there's just a gap analysis that's missing there in terms of our training...feels like you're pushing it down somebody's throat", underscores the insufficiency of a sustained and embraced green skills alignment.

The lack of comprehensive gap analyses within the organisation, which are required for precisely identifying and bridging skills gaps, is a major area of concern expressed by 90% of survey respondents. Participant 16 levelled criticism, "I don't think we take the time...around gap analysis in terms of what is the role requirement, what does the person have...and how do we close those gaps", demonstrates a widespread consensus to systematically assess and manage skill gaps.

Regarding improved policy broadly, almost 60% of participants expressed a need for enhanced policy and regulatory support to stimulate widespread adoption of green skills training at firstly, sectoral level, and then companies. According to Participant 15, "government is also trying to come up with different policies...but those policies themselves are still not robust enough". This may illuminate the importance of more intentional and authoritative policy frameworks in driving SDP change towards sustainability.

The issues above are depicted in the summary diagram below, where Shortcomings of Green Skills Programmes remained the main contributor to issues relating to accessibility, practicality, alignment and strategy of holistically. 81% or 26 of 32 usable responses could be analysed. Negative sentiment toward the questions posed significant discussion and subsequent key words and concerns. Positive sentiment was expressed overall with Programmes and their general effectiveness in none-Green Skills disciplines.

Sentiment / Sub-category

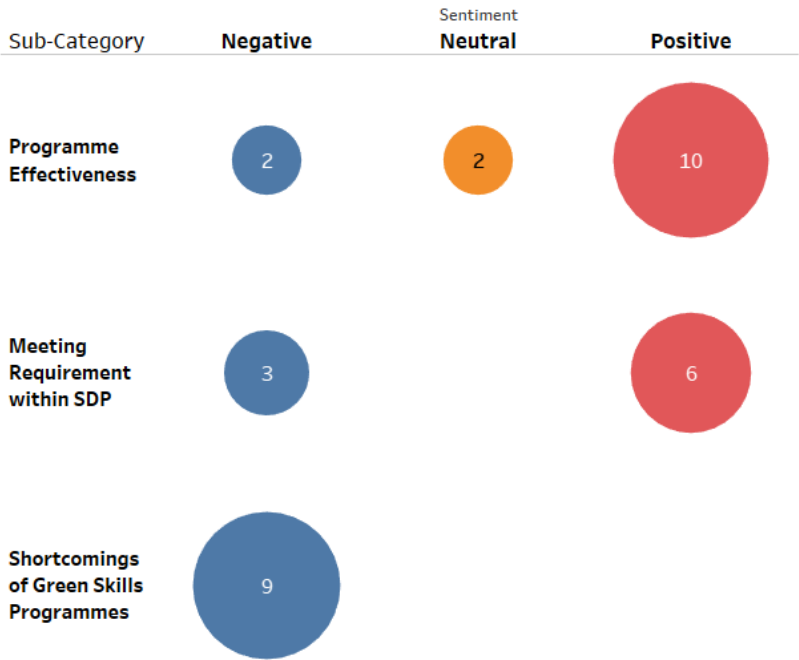


Figure 6. Skills Development: Respondent Sentiment Summary

Theme: Skills Development Programmes (SDP) Evaluation			
Participant	Interview excerpt	Final Code	Sub-theme
P7	...the skills development within an organisation is going to teach you the year now hopefully. And not the theory that was printing a textbook	Unmet Requirements	Programme Effectiveness
P4	...I'd say it's grooming me towards being a more confident, decisive and effective leader in the sector	Personal Growth	
P4	...It's a very critical component towards one's advancement.	Personal Growth	
P1	...I would say no, the long and short of it	Unmet Requirements	
P3	...I would say the skills are there, maybe it's just to tweak them like as I'm saying to, let's say, leadership skills.	Alignment & Relevance	
P12	...We could do more... It's not visible enough	Unmet Requirements	
P3	...We're going to the right direction. Around this topic, so I'll try and align to this green economy.	Slow Progress	Meeting Requirements within SDP
P10	...we tick the box. There are some good concepts in it, but is it aligned?	Alignment Gap	
P3	...I would think they are being met, but the progress would be slow because we take only a few employees through those programmes	Slow Progress	
P5	...It is important for programmes such as SDPs to be there to close that particular gap. Very positive as a concept.	Alignment Gap	
P6	...It's important, both internally and externally.	Value Creation	
P8	...starts with the competency review and then... the competence review goes to the training plan and HR takes it from there.	Value Creation	
P13	...I think for me where I find a bit of a gap... How do we assess?	Resource Disparity	Shortcomings of Green Skills Programmes
P13	...there's a gap analysis that's missing there in terms of our training.	Gap Analysis	
P4	...Practical experience is lacking for negotiations, and the focus is on theoretical academic courses.	Gap Analysis	
P9	...Most of the time they're not implemented.	Resource Disparity	
P3	...I would say the skills are there, maybe it's just to tweak them like as I'm saying to, let's say, leadership skills.	Gap Analysis	
P16	...For me, I still say the programme needs to have a practical element to it.	Practical Application	

Table 6-2. Skills Development Programme emerging sub-themes and codes.

The findings of this theme and emergent sub-themes highlight the widening gap between the current design and implementation of Skills Development Programmes and the imperatives of incorporating sustainability and green skills within organisational and sectoral frameworks. Participants endorse the principles attached to SDPs, however, advocate for more realistic, inclusive, strategically aligned, practical by design and supportive of the transition to a green economy. The demonstration of these subjects through direct respondent commentary underpins the crucial necessity for adaptive adjustments in SDP policies to better meet the workforce's ever-changing expectations as well as global sustainability goals.

6.5 Obstacles and Challenges

This section provides a concise overview of the main findings derived from the inquiries made on Skill Development Programmes in South Africa's Green Economy. Energy and petrochemical businesses are specifically focused on to emphasise significant difficulties. Thematic analysis was utilised to identify the main themes in the responses provided by the participants. The sub-themes allowed the researcher to furnish them with pertinent quotations to support the findings made. **Table 3:** Obstacles & Challenges, provides additional support for this section. A summary of the respondent sentiment informs the findings.

Questions four to six of the Interview questionnaire were as follows:

- *What are the common shortcomings in important green skills among employees in South Africa's green economy, impacting the petrochemical & energy industries?*
- *To what extent do current plans in the SDP for skill development in the green economy effectively meet the recognised gaps in skills in your organisation?*
- *What obstacles have you faced in obtaining green skills through existing skill development programmes?*

Findings

Codes have developed around a significant number of participants underlined the importance of properly identifying and acknowledging current skill gaps in the green

economy sector. This requirement was brought up during a conversation about recognising gaps. Participant 12 observed: "...organisations are not recognising skills gaps because green economy advancements aren't sufficiently prioritised or integrated into their strategic planning" and surfaced several times during the interview. Considering this perspective reveals a significant impediment to the development of green talents. The respondent implied that it is difficult to advance through meaningful strategic action without first acknowledging these gaps.

The research revealed that around 75% of participants agreed on the need for more practical, hands-on training methods. This is to provide additional details on the problems linked to the existing learning methods. Participant 13's statement underscores the importance of experience learning in connecting theoretical knowledge with practical application observing "...field tours, job shadowing and operational exposure could significantly complement theoretical knowledge".

The researcher generated codes that were associated with access obstacles to training, and participants raised concerns about limited options and training opportunities for niche skills, in Renewables for example. There was a considerable need for "democratising access to green economy-related training and ensuring that it caters to a wider demographic" (Participant 15). This was one of the numerous topics that were discussed. This comment emphasises that skill development courses must be inclusive and not further widen skills gaps. It further underscores that good, relevant training should be available to a broader spectrum of the workforce to ensure that a diverse set of skills and perspectives are documented.

More than 60% of respondents emphasised the importance of academic institutions and businesses collaborating in ways that benefit both. There is a "scarcity of formal, practical, certification-focused training opportunities," according to Participant 12. This is a deficit that could be filled if sectors collaborate more closely. This collaboration could make the curriculum more valuable and relevant by aligning academic offerings with what businesses require. Even though very few institutions provide the academic programmes, respondents were less likely to report having easy access to assistance.

An important aspect that was brought up often in the comments was the significance of education, behavioural change, and awareness-raising in the process of cultivating a culture that is supportive of the green economy. Participant 15 made a statement on the importance of "...training a normal person on the street as well," bringing attention to the more extensive educational requirements that extend beyond the setting of the organisation or sector. The importance of public knowledge and participation in the transition to a green economy is shown by this fact, which highlights the socio-cultural significance of the shift.

The research findings from this topic underscored the necessity for any organisation to wholeheartedly incorporate green economy objectives into both operational and long-term strategy. Participant 16 observed "...it's about awareness, creation, and understanding what we're doing as a company,". By implication, company operations should align with broader societal and strategic objectives, underscoring the crucial nature of awareness building and implementation.

Figure 7. highlights a summary with glaring negative sentiment expressed on by the majority of respondents to address this issue around gap closure and challenges related to these processes.

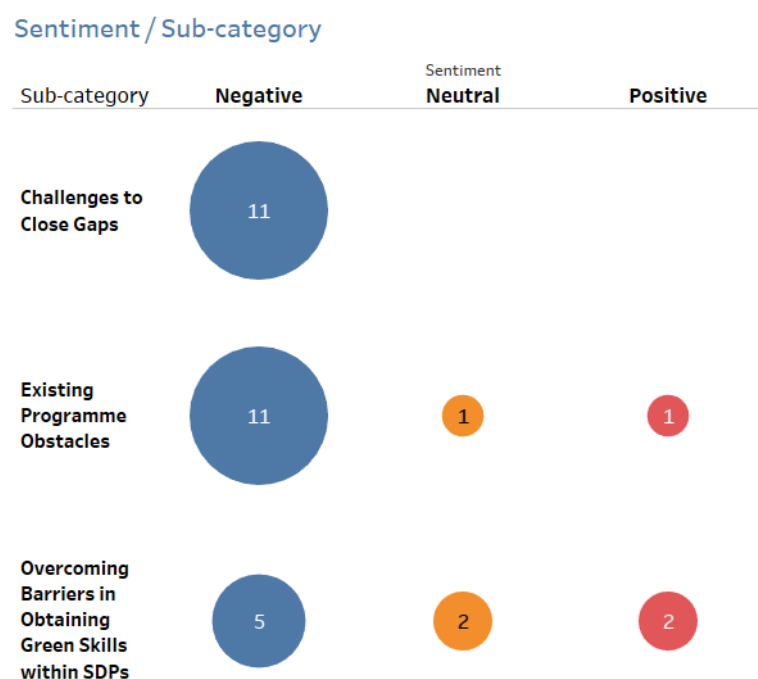


Figure 7. Obstacles and Challenges: Respondent Sentiment Summary

Theme: Obstacles & Challenges			
Participant	Interview excerpt	Final Code	Sub-theme
P1	...we are still not consciously aware of how our actions are affecting the green economy, right? Or the environment as a whole.	Awareness	Existing Programme Obstacles
P10	...there's been a lot of training interventions when it comes to clean skills and, but we tend to think we tend to only focus on what is applicable to the industry	Accessibility	
P14	...Technical knowledge and understanding as obstacles; need for basic understanding and a knowledge center	Accessibility	
P3	...I think I mentioned earlier on that this is a big topic for us, including head office coming up with those kind of skills	Awareness	
P4	...The balancing of work, personal life, and the school dynamic is a mission and half	Balance	
P8	...something that you, I think, want to do in your private capacity or personal... but today's skills. It's a little short-sighted.	Accessibility	
P14	...Partial meet of green skills needs; need to focus on specialized people for driving green skills forward	Behavioural	Challenges to close gaps
P15	...Company's paying for, but they are not necessarily having any opposition, so the organisation pushes that you take those people so that they have something to do.	Behavioural	
P12	...There's nothing formal	Awareness	
P13	...I would like to understand the level of training or knowledge... impact analysis	Awareness	
P13	...make specific time in your month calendar, whatever the case may be and dedicate that to enhancing your knowledge base.	Intentionality	
P4	...Education and training system is just not keeping up	Perceived regression	Overcoming Barriers in Obtaining Green Skills within SDPs
P6	...conflict of interest between business as usual the old way and SDP	Behavioural	
P2	...The biggest challenge is the lack of experienced people in South Africa.	Accessibility	
P5	...I don't think we talk enough about it. I think it's probably a conversation that happens. A strategy has been decided and we'll talk about it at the results level	Awareness	
P9	...The whole green skills movement is relatively new	Awareness	
P6	...we're still a bit further away from doing it ourselves.	Accessibility	

Table 6-3. Obstacles and Challenges sub-themes and codes

Addressing challenges is critical for the advancement and accessibility of skills development programmes within South Africa's green economy. This requires a diverse approach that deals with educational, organisational, policy, and societal levels in parallel. In this section, according to the respondents, there is an urgent need for strategic focus, practical training, inclusive education, cross-sector collaboration, solid policies, public awareness, and integrated organisational commitment to minimise and reduce challenges faced. In this way, closing challenges to gaps experienced and issues faced with existing programmes can be addressed.

6.6 Return on Investment and Talent Development

This section outlines participant insights and the appropriate summaries thereof. The observations emphasised the need to invest in talent development, the challenges of assessing the Return on Investment (ROI) of training, and some ideas to enhance the assessment and achievement of training ROI in businesses. The views include a plethora of information that highlighted the diverse attitudes and perspectives within the organisation. Sub-themes emerging from the following questions include talent investing dividends, employee well-being and measuring ROI. The addition of Table 4: Return on Investment and Talent Development, provides further support in this regard. A summary of the respondent sentiment informs the findings.

Questions seven to eight of the Interview questionnaire were as follows:

- *How important for you is investment in talent to improve productivity for your department and organisation?*
- *Can you offer ideas on assessing the return on investment (ROI) for training personnel, specifically in relation to the development of human capital and skills?*

Findings

All participants agreed that continued talent development is crucial. To prepare employees for success in ever-changing commercial and technical environments, it is critical to provide them with the required workplace skills and information. Narratives make it clear why prioritising investment is critical for preventing inhibiting innovation

and creativity and ensuring an organization's continued competitive position in the market. Participant 13 made a personal reflection "...The world of business is evolving so fast... If I don't upskill... I feel I'm going to remain in the position that I currently am facing". These sentiments were echoed even closer by participant 15 who observed "Investment in talent is imperative... the only way you will get innovation, creativity, new ideas." Participant 6 asserts "... they will come up with new ideas of solving some of the challenges that we have, so in terms of return on investment, you basically have a richer and more enriched engagement in terms of content and delivery, and even performance ultimately."

Although training is widely considered to be essential, there is a significant challenge that develops regarding the evaluation of training return on investment (ROI). Nearly eighty percent of participants acknowledge that it is difficult to properly correlate training efforts to actual business results. These kinds of problems are sometimes associated with a misalignment between the aims of the training course and the immediate operational demands or strategic goals of the organisation, as well as a failure to guarantee that the gained skills are put into practice in the real world. Participant 3 expressed "... it is a very complicated question, especially when it comes to Learning and Development and then looking at the bottom line, because there's so many moving parts, say everybody is contributing." Participant 10 added abstract views "...But you know it in a in a in a technical environment, yes, you can probably measure, you know, things accurately when it comes to employees. Performance and objectives, but how do you link?" Generally, respondents found it challenging to identify concrete indicators to measure impact of investing in talent. In contrast, Participant 2 observed that "...without strong talent, we wouldn't be able to leverage on their acquired skills to help secure business through tenders. The business case in acquiring knowledge is clear."

In response to these obstacles, participants proposed tangible solutions for tightening the link between training programmes and meaningful business returns. These arguments revolve around the alignment of training activities with specific organisational goals, as well as the implementation of actual projects or jobs that allow newly acquired skills to be applied right away. Participant 14 states that "...Involvement in projects that are pertinent to what they did...", implying that people

start and are integrated in a way that allows them to apply what they've been taught. Furthermore, the call for continual evaluation methods reflects a general view in the importance of using an iterative assessment methodology to monitor and incrementally improve the effectiveness of training programmes.

The summary of responses in figure 8. below, demonstrates value and positive sentiment generally toward investing in talent to meet productivity goals, however, it was challenging for most of the respondents to provide practical ideas of what that would look like in the context of skills programmes returns. This becomes evident through a high percentage of neutral and / or mixed views on measuring ROI in relation to talent. Of the 90% responses which could be used, 63% (27) respondents indicated a positive overall sentiment.

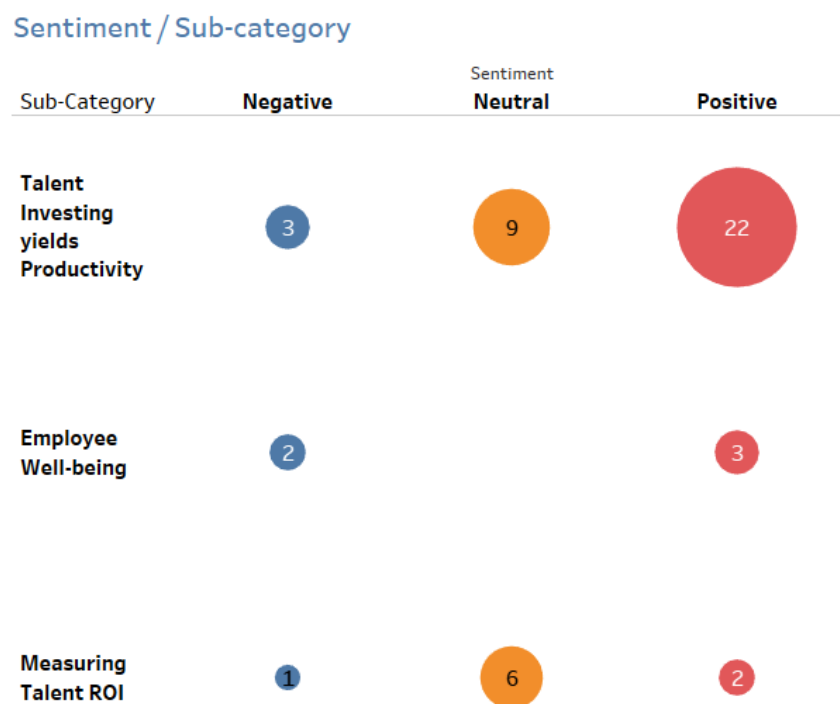


Figure 8. Return on Talent Investing: Respondent Sentiment Summary

Theme: Return on Investment and Talent Development			
Participant	Interview excerpt	Final Code	Sub-theme
P10	...Investment in talent is definitely crucial for enhancing productivity and innovation with departments and organisations	Improved Productivity	Talent Investing yields Productivity
P14	...Critical to invest in talent for organization's growth; affordability as an obstacle to further studies or skill enhancement	Improved Productivity	
P15	...So continuous investment in the in the training to improve you to improve the resource	Continuous Improvement	
P2	...Investing in talent is critical due to competition and directly impacts project optimization	Employee Value Proposition	
P4	...Investing in talent speaks to showing value to employees	Employee Value Proposition	
P16	...So yes, I think it's critical, that the companies are doing better than the ones that are investing more in talent, those are the ones that are going to put their head above the rest.	Shared Value	
P6	...It's critical...people then become engaged.	Employee Value Proposition	Employee Well-being
P6	...You basically have a richer and more enriched engagement.	Shared Value	
P9	...How long do they stay in the organisation afterwards?	Turnover Rate	Measuring Talent ROI
P1	...it is through skills that one can perform tasks efficiently, which will yield to cost-saving opportunities	Cost efficiencies	
P8	...HR is a bit of a science, so you have to have the right job profile... So, is our salary bands correct? So, it's all kind of related...	Structured	
P3	...It is a very complicated question, especially when it comes to Learning and development and then looking at the bottom line	Structured	
P13	...I'm looking for a personal perspective... I'd have staff that are having balanced work life balances... I'll have healthier staff	Employee Value Proposition	
P7	...Crucial. I think you need to we need to broaden the statement how important investment and talent in the productivity of the country... The person I equip here may not stay here. And hopefully it'll benefit the country as a whole...	Shared Value	

Table 6-4. Return on Investment & Talent development sub-themes and codes.

To conclude this section, it encompasses connecting training with strategic organisational objectives, integrating chances for practical application post-training, and implementing dependable, ongoing evaluation methods. The synthesis offered an understanding of the complexities related to training ROI assessment and suggested in parts, mechanisms for enhancing the effectiveness, efficiency, and traceability of training results.

6.7 Skills Mismatch and Industry Impact

This section synthesizes the challenges, techniques, and perspectives on skill mismatches in South Africa's emerging green economy, with a focus on government influence, organisational structures, and individual career advancement. The findings are based on a qualitative assessment of expert perspectives, which were prompted by a unique set of questions for this purpose. This allowed for a thorough knowledge of the vertical and horizontal orientation of skill gaps, as well as their impact on industry adaptability and productivity. A summary of the respondent sentiment informs the findings.

Questions nine to eleven of the Interview questionnaire were as follows:

- *How do your people development and skill-building programmes specifically tackle mismatches and gaps inside your organisation, based on your expertise? Could you provide examples of how these plans have developed to tackle potential anomalies?*
- *What are the major obstacles related to the existing skills mismatch in South Africa's green economy, and what solutions do you think can effectively tackle these obstacles?*
- *Based on your observations, are the skill gaps in South Africa's green economy, particularly in the petrochemical industry, more horizontally or vertically oriented? How have these trends affected both industry perspectives and organisational productivity and adaptability?*

Findings

The conversations reveal a common issue in organisations known as talent mismatch, where employees' skills do not align well with the job's demands. Participant 15 observes "...at senior level, there are people who have the necessary skill and experience within the organisation... but those people have been overlooked." This highlights vertical mismatches at varying levels causing an imbalance. The lack of appropriate internal mobility tools and unclear succession planning exacerbates this discrepancy may result in operational inefficiencies and widening of skills gaps.

It has been discovered that there is a gap between educational offerings and market demand. The current curricula do not effectively address the practical skill sets required in the green economy. One of the panellists observed that "you find people being given positions and they have no idea what's going on in those positions" (P15), emphasising the disconnect between academic knowledge and the actual demands of the sector. Participant 4 observes "...You definitely do get qualified individuals that are misplaced."

An examination of the directionality of skill mismatch reveals a propensity towards vertical gaps. These gaps are distinguished by ineffective use of existing talents as a result of prolonged employment stagnation or early position shifts. Transformative and BEE programmes unintentionally contribute to talent underutilization, which exacerbates the problem. According to the depiction, "our problem lies more in a vertical than in a horizontal... we have more issues with people with a lack of skills and skill gaps" Participant 16 voices, emphasising the critical need for effective talent deployment strategies.

Having skill sets that are not matched with work requirements might reduce an organisation's efficiency and make it more difficult to adapt to the frequently changing demands of the green economy. 80% of participants support more flexible organisational structures and a strategic focus on continuing professional development that is aligned with future trends. This boosts innovation and competition

in the green economy arena as technology evolves. Participant 9 made this statement “...this mismatch often arises due to the traditional focus within the industry... towards change and a lack of focus on sustainable skills. A strategic pivot in recruitment.” The implication the recruitment should be forward-thinking in how gaps are addressed.

The responses indicated a general concern in how the impact of skills mismatches will ultimately impact the industry as it transitions to alternate forms of energy. More than 66% of respondent observations highlights gaps and mismatches perpetuated as a consequence of secondary processes not easily identifiable.

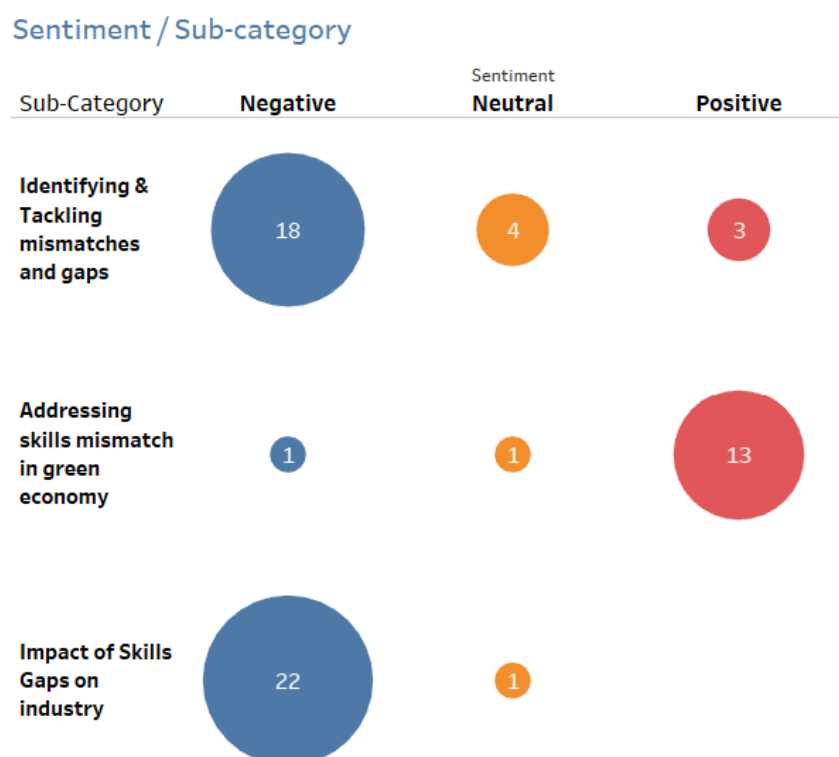


Figure 9. Skills Mismatch and Industry Impact: Respondent Sentiment Summary

Theme: Skills Mismatch and Industry Impact			
Participant	Interview excerpt	Final Code	Sub-theme
P2	...In the green skills sector, there's a horizontal spread of overqualified resources.	Skills Mismatch	Identifying & Tackling mismatches and gaps
P6	...So, the more diverse a skill set we have the better	Skills Mismatch	
P1	...in my personal view, there currently is no skill gap analysis, one which is a huge gap on its own	Gap assessments	
P12	...When we look at draught our job specifications, we don't ask for a degree person, we ask more for relevant experience.	Competency Analysis	
P16	...If I just take a step back and look at the, at a higher level, I would say we more, our problem lies more in a vertical than a horizontal.	Skills Mismatch	
P7	...one of the things we in...this organisation, though we've tried it is competency benchmarking... better competency benchmarking and trying to match jobs with competencies	Competency Analysis	
P13	...It is more for horizontal mismatch then I think there's a lot of people sitting with the vast knowledge with a lot of skills	Skills Mismatch	Addressing skills mismatch in green economy
P12	...I think there's a lot of these things being drafted and only certain people within the organisation are privy to it.	Awareness	
P8	...This mismatch often arises due to the traditional focus within the industry... towards change and a lack of focus on sustainable skills. A strategic pivot in recruitment.	Skills Mismatch	
P3	...The sector and skills plan, if there's a hundreds and hundreds of jobs that falls within that space, so it's so broad and sometimes you even get confused.	Gap assessments	Impact of Skills Gaps on Industry
P1	...developing a skill is not a one-way street. It requires a joint effort.	Gap assessments	
P14	...Combination of over-skilled and under-skilled individuals; taking responsibility for skill alignment.	Skills Mismatch	
P2	...In the green skills sector, there's a horizontal spread of overqualified resources.	Skills Mismatch	
P2	...We hire very multi-skilled people and there's a lot of knowledge transfer across workstreams.	Skills Mismatch	

Table 6-5. Skills Mismatch & Industry Impact sub-themes and codes

The findings which conclude this section shed light on the intricate landscape of skill mismatches that exist within South Africa's green economy, call for a holistic approach that involves government policy reforms, organisational change management, and individual empowerment. Although greater negative sentiment was observed in this part generally across all respondents within the defined sub-themes, greater effort toward discussing green skills gaps can be made. In addition to emphasising the importance of dynamic organisational practices, educational alignment with industry needs, and bridging vertical vs horizontal skill gaps, these participants have offered insights into lived experiences. There has been another view offered and that of participant 6 voicing "...So, the more diverse a skill set we have the better." Their view was that skills mismatch should be looked at differently, and not as a crutch, but allowing people to navigate and grow into roles at specific positions in time, developing themselves in the process.

7 Data Analysis

Using the findings reported in the preceding chapter as a foundation, this section analyses the significance of those findings by situating them within the larger body of research on Skills Development programmes. The goal of this analysis is to show how the identified themes of: Skills Development Programme Evaluation, Obstacles and Challenges for Green Skills, Return on Investment & Talent Development, and Skills Mismatch & Industry Impact help us understand the challenges and opportunities involved in moving such initiatives forward at both the company and sectoral levels.

Skills Development Programme (SDP) Evaluation

Development programmes can encounter substantial hurdles when attempting to connect academic knowledge with practical skills in a role. Although Skills Development Programmes aim to equip students with essential skills, there is often disconnect in practical information in real-world situations. This creates significant hurdles with marrying theory with practice and is of difficulty and not uncommon in industries like petrochemicals and oil & gas, where the implementation of theoretical concepts is crucial for practical achievements (Shafiee et al., 2019). Relying solely on theoretical knowledge may not be enough to effectively prepare individuals for the constantly evolving and intricate challenges encountered in these industries. Significant operational equipment support, which include, decision-making efficiency, project appraisal systems and maintenance for successful petrochemical operations require practical application, without which poses risks to livelihoods (Ponomarenko et al., 2022). Knowledge supports the view theory enhances in a supplementary way, the need for practical skills.

Enhancing an employee's practical skills in these circumstances is achievable by incorporating hands-on training, case studies, and simulations that accurately mirror real-life situations (Yaacob et al., 2021). Beisekenov et al., (2022) posit that academic knowledge can be enhanced richly through an integrated experience by collaborating fully with industry experts and sharing valuable ideas in addition to real-world environments. New technologies such as computer energy optimisation methodologies and intelligent asset management platforms can enhance individuals'

readiness for technological advancements in the oil, gas and petrochemical sectors (Crespo Marquez et al., 2020; J. Li et al., 2021).

In conclusion of this section, there is evidence to support the findings that practical application does make strides to concretise theory-based learning. It cannot be ignored that acknowledgement for the work done by the South African National Energy Association (SANEA), Wits Business School's Africa Energy Leadership Centre (AELC), BRICS Business Council and Researching Education and Labour in publishing the Energy Skills Roadmap 2023 is a great achievement. Whilst refreshing to observe the collaboration, putting forward tangible recommendations, the research findings may have extended itself to suggest a more radical and greater effort from the private sector.

Obstacles and Challenges

Methods to ensure universal access to diverse skills within petrochemical and renewable energy programmes differ. Industry experts, educators, and politicians may help develop and implement training programmes to meet diverse these needs and foster an inclusive environment (Cooper et al., 2021). Workplace-based courses and mentorship can help overcome mitigate against barriers related to access, skill, and time, thus enhancing the efficiency and breadth of skills development (Cooper et al., 2021). This should, at all-time be supportive of wider company strategies and objectives.

When the organisation's objectives, Skills Development Programmes, and green economy goals are out of sync, it can impede training operations. Skills Development Programmes should facilitate the transition to a green economy to address this disparity. Collaborating with policy-makers, executives, and national stakeholders can help achieve consensus and facilitate advancing to a green economy (Pulcini et al., 2019). Integrating sustainability concepts and eco-friendly technologies into training programmes can help ensure that staff possess the necessary skills to advance environmental objectives while meeting corporate requirements (Pulcini et al., 2019). A good means to generally weave these together is through frameworks which are aligned to development goals.

Training frameworks should consistently incorporate criteria related to environmental stewardship and sustainability competencies, including the Sustainable Development Goals (SDGs) (Asher et al., 2022). Prioritise sustainable practices, waste management, and renewable energy skills to encourage the staff to participate in green initiatives (Asher et al., 2022). Skills Development Programmes can enhance individuals' success in the petrochemical and renewables sectors while advancing environmental goals. Virtual reality simulations and professional growth aid in achieving this goal (Thomas et al., 2020).

In conclusion of this section, accessibility is largely underpinned by better collaboration and multi-stakeholder commitment.

Return on Investment and Talent Development

Return on investment and Human Capital Theory (HCT) are interrelated. Human Capital is created when people apply their knowledge, skills, abilities, and talents to their respective roles (Boon et al., 2018). On these bases, research offers compelling insights to support this argument. According to the concept, investing in employee education and development improves an organization's performance and competitive advantage (Rafiq et al., 2019). Within the preceding chapter, the emerging theme, Return on Investment and Talent Development, explores this nexus through the HCT conceptual framework. The researcher posits that moderating variables, which include training, accessibility, and support, can pull at varying degrees a company's propensity to yield gains, financial or otherwise, based on investing in people. In areas such as petrochemicals, oil, and gas, where technical competence is critical, human capital theory highlights the necessity of developing personnel capabilities to drive innovation, efficiency, and overall performance (Chin et al., 2021b).

The concept of human capital in these industries lays a strong emphasis on the need to fill skill gaps. According to recent research findings, human capital theory development initiatives are critical for bridging these gaps and ensuring that staff have the skills required to meet the sector's objectives (Pionorio & Sebestyén, 2022). Organisations can align their human resource practices with human capital theory by

emphasising training, job descriptions, teamwork, empowerment, and rewards. This enables them to develop employee abilities and fill any gaps that may emerge between sought-after talents and those available in the workforce (Mao et al., 2022). This strategic approach not only enhances individual performance, but it also increases operational efficiency in key areas.

Oil & gas and petrochemical skill-building programmes also benefit from human capital development. Investment in employee education and skills boosts productivity, job satisfaction, and performance (Wulandari & Nurannisa, 2022). Human capital development connects entrepreneurial orientation and employee retention by creating a talented and engaged workforce (Kapur & Tyagi, 2023). Employee involvement, training, and growth can promote continual learning in a business. This culture can increase industry-standard skill programmes and support long-term success (Gebremedhn, 2022).

Organisations can use a structured process, as outlined in the literature, to determine and calculate the Return on Investment (ROI) of training individuals. To begin, it is critical to document the history and significance of corporate training, with a focus on the shift to eLearning (Devarakonda, 2019). As a result, conducting research studies with individuals relevant to the training course may provide valuable insights about the programme's success (Curado & Sousa, 2021). The Kirkpatrick Model can be useful in undertaking a comprehensive evaluation of training initiatives, including calculating the return on investment (ROI) (Curado & Sousa, 2021). Devarakonda (2019) further states that when assessing return on investment (ROI), it is critical to consider both the training expenses and the subsequent benefits in terms of improved performance and productivity. Approaches such as the Benefit-Cost Ratio (BCR) may be useful in determining the economic viability of training courses (Devarakonda, 2019). Furthermore, data augmentation approaches and patch-wise centralization can improve the quality of ROI patches for training, influencing ROI calculation accuracy (Yu et al., 2020). In so doing, management teams competencies are evaluated and improved.

Other industry studies have indicated that Investment and Fund management teams' competence and skill affect portfolio performance (M. Li et al., 2018). These studies

demonstrate that human capital improves investment outcomes through positive correlation. Human Capital Theory is a far-reaching phenomenon. By studying investment professionals' human capital and investment returns, researchers have shown the value of knowledge, skills, and experience in financial performance. The researcher positions several threads of academia to demonstrate the positive relationship between HCT, in terms of developing talents and realising returns. At the level of economist, they utilise education investment rate on return to evaluate human capital investment (Tran, 2020). This method assesses the revenue or value gained by education, training, and skill development. HCT therefore is directly linked to underlying competencies to strengthen skills programmes through people.

Skills Mismatch & Industry Impact

Vertical mismatch occurs when people lack the abilities required for their current work compared to the skills they already possess. There is a danger that this disparity would result in unused skills and decreased job satisfaction (Santiago-Vela & Hall, 2023). Horizontal mismatch, on the other hand, refers to an uneven distribution of talent across different sectors (Ozer & Perc, 2020). These imbalances can result in shortages in some areas and surpluses in others, making the job market less stable in the long run. Not addressing the problem of skills mismatch can have a variety of negative consequences (Kabir & Kamal, 2023). Significant barriers can be created through mismatch of skills and talents.

It can make it increasingly more difficult to be entrepreneurial due to the barriers associated with skill mismatches (Jam & Puteh, 2022) (C. Li, 2023). There are also rising rates of unemployment among college graduates because their skills do not match what employers want, and slowing down innovation, growth, and efficiency (Jam & Puteh, 2022). These impacts demonstrate how critical it is to manage skill alignment in the petrochemical industry to ensure that people are used most efficiently and with the goal of the company continuing to develop (Ozer & Perc, 2020). Period skills gaps assessments advance this point.

It is incumbent on businesses to undertake thorough skills gap analysis to detect gaps between skills people have and those needed to attain peak performance (McGunagle

& Zizka, 2020). The petrochemical and renewable energy industries are especially vulnerable to the rapid pace of change. To address hazardous work settings and the need for specific skills, one must understand the skill shortages in the petrochemical industry, which prioritises safety, environmentally aware mindsets, and efficiency (Harsini et al., 2020). These organisations should embody safety leadership, management, and climate systems through safe conduct (Harsini et al., 2021). These do the minimum to isolate constraints.

Constraints however, in the evidence base may make skill gap analysis estimation a challenge, underpinning the need for worldwide benchmarking competency assessments (Jephcote & Mah, 2019). Continuous learning stimulation, creative improvement, and educational gaps can help these organisations improve green competencies (Groeneveld et al., 2022). To reduce staff turnover and labour shortages and ensure a skilled and efficient workforce, sustainability skills must be implemented (Subramaniam et al., 2021).

8 Recommendations

8.1 Introduction

The need to solve Skills Development Programme falls short in five pivotal areas namely: practical application, programme accessibility, alignment with strategic goals, measuring returns on talent and skills gap analyses. While work is proceeding at an unsatisfactory rate in areas, practical recommendations are provided.

8.2 Recommendations

Enhance Practical Learning

The researcher proposes that private-sector entities collaborate in a joint-venture to apply practical skills in implementing theoretical concepts. The oil, gas, and coal industries are close to significant transitions towards alternative energy sources. Supporting a self-sustaining vehicle that offers training in Solar, Wind, Decarbonisation, and other pertinent green skills. This can enable other African nations to enhance their capacities on the continent. The researcher recommends conducting further research to explore a feasibility study outlining such a project.

Accessibility and Inclusivity

There is potential for development in efficiently incorporating projected future changes, understanding, and scenarios into everyday business discourse by regular citizens and industry specialists. This could help teams prepare and share knowledge in the present. This conversation includes established forums and should make them easily available to skill-seeking professionals.

Strategic Alignment of SPDs

A multitude of enterprises aspire to be "First-Movers," and an abundance of partnerships and resources are at their disposal to aid in the development of strategic integration, the cultivation of heightened awareness, and the oversight of progress by the executive level, which functions as a board indicator. This organisation could have the strategic, human, physical and financial resources to lead this topic.

Continuous Gap Analysis

The development of an exhaustive and in-depth system is imperative to evaluate gaps. A critical element is the alignment of present skill levels with those of desired skills. A variety of models may be utilised to contemplate: Competency Benchmarks, Change Management, and Measuring Deficits. A research article expressly focusing on this must reveal significant works to be done.

Developing Talents and measuring ROI

At the foundation of managing returns is the ability to measure how well or how poor it is performing. Human Capital Theory is underpinned by the notion that investing in people yields positive returns. These can be managed as such, with the right toolkit and framework. A toolkit must be developed to make levers easier to conceptualise and understand. These triggers, when done in a cohesive manner, could unlock additional shared value for both organisation and employees. Again, the exact scope of such a model is beyond the scope of this paper but may be a case worthwhile case study to explore.

8.3 Limitations and Future Research

8.3.1 Limitations

The researcher acknowledges limitations of the study due to sample size and not expanding the research to an industry population. Limited sample sizes in qualitative research may restrict the ability to capture the complexities and diversity of a larger group, reducing their value (Malterud et al., 2016). In addition, non-randomised sampling is common in qualitative research, complicating the findings' and impacting study outcomes (Vasileiou et al., 2018). The researcher acknowledges that the findings may not be generalised to the larger industry.

Additional considerations were scale as a constraint. The sector magnitude is vast, with several associations cutting across chemicals, petroleum products, and in the recent past, transitioning into multi-energy firms. This requires significant time and resources needed to enable a comprehensive assessment. Furthermore, a mixed-method approach combining qualitative and quantitative datasets across industry,

government, research institutions and non-governmental organisations may yield invaluable research opportunities. This does however pave the way for additional scope.

8.3.2 Further Research

The researcher is of the view, that this sample of findings and recommendations has but nearly been a tip of the iceberg. In the future, research opportunities are aplenty and may incorporate a wider array of viewpoints and stakeholders within the industry. Mixed-methods approaches should be utilised to comprehensively understand the intricacies and subtleties of the opportunities and challenges associated with skill development in the green economy.

9 References

- Adamowicz, M. (2022). A Green Concept of Economic Growth and Development. *Economic and Regional Studies / Studia Ekonomiczne i Regionalne*, 15(2), 158–180.
<https://doi.org/10.2478/ers-2022-0011>
- Adriani, E. (2019). Pengukuran Modal Manusia (Suatu Studi Literatur). *J-MAS (Jurnal Manajemen Dan Sains)*, 4(1), 176. <https://doi.org/10.33087/jmas.v4i1.86>
- Afroze, T., Alam, K., Akther, E., & Jui, N. S. (2015). Women Entrepreneurs in Bangladesh- Challenges and Determining Factors. *Journal of Business and Technology (Dhaka)*.
<https://doi.org/10.3329/jbt.v9i2.26194>
- Aguboshim, F. C. (2021). Adequacy of sample size in a qualitative case study and the dilemma of data saturation: A narrative review. *World Journal of Advanced Research and Reviews*, 10(3), 180–187. <https://doi.org/10.30574/wjarr.2021.10.3.0277>
- Akoojee, S., & Arends, F. (2009). Intermediate-Level ICT Skills and Development in South Africa: Private Provision Form Suited to National Purpose! *Education and Information Technologies*.
<https://doi.org/10.1007/s10639-009-9089-9>
- Akram, N., Padda, I. U. H., & Khan, M. (2008). The Long Term Impact of Health on Economic Growth in Pakistan. *The Pakistan Development Review*, 47(4II), 487–500.
<https://doi.org/10.30541/v47i4Ipp.487-500>
- Al Siyabi, A. S., & AHakro, A. N. (2020). Green Economy and Sustainable Development in the Sultanate of Oman. *Journal of Student Research*. <https://doi.org/10.47611/jsr.vi.915>
- Alam, Md. K. (2020). A systematic qualitative case study: Questions, data collection, NVivo analysis and saturation. *Qualitative Research in Organizations and Management: An International Journal*, 16(1), 1–31. <https://doi.org/10.1108/QROM-09-2019-1825>

- Al-Asfour, A., & Zhao, Y. (2024). Bridging the skills gap divide in manufacturing: Perspectives from industry leaders. *Industrial and Commercial Training*, 56(1), 78–90.
<https://doi.org/10.1108/ICT-10-2023-0075>
- Albekov, A., Vovchenko, N., Medvedkina, Y., & Medvedkin, T. (2017). Green Economy and Economic Growth: Trends, Challenges and Opportunities for the EU. *International Journal of Economics and Business Administration*, V(Issue 1), 49–62. <https://doi.org/10.35808/ijeba/118>
- Aleksandrov, I., Daroshka, V., Trushkin, V., Chekhovskikh, I., & Ol, E. (2022). The green game: How digital technology is changing Russia's oil and gas business. *E3S Web of Conferences*, 363, 01036. <https://doi.org/10.1051/e3sconf/202236301036>
- Allais, S. (2011). The Changing Faces of the South African National Qualifications Framework. *Journal of Education and Work*. <https://doi.org/10.1080/13639080.2011.584696>
- Aloyo, N. O., & Wentzel, A. (2011). The Potential Skills Contribution of International Students to South Africa. *Africa Education Review*. <https://doi.org/10.1080/18146627.2011.603230>
- Alsmadi, A. A., & Alzoubi, M. (2022). Green Economy: Bibliometric Analysis Approach. *International Journal of Energy Economics and Policy*, 12(2), 282–289.
<https://doi.org/10.32479/ijeep.12758>
- Alwani, P. (2021). *How does the professional identity of teachers from India change when they work as early childhood educators in Ontario?* [Dissertation].
<https://doi.org/10.32920/ryerson.14644134>
- Alwi, A., Kamis, A., Mohd Affandi, H., Amin Nur Yunus, F., & Che Rus, R. (2017). *Green Skills: Innovation in the subject of Design and Technology (D&T)*. 145–154.
<https://doi.org/10.17501/icedu.2017.3116>
- Amiti, M., & Freund, C. (2008). *The Anatomy of China's Export Growth*.
<https://doi.org/10.1596/1813-9450-4628>
- Apturkar, D. K., Jorwekar, G. J., Baviskar, P. K., Shaikh, M. H., & Sadawarte, N. A. (2014). Impact of SNAPPS on Clinical Reasoning Skills of Surgery Residents in Outpatient Setting. *International*

Journal of Biomedical and Advance Research, 5(9), 418.

<https://doi.org/10.7439/ijbar.v5i9.852>

Asher, R. C., Shrewsbury, V. A., Bucher, T., & Collins, C. E. (2022). Culinary medicine and culinary nutrition education for individuals with the capacity to influence health related behaviour change: A scoping review. *Journal of Human Nutrition and Dietetics*, 35(2), 388–395.

<https://doi.org/10.1111/jhn.12944>

Assan, J., & Nalutaaya, V. (2018). Africa's Youth Unemployment Challenge and the Pursuit of Soft Skills Development by University Students. *Review of European Studies*.

<https://doi.org/10.5539/res.v10n3p58>

Atay, O., & Kocman, O. (2023). A comparative study of the petroleum industry environmentally-responsible green management implementations. *Journal of Global Strategic Management*, 15(2), 5–17. <https://doi.org/10.20460/JGSM.2022.299>

Barna, C., Zbucnea, A., & Stănescu, S. M. (2023). Social economy enterprises contributing to the circular economy and the green transition in Romania. *CIRIEC-España, Revista de Economía Pública, Social y Cooperativa*, 107, 47. <https://doi.org/10.7203/CIRIEC-E.107.21738>

Beidari, M., Lin, S.-J., & Lewis, C. (2017). Multiplier Effects of Energy Consumption and CO2 Emissions by Input-Output Analysis in South Africa. *Aerosol and Air Quality Research*.

<https://doi.org/10.4209/aaqr.2017.04.0150>

Beisekenov, I., Suleiman, Z., Tokbergenova, A., Shaikholla, S., Dikhanbayeva, D., El-Thalji, I., Emir, D., & Turkyilmaz, A. (2022). Maturity Assessment of Industry 4.0 Implementation in Kazakhstani and Norwegian Oil and Gas Contexts. *Journal of Industrial Integration and Management*, 07(04), 455–477. <https://doi.org/10.1142/S2424862222500191>

Bek, M. G., & Aygun, E. (2016). Equality Through the Internet? Communicating Digital Inequality and the Identity of Youth in Turkey. *Online Journal of Communication and Media Technologies*.

<https://doi.org/10.29333/ojcm/2568>

- Bielby, D. D., & Bielby, W. T. (1988). She Works Hard for the Money: Household Responsibilities and the Allocation of Work Effort. *American Journal of Sociology*, 93(5), 1031–1059.
<https://doi.org/10.1086/228863>
- Bielinska, A.-M., Archer, S., Obanobi, A., Soosipillai, G., Darzi, L. A., Riley, J., & Urch, C. (2021). Advance care planning in older hospitalised patients following an emergency admission: A mixed methods study. *PLOS ONE*, 16(3), e0247874.
<https://doi.org/10.1371/journal.pone.0247874>
- Bilokon, A. (2022). Ukraine's Green Economy Development in the International Context. *Modern Economics*, 36(1), 12–18. [https://doi.org/10.31521/modecon.V36\(2022\)-02](https://doi.org/10.31521/modecon.V36(2022)-02)
- Birner, R. (2018). Bioeconomy Concepts. In I. Lewandowski (Ed.), *Bioeconomy* (pp. 17–38). Springer International Publishing. https://doi.org/10.1007/978-3-319-68152-8_3
- Blackmore, P. (1999). A Categorisation of Approaches to Occupational Analysis. *Journal of Vocational Education and Training*. <https://doi.org/10.1080/13636829900200071>
- Blum, R. W. (1997). Adolescent Substance Use and Abuse. *Archives of Pediatrics and Adolescent Medicine*. <https://doi.org/10.1001/archpedi.1997.02170450055008>
- Bondarenko, S., Perevozova, I., & Maksimenko, T. (2020). Implementation of innovative projects using renewable energy sources in the fields of “future economy”. *Journal of Scientific Papers 'Social Development and Security'*, 10(3), 145–157.
<https://doi.org/10.33445/sds.2020.10.3.13>
- Bondarenko, V., Pokynchereda, V., Pidvalna, O., Kolesnyk, T., & Sokoliuk, S. (2023). Green Economy as a Prerequisite for Sustainable Development: Analysis of International and Ukrainian Experience. *European Journal of Sustainable Development*, 12(1), 221.
<https://doi.org/10.14207/ejsd.2023.v12n1p221>
- Boomsma, J., Dingemans, C. A. J., & Dassen, Th. W. N. (1997). The nursing process in crisis-oriented psychiatric home care. *Journal of Psychiatric and Mental Health Nursing*, 4(4), 295–301.
<https://doi.org/10.1046/j.1365-2850.1997.00066.x>

- Boon, C., Eckardt, R., Lepak, D. P., & Boselie, P. (2018). Integrating strategic human capital and strategic human resource management. *The International Journal of Human Resource Management*, 29(1), 34–67. <https://doi.org/10.1080/09585192.2017.1380063>
- Borel-Saladin, J. M., & Turok, I. N. (2013). Impact of the green economy on jobs in South Africa. *South African Journal of Science*, 109(9/10), 4. <https://doi.org/10.1590/sajs.2013/a0033>
- Bradley, A., & James, R. (2019). Web Scraping Using R. *Advances in Methods and Practices in Psychological Science*. <https://doi.org/10.1177/2515245919859535>
- Braun, G., Stahre, J., & Härmäläinen, R. (2022). *Skills Matching for a Greener Industry 4.0 – A Literature Review*. <https://doi.org/10.3233/atde220186>
- Brown, P., Lauder, H., Ashton, D., Yingjie, W., & Vincent-Lancrin, S. (2008). Education, Globalisation and the Future of the Knowledge Economy. *European Educational Research Journal*, 7(2), 131–156. <https://doi.org/10.2304/eerj.2008.7.2.131>
- Buda, G., & Ricz, J. (2023). Industrial symbiosis and industrial policy for sustainable development in Uganda. *Review of Evolutionary Political Economy*. <https://doi.org/10.1007/s43253-023-00097-8>
- Campbell, O., & Aderinto, E. (2022). Human Capital Development and Labour Market Outcomes in Africa: Evidence from Sub-Saharan African Countries. *Journal of Economics and Sustainable Development*. <https://doi.org/10.7176/JESD/13-6-05>
- Caprian, I., Iulita, B., & Trushkina, N. (2023). Eco-efficiency as a philosophy of modern business in the conditions of global transformations. *Green, Blue and Digital Economy Journal*, 4(1), 1–10. <https://doi.org/10.30525/2661-5169/2023-1-1>
- Caprotti, F., & Bailey, I. (2014). Making sense of the green economy. *Geografiska Annaler: Series B, Human Geography*, 96(3), 195–200. <https://doi.org/10.1111/geob.12045>
- Carlisle, S., Zaki, K., Ahmed, M., Dixey, L., & McLoughlin, E. (2021). The Imperative to Address Sustainability Skills Gaps in Tourism in Wales. *Sustainability*, 13(3), 1161. <https://doi.org/10.3390/su13031161>

- Carpenter-Song, E., Jonathan, G., Brian, R., & Ben-Zeev, D. (2020). Perspectives on Mobile Health Versus Clinic-Based Group Interventions for People With Serious Mental Illnesses: A Qualitative Study. *Psychiatric Services*, 71(1), 49–56.
<https://doi.org/10.1176/appi.ps.201900110>
- Carroll, E. M. (2015). Health Care Transition Experiences of Young Adults With Cerebral Palsy. *Journal of Pediatric Nursing*, 30(5), e157–e164. <https://doi.org/10.1016/j.pedn.2015.05.018>
- Chaaben, N., Elleuch, Z., Hamdi, B., & Kahouli, B. (2022). Green economy performance and sustainable development achievement: Empirical evidence from Saudi Arabia. *Environment, Development and Sustainability*. <https://doi.org/10.1007/s10668-022-02722-8>
- Chen, S.-Y., Zhang, Q., Mclellan, B., & Zhang, T.-T. (2020). Review on the petroleum market in China: History, challenges and prospects. *Petroleum Science*, 17(6), 1779–1794.
<https://doi.org/10.1007/s12182-020-00501-6>
- Chen, Y.-K., & Hsieh, T. (2010). Establishment and applied research on green economy assessment indicators in Taiwan. *2010 International Conference on Chemistry and Chemical Engineering*, 261–264. <https://doi.org/10.1109/ICCCENG.2010.5560439>
- Chetty, S., Reddy, M., Ramsamy, Y., Naidoo, A., & Essack, S. Y. (2019). Antimicrobial Stewardship in South Africa: A Scoping Review of the Published Literature. *Jac-Antimicrobial Resistance*.
<https://doi.org/10.1093/jacamr/dlz060>
- Chin, S. Y., Shahrudin, S., Chua, G. K., Samsodin, N., Setiabudi, H. D., Karam Chand, N. S., Chew, F. N., Leong, J. X., Jusoh, R., & Samsudin, N. A. (2021a). Palm Oil-Based Chemicals for Sustainable Development of Petrochemical Industries in Malaysia: Progress, Prospect, and Challenges. *ACS Sustainable Chemistry & Engineering*, 9(19), 6510–6533.
<https://doi.org/10.1021/acssuschemeng.0c09329>
- Chin, S. Y., Shahrudin, S., Chua, G. K., Samsodin, N., Setiabudi, H. D., Karam Chand, N. S., Chew, F. N., Leong, J. X., Jusoh, R., & Samsudin, N. A. (2021b). Palm Oil-Based Chemicals for Sustainable Development of Petrochemical Industries in Malaysia: Progress, Prospect, and

- Challenges. *ACS Sustainable Chemistry & Engineering*, 9(19), 6510–6533.
<https://doi.org/10.1021/acssuschemeng.0c09329>
- Chirat, A., & Le Chapelain, C. (2020). ECONOMIC ANALYSIS OF EDUCATION IN POST-WAR AMERICA: NEW INSIGHTS FROM THEODORE SCHULTZ AND JOHN KENNETH GALBRAITH. *Journal of the History of Economic Thought*, 42(1), 61–78. <https://doi.org/10.1017/S1053837218000779>
- Chirat, A. & Le Chapelain Charlotte. (2019). *Journal of the History of Economic Thought Preprints - Economic Analysis of Education in Post-War America: New insights from Theodore Schultz and John Kenneth Galbraith* [Preprint]. SocArXiv. <https://doi.org/10.31235/osf.io/jyt3z>
- Cho, J., & Trent, A. (2006). Validity in qualitative research revisited. *Qualitative Research*, 6(3), 319–340. <https://doi.org/10.1177/1468794106065006>
- Chou, Walther, & Liou. (2019). The Conundrums of Sustainability: Carbon Emissions and Electricity Consumption in the Electronics and Petrochemical Industries in Taiwan. *Sustainability*, 11(20), 5664. <https://doi.org/10.3390/su11205664>
- Chun Tie, Y., Birks, M., & Francis, K. (2019). Grounded theory research: A design framework for novice researchers. *SAGE Open Medicine*, 7, 205031211882292.
<https://doi.org/10.1177/2050312118822927>
- Conger, J. A. (2013). Mind the Gaps: What Limits the Impact of Leadership Education. *Journal of Leadership Studies*. <https://doi.org/10.1002/jls.21270>
- Cooper, S., Sanders, J., & Pashayan, N. (2021). Implementing a novel programme for nurses and allied health professionals to develop capacity for evidence-informed clinical practice. *Journal of Research in Nursing*, 26(5), 395–404.
<https://doi.org/10.1177/17449871211013074>
- Crawford-Lee, M. S., & Wall, T. (2018). Sustainability 2030: A Policy Perspective From the University Vocational Awards Council. *Higher Education Skills and Work-Based Learning*.
<https://doi.org/10.1108/heswbl-03-2018-0043>

- Crespo Marquez, A., Gomez Fernandez, J. F., Martínez-Galán Fernández, P., & Guillen Lopez, A. (2020). Maintenance Management through Intelligent Asset Management Platforms (IAMP). Emerging Factors, Key Impact Areas and Data Models. *Energies*, 13(15), 3762. <https://doi.org/10.3390/en13153762>
- Curado, C., & Sousa, I. (2021). Training evaluation of a sales programme in a Portuguese cosmetics SME. *Industrial and Commercial Training*, 53(3), 283–293. <https://doi.org/10.1108/ICT-12-2019-0107>
- Dakin, E. K., & Areán, P. (2013). Patient Perspectives on the Benefits of Psychotherapy for Late-Life Depression. *The American Journal of Geriatric Psychiatry*, 21(2), 155–163. <https://doi.org/10.1016/j.jagp.2012.10.016>
- Davids, B., & Esau, M. V. (2012). The Prevailing Skills Crisis in South Africa. *Journal of Developing Societies*. <https://doi.org/10.1177/0169796x1102800104>
- De Villiers, R., & Books, S. (2009). Recruiting teachers online: Marketing strategies and information dissemination practices of UK-based agencies. *Educational Review*, 61(3), 315–325. <https://doi.org/10.1080/00131910903045955>
- Della Tamin, M., Du Plooy, D. M., Solms, S. V., & Meyer, J. (2019). A Proposed Modular Work Integrated Learning Framework for South Africa. *IEEE Access*, 7, 2559–2566. <https://doi.org/10.1109/ACCESS.2018.2884567>
- Derviş Boztosun, Semra Aksoylu, & Zübeyde Şentürk Ulucak. (2016). The Role of Human Capital in Economic Growth. *Economics World*, 4(3). <https://doi.org/10.17265/2328-7144/2016.03.001>
- Devarakonda, S. (2019). Calculating the Economic Viability of Corporate Trainings (Traditional & eLearning) using Benefit-Cost Ratio (BCR) and Return On Investment (ROI). *International Journal of Advanced Corporate Learning (IJAC)*, 12(1), 41. <https://doi.org/10.3991/ijac.v12i1.9735>

- Dey, P. K., Malesios, C., De, D., Budhwar, P., Chowdhury, S., & Cheffi, W. (2020). Circular economy to enhance sustainability of small and medium-sized enterprises. *Business Strategy and the Environment*, 29(6), 2145–2169. <https://doi.org/10.1002/bse.2492>
- Dickey, H., Watson, V., & Zangelidis, A. (2011). Job satisfaction and quit intentions of offshore workers in the UK North Sea oil and gas industry. *Scottish Journal of Political Economy*, 58(5), 607–633. <https://doi.org/10.1111/j.1467-9485.2011.00561.x>
- Diedericks, D. E., van Schoor, G., & Ranft, E. O. (2019). *Cathodic Protection System Design Framework*. <https://doi.org/10.1109/robomech.2019.8704760>
- Dogaru, L. (2021). Green Economy and Green Growth—Opportunities for Sustainable Development. *The 14th International Conference on Interdisciplinarity in Engineering—INTER-ENG 2020*, 70. <https://doi.org/10.3390/proceedings2020063070>
- Dziekański, P., Wyszowski, A., Prus, P., Pawlik, A., Maitah, M., & Wrońska, M. (2022). Zero Waste as a Determinant of Shaping Green Economy Processes on the Example of Communes of Eastern Poland in 2010–2020. *Energies*, 16(1), 19. <https://doi.org/10.3390/en16010019>
- Dzwigo, H., Trushkina, N., & Kwilinski, A. (2021). The Organizational and Economic Mechanism of Implementing the Concept of Green Logistics. *Virtual Economics*, 4(2), 41–75. [https://doi.org/10.34021/ve.2021.04.02\(3\)](https://doi.org/10.34021/ve.2021.04.02(3))
- Ebekozien, A., Aigbavboa, C., Aliu, J., & Thwala, W. (2022). Generic Skills of Future Built Environment Practitioners in South Africa: Unexplored Mechanism via Students' Perception. *Journal of Engineering Design and Technology*. <https://doi.org/10.1108/jedt-10-2021-0571>
- Elimam, H. (2023). *Opportunities and Constraints Confronting transformation Towards a Green Economy in the Developing Countries* [Preprint]. Open Science Framework. <https://doi.org/10.31219/osf.io/hj2wq>
- Elkonin, D. S., & Sandison, A. (2006). Mind the Gap: Have the Registered Counsellors Fallen Through? *South African Journal of Psychology*, 36(3), 598–612. <https://doi.org/10.1177/008124630603600310>

- Ellis, M., & Steyn, G. (2014). The Regulatory Context in Private Higher Education in South Africa. *Mediterranean Journal of Social Sciences*. <https://doi.org/10.5901/mjss.2014.v5n20p258>
- Elyta, Jamaliah, & Zhan, F. F. (2021). The Role of Non-Government Actors in Realizing Ecopreneurship Based on Environmental Security. *International Journal of Social Science and Human Research*, 04(09). <https://doi.org/10.47191/ijsshr/v4-i9-45>
- Erasmus, J. C., Steyn, S. C., & Mentz, P. J. (2005). Expectations of the Unemployed in South Africa: An Education System Perspective. *Africa Education Review*. <https://doi.org/10.1080/18146620508566289>
- Fitong Ketchiwou, G., Naong, M. N., Van Der Walt, F., & Dzansi, L. W. (2022). Investigating the relationship between selected organisational factors and women's skills development aspirations and career progression: A South African case study. *SA Journal of Human Resource Management*, 20. <https://doi.org/10.4102/sajhrm.v20i0.1958>
- Fletcher. (1999). The process of constant observation: Perspectives of staff and suicidal patients. *Journal of Psychiatric and Mental Health Nursing*, 6(1), 9–14. <https://doi.org/10.1046/j.1365-2850.1999.00181.x>
- Flurey, C. A., Tugwell, P., Black, R. J., Halls, S., Page, M. J., Robson, J., Sahbudin, I., Siddle, H. J., Sinnathurai, P., Stok, K. S., & Richards, B. (2019). The OMERACT Emerging Leaders Program: The Good, the Bad, and the Future. *The Journal of Rheumatology*. <https://doi.org/10.3899/jrheum.181126>
- Gadzhiev, N., Konovalenko, S., Trofimov, M., Leontieva, J., & Akhmedova, K. (2020). Management mechanism of human capital formation under a postindustrial economy. *E3S Web of Conferences*, 164, 10005. <https://doi.org/10.1051/e3sconf/202016410005>
- Gaisina, L. M., Litvinenko, I. L., Magomaeva, L. R., & Agayev, A. A. (2022). Impact of the pandemic and the green economy on the development of the oil and gas sector. *SOCAR Proceedings*, 3. <https://doi.org/10.5510/OGP20220300715>

- Gakusi, A.-E., Sartori, D., & Asamoah, J. (2015). Fostering Regional Integration in Africa: Lessons From Sasol Natural Gas Project Between South Africa and Mozambique. *Open Journal of Social Sciences*. <https://doi.org/10.4236/jss.2015.310025>
- Gaurina-Medjimurec, N. (Ed.). (2015). *Handbook of Research on Advancements in Environmental Engineering*: IGI Global. <https://doi.org/10.4018/978-1-4666-7336-6>
- Gebremedhn, A. (2022). The Mediation Role of Employee Engagement on the Relationship between Aspects of Human Capital Management and Employee Job Performance. *European Journal of Business and Management*. <https://doi.org/10.7176/EJBM/14-13-02>
- Georgeson, L., Maslin, M., & Poessinouw, M. (2017). The global green economy: A review of concepts, definitions, measurement methodologies and their interactions: Global green economy: definitions & measurement. *Geo: Geography and Environment*, 4(1), e00036. <https://doi.org/10.1002/geo2.36>
- Getha-Taylor, H., Fowles, J., Silvia, C., & Merritt, C. C. (2015). Considering the Effects of Time on Leadership Development. *Public Personnel Management*. <https://doi.org/10.1177/0091026015586265>
- Ghotbifar, F., Marjani, M. R., & Ramazani, A. (2017). Identifying and assessing the factors affecting skill gap in digital marketing in communication industry companies. *Independent Journal of Management & Production*, 8(1), 1–14. <https://doi.org/10.14807/ijmp.v8i1.507>
- Gissin, V. I., Mekhantseva, K. F., Putilina, T. I., & Surzhikov, M. A. (2018). «Green Economy»: Emerging National Models, Estimations, Trends in EU and CIS. *EUROPEAN RESEARCH STUDIES JOURNAL*, XXI(Special Issue 1), 156–166. <https://doi.org/10.35808/ersj/1168>
- Gooijer, J. (2022). Corporate Taxation in a Circular Economy. In A. Siegmann (Ed.), *Climate of the Middle* (pp. 53–61). Springer International Publishing. https://doi.org/10.1007/978-3-030-85322-8_6

- Gowen, C. R., & Tallon, W. J. (2003). Enhancing supply chain practices through human resource management. *Journal of Management Development*, 22(1), 32–44.
<https://doi.org/10.1108/02621710310454842>
- Griffith, D. M., Shelton, R. C., & Kegler, M. (2017). Advancing the Science of Qualitative Research to Promote Health Equity. *Health Education & Behavior*, 44(5), 673–676.
<https://doi.org/10.1177/1090198117728549>
- Grobler, P. A., & Bruyn, A. J. D. (2011). Flexible Work Practices (FWP) – An Effective Instrument in the Retention of Talent: A Survey of Selected JSE-listed Companies. *South African Journal of Business Management*. <https://doi.org/10.4102/sajbm.v42i4.506>
- Groeneveld, W., Vennekens, J., & Aerts, K. (2022). Identifying Non-Technical Skill Gaps in Software Engineering Education: What Experts Expect But Students Don't Learn. *ACM Transactions on Computing Education*, 22(1), 1–21. <https://doi.org/10.1145/3464431>
- Grossman, M. (1999). *The Human Capital Model of the Demand for Health* (w7078; p. w7078). National Bureau of Economic Research. <https://doi.org/10.3386/w7078>
- Gruber, J., Kogan, A., Quoidbach, J., & Mauss, I. B. (2013). Happiness is best kept stable: Positive emotion variability is associated with poorer psychological health. *Emotion*, 13(1), 1–6.
<https://doi.org/10.1037/a0030262>
- Gupta, D. D. (2013). The Effect of Gender on Women-Led Small Enterprises: The Case of India. *South Asian Journal of Business and Management Cases*.
<https://doi.org/10.1177/2277977913480654>
- Gyllensten, K., Pousette, A., & Törner, M. (2022). Value conflicts and information security – a mixed-methods study in high-risk industry. *Information & Computer Security*, 30(3), 346–363.
<https://doi.org/10.1108/ICS-09-2021-0139>
- Halilbasic, M. (2021). Skill Mismatch Assessment: Example of Software Industry in Bosnia and Herzegovina. *Journal of Economics, Finance and Management Studies*, 04(09).
<https://doi.org/10.47191/jefms/v4-i9-03>

- Hall, J., & Sandelands, E. (2009). Addressing South Africa's Engineering Skills Gaps. *Education + Training*. <https://doi.org/10.1108/00400910910960759>
- Har, W. M., Kee, X. N., Lee, H. S., & Low, C. W. (2022). Green Economy and Good Governance towards income equality: A Quantile analysis. *JOURNAL OF SUSTAINABILITY SCIENCE AND MANAGEMENT*, 17(9), 62–74. <https://doi.org/10.46754/jssm.2022.09.005>
- Harsini, A., Bohle, P., Matthews, L. R., Ghofranipour, F., Sanaeinasab, H., Amin Shokravi, F., & Prasad, K. (2021). Evaluating the Consistency Between Conceptual Frameworks and Factors Influencing the Safe Behavior of Iranian Workers in the Petrochemical Industry: Mixed Methods Study. *JMIR Public Health and Surveillance*, 7(5), e22851. <https://doi.org/10.2196/22851>
- Harsini, A., Ghofranipour, F., Sanaeinasab, H., Amin Shokravi, F., Bohle, P., & Matthews, L. R. (2020). Factors associated with unsafe work behaviours in an Iranian petrochemical company: Perspectives of workers, supervisors, and safety managers. *BMC Public Health*, 20(1), 1192. <https://doi.org/10.1186/s12889-020-09286-0>
- Hassan, F., Ismail, Z., Zaini, A. A., Hassan, S., & Maisham, M. (2011). A critical assessment of the challenges of developing the Malaysian construction workforce through training. *2011 IEEE Colloquium on Humanities, Science and Engineering*, 223–227. <https://doi.org/10.1109/CHUSER.2011.6163721>
- Horwitz, F. M. (2013). An analysis of skills development in a transitional economy: The case of the South African labour market. *The International Journal of Human Resource Management*, 24(12), 2435–2451. <https://doi.org/10.1080/09585192.2013.781438>
- Houston, D. (2005). Employability, Skills Mismatch and Spatial Mismatch in Metropolitan Labour Markets. *Urban Studies*. <https://doi.org/10.1080/0042098042000316119>
- International Energy Agency. (2022). *Skills Development and Inclusivity for Clean Energy Transitions*. OECD. <https://doi.org/10.1787/fdaf2737-en>

- International Labour Organisation. (2018). *Skills for Green Jobs in South Africa*. International Labour Organisation.
- Jam, N. A. M., & Puteh, S. (2022). Exploring the Teaching and Learning Indicators towards Education 4.0 in MTUN, Malaysia. *International Journal of Information and Education Technology*, 12(2), 179–184. <https://doi.org/10.18178/ijiet.2022.12.2.1602>
- Jephcote, C., & Mah, A. (2019). Regional inequalities in benzene exposures across the European petrochemical industry: A Bayesian multilevel modelling approach. *Environment International*, 132, 104812. <https://doi.org/10.1016/j.envint.2019.05.006>
- Jiboku, J. O. (2021). State and Contradictions on Skills Development in Nigeria. *Equidad Y Desarrollo*. <https://doi.org/10.19052/eq.vol1.iss37.9>
- Jin, Z., & Hunter, K. (2013). A Systemic Solution to Achieving Green Transition. *World Futures Review*, 5(2), 153–176. <https://doi.org/10.1177/1946756713491380>
- Jinfang, L., & Shusheng, Q. (2016). Policy Support for Developing Green Economy and Promoting the Construction of Ecological Civilization. *Philosophy Study*, 6(5). <https://doi.org/10.17265/2159-5313/2016.05.005>
- Joubert, C., & Hay, J. (2022). Alumni Perceptions of Registered Psychological Counsellor Training at a South African University. *South African Journal of Higher Education*. <https://doi.org/10.20853/36-5-4503>
- Juan, D. M. M. S. (2020). Transitioning to a Progressive Green Economy in the Philippines. *Journal of Developing Societies*, 36(2), 155–181. <https://doi.org/10.1177/0169796X20912632>
- Kabir, N., & Kamal, S. S. (2023). Skill Mismatch as Constraint to Entrepreneurship in the Leather Sector of Bangladesh: A Conceptual Study. *Social Science Review*, 39(1), 103–123. <https://doi.org/10.3329/ssr.v39i1.64915>
- Kang, Y., & Mok, K. H. (2022). The Broken Promise of Human Capital Theory: Social Embeddedness, Graduate Entrepreneurs and Youth Employment in China. *Critical Sociology*, 48(7–8), 1205–1219. <https://doi.org/10.1177/08969205221088894>

- Kapur, I., & Tyagi, P. (2023). Entrepreneurial orientation driven employee retention: Mediating role of human capital development. *Development and Learning in Organizations: An International Journal*, 37(5), 8–10. <https://doi.org/10.1108/DLO-08-2022-0158>
- Kayii, N. E., & Akpomi, M. E. (2022). Constructivist Approaches: A Budding Paradigm for Teaching and Learning Entrepreneurship Education. *International Journal of Education, Teaching, and Social Sciences*, 2(1), 31–44. <https://doi.org/10.47747/ijets.v2i1.586>
- Kellenberg, D. (2012). Trading wastes. *Journal of Environmental Economics and Management*, 64(1), 68–87. <https://doi.org/10.1016/j.jeem.2012.02.003>
- Kikasu, E. T. (2021). *Exploring capacity development programmes for socio-economic transformation in South Africa: A case study of the South African petroleum industry* [Doctor of Philosophy in Public Administration and Management, Durban University of Technology]. <https://doi.org/10.51415/10321/3942>
- Kirsten, C. L., & Fourie, J. J. (2012). The Accounting Professions' Role in Financial Management Skills Development of Small Businesses. *Journal of Economic and Financial Sciences*. <https://doi.org/10.4102/jef.v5i2.294>
- Kishun, R. (2007). The Internationalisation of Higher Education in South Africa: Progress and Challenges. *Journal of Studies in International Education*. <https://doi.org/10.1177/1028315307304184>
- Kizu, T., Mahmud, T., Saget, C., & Strietska-Ilina, O. (2018). Skills for the green transition. *World Employment and Social Outlook*, 2018(2), 129–155. <https://doi.org/10.1002/wow3.142>
- Kozlova, O., & Volkova, I. (2019). 'Green skills' of a new generation of managers and entrepreneurs as a potential of company leadership. *Proceedings of the 3rd International Conference on Social, Economic, and Academic Leadership (ICSEAL 2019)*. Proceedings of the 3rd International Conference on Social, Economic, and Academic Leadership (ICSEAL 2019), Prague, Czech Republic. <https://doi.org/10.2991/icseal-19.2019.57>

- Kozuń-Cieślak, G. (2020). Does the efficiency of public investment in human capital affect the country's economic development? *Prace Naukowe Uniwersytetu Ekonomicznego We Wrocławiu*, 64(10), 43–54. <https://doi.org/10.15611/pn.2020.10.04>
- Kuvalin, D. B., Moiseev, A. K., & Zinchenko, Yu. V. (2019). Russian Enterprises at the End of 2018: Analysis of Global Sustainable Development Goals and Difficulties in Obtaining Bank Loans. *Studies on Russian Economic Development*, 30(3), 334–345. <https://doi.org/10.1134/S1075700719030092>
- Kwauk, C. T., & Casey, O. M. (2022). A green skills framework for climate action, gender empowerment, and climate justice. *Development Policy Review*, 40(S2). <https://doi.org/10.1111/dpr.12624>
- Labonté, R., Sanders, D., Mathole, T., Crush, J., Chikanda, A., Dambisya, Y., Runnels, V., Packer, C., MacKenzie, A., Murphy, G. T., & Bourgeault, I. L. (2015). Health worker migration from South Africa: Causes, consequences and policy responses. *Human Resources for Health*, 13(1), 92. <https://doi.org/10.1186/s12960-015-0093-4>
- Laseinde, O. T., & Kanakana, G. M. (2017). *Interventions to Skills Development in the Automotive Manufacturing Sector of South Africa*. <https://doi.org/10.5772/intechopen.70305>
- Lee, G., & Davison, A. M. (2018). Designing Payroll Levies for Firm Training. *International Journal of Manpower*. <https://doi.org/10.1108/ijm-01-2017-0009>
- Leroux, J. A., & Lafleur, S. (1995). Employability Skills: The demands of the workplace. *The Vocational Aspect of Education*, 47(2), 189–196. <https://doi.org/10.1080/0305787950470207>
- Lewis, S. (2015). Qualitative Inquiry and Research Design: Choosing Among Five Approaches. *Health Promotion Practice*, 16(4), 473–475. <https://doi.org/10.1177/1524839915580941>
- Li, C. (2023). The Restraining Effect of Human Capital Mismatch and Structure Distortion on Economic Growth—A New Structural Economics Analysis. *International Journal of Financial Research*, 14(2), 1. <https://doi.org/10.5430/ijfr.v14n2p1>

- Li, F., Sun, Y., Li, X., Hao, X., Li, W., Qian, Y., Liu, H., & Sun, H. (2016). Research on the Sustainable Development of Green-Space in Beijing Using the Dynamic Systems Model. *Sustainability*, 8(10), 965. <https://doi.org/10.3390/su8100965>
- Li, J., Huang, C., Ye, F., Qin, M., & Zhang, W. (2021). Application of Computer Energy Optimization Method in Oil and Gas Gathering and Transportation System. *Journal of Physics: Conference Series*, 1744(2), 022045. <https://doi.org/10.1088/1742-6596/1744/2/022045>
- Li, M., Goetz, S. J., & Weber, B. (2018). Human Capital and Intergenerational Mobility in U.S. Counties. *Economic Development Quarterly*, 32(1), 18–28. <https://doi.org/10.1177/0891242417752436>
- Little, A. W. (2003). Motivating Learning and the Development of Human Capital. *Compare: A Journal of Comparative and International Education*, 33(4), 437–452. <https://doi.org/10.1080/0305792032000127748>
- Liulienė, A., & Metiūnienė, R. (2009). Students' Learning Through Reflective Journaling. *Santalka*. <https://doi.org/10.3846/1822-430x.2009.17.4.32-37>
- Lose, T., & Tengeh, R. K. (2016). An Evaluation of the Effectiveness of Business Incubation Programs: A User Satisfaction Approach. *Investment Management and Financial Innovations*. [https://doi.org/10.21511/imfi.13\(2-2\).2016.12](https://doi.org/10.21511/imfi.13(2-2).2016.12)
- Maisiri, W., Darwish, H., & Van Dyk, L. (2019). AN INVESTIGATION OF INDUSTRY 4.0 SKILLS REQUIREMENTS. *South African Journal of Industrial Engineering*, 30(3). <https://doi.org/10.7166/30-3-2230>
- Malik, G., & Venkatraman, A. (2017). “The great divide”: Skill gap between the employer’s expectations and skills possessed by employees. *Industrial and Commercial Training*, 49(4), 175–182. <https://doi.org/10.1108/ICT-11-2016-0071>
- Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample Size in Qualitative Interview Studies: Guided by Information Power. *Qualitative Health Research*, 26(13), 1753–1760. <https://doi.org/10.1177/1049732315617444>

- Maltseva, V. (2019). The Concept of Skills Mismatch and the Problem of Measuring Cognitive Skills Mismatch in Cross-National Studies. *Voprosy Obrazovaniya/ Educational Studies Moscow*.
<https://doi.org/10.17323/1814-9545-2019-3-43-76>
- Mandava, A., Pace, C., Campbell, B., Emanuel, E., & Grady, C. (2012). The quality of informed consent: Mapping the landscape. A review of empirical data from developing and developed countries. *Journal of Medical Ethics*, 38(6), 356–365. <https://doi.org/10.1136/medethics-2011-100178>
- Manyati, T. K., Kalima, B. G., Owolabi, T., & Mutsau, M. (2024). Exploring the potential for enhancing green skills training, innovation and sustainable livelihoods in informal spaces of Harare, Zimbabwe: Identifying gaps and opportunities. *IIMBG Journal of Sustainable Business and Innovation*, 2(1), 60–79. <https://doi.org/10.1108/IJSBI-06-2023-0036>
- Mao, J., Siyal, S., Javed Ahmed, M., Ahmad, R., Xin, C., & Qasim, S. (2022). The Nexus Between Human Resource Management Practices and Service Recovery Performance in Takaful Insurance Industry in Pakistan: The Mediating Role of Employee Commitment. *Frontiers in Psychology*, 12, 752912. <https://doi.org/10.3389/fpsyg.2021.752912>
- Masduqie, M. H. A., Syarifudin, S., & Yudha, A. T. R. C. (2021). Green Economy of Waste Bank in the perspective of Maqashid Sharia in Surabaya. *Jurnal Ekonomi Syariah Teori Dan Terapan*, 8(5), 593. <https://doi.org/10.20473/vol8iss20215pp593-606>
- Matashu, M., & Skhephe, M. (2022). Human Capital and Economic Growth in Sub Saharan Africa Countries: ARDL and ECM Analysis. *Journal of Economics Education and Entrepreneurship*, 3(1), 49. <https://doi.org/10.20527/jee.v3i1.5007>
- Mateus, A. D., Allen-Ile, C., & Iwu, C. G. (2014). Skills Shortage in South Africa: Interrogating the Repertoire of Discussions. *Mediterranean Journal of Social Sciences*.
<https://doi.org/10.5901/mjss.2014.v5n6p63>

- Mathekga, J., Mahlaela, A., & Maciko, L. (2022). Evidence of Sasol Limited's Contribution to Skills Development in Democratic South Africa. *African Journal of Employee Relations*, 46.
<https://doi.org/10.25159/2664-3731/10622>
- Matotoka, D., & Odeku, K. O. (2018). Transformative Interventions Fostering Mainstreaming of Black South African Women Into Managerial Positions in the Private Sector. *European Review of Applied Sociology*. <https://doi.org/10.1515/eras-2018-0004>
- Maumbe, K., & van Wyk, L. (2011). Addressing the Skills Shortage Problem of the South African Tourism and Hospitality Industry: An Evaluation of the Effectiveness of the 2007/2008 SA Host Training Program in the Western Cape Province. *Urban Forum*.
<https://doi.org/10.1007/s12132-011-9115-z>
- Mayilyan, F., & Yedigaryan, K. (2022). THE EVOLUTION OF HUMAN CAPITAL THEORY. *ALTERNATIVE*, 68–79. <https://doi.org/10.55528/18292828-2022.4-68>
- Maziriri, E. T., Mapuranga, M., Maramura, T. C., & Nzewi, O. I. (2019). Navigating on the key drivers for a transition to a green economy: Evidence from women entrepreneurs in South Africa. *Entrepreneurship and Sustainability Issues*, 7(2), 1686–1703.
[https://doi.org/10.9770/jesi.2019.7.2\(62\)](https://doi.org/10.9770/jesi.2019.7.2(62))
- McCarthy, P., Sammon, D., & O'Raghallaigh, P. (2016). Designing an executive education programme: Towards a programme design matrix. *Journal of Decision Systems*, 25(sup1), 566–571.
<https://doi.org/10.1080/12460125.2016.1189640>
- McCord, A. (2005). A Critical Evaluation of Training Within the South African National Public Works Programme. *Journal of Vocational Education and Training*.
<https://doi.org/10.1080/13636820500200302>
- McEwan, E., Conway, M. E., Bull, D., & Malison, M. D. (2001). Developing Public Health Management Training Capacity in Nicaragua. *American Journal of Public Health*.
<https://doi.org/10.2105/ajph.91.10.1586>

- McGuinness, S., Pouliakas, K., & Redmond, P. (2018). Skills Mismatch: Concepts, Measurement and Policy Approaches. *Journal of Economic Surveys*. <https://doi.org/10.1111/joes.12254>
- McGunagle, D., & Zizka, L. (2020). Employability skills for 21st-century STEM students: The employers' perspective. *Higher Education, Skills and Work-Based Learning*, 10(3), 591–606. <https://doi.org/10.1108/HESWBL-10-2019-0148>
- McKenney, M. J., & Handley, H. A. (2019). Identifying and Quantifying Personnel Skill Gaps. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 63(1), 332–336. <https://doi.org/10.1177/1071181319631078>
- Melnichuk, M. V., Osipova, V. M., & Kondrakhina, N. (2017). Market-Oriented LSP Training in Higher Education: Towards Higher Communicative Skills. *Eurasia Journal of Mathematics Science and Technology Education*. <https://doi.org/10.12973/eurasia.2017.00983a>
- Meng, L., & Sager, J. (2017). Energy Consumption and Energy-Related CO₂ Emissions from China's Petrochemical Industry Based on an Environmental Input-Output Life Cycle Assessment. *Energies*, 10(10), 1585. <https://doi.org/10.3390/en10101585>
- Meta, S. M. (2022). Critical Literature Review on Bridging Skills Gap Through Development of Professional Courses: A Remedy for Unemployment Crisis in Kenya. *Advances in Applied Sociology*. <https://doi.org/10.4236/aasoci.2022.129033>
- Miller, H. A., Bouzek, K., Hnat, J., Loos, S., Bernäcker, C. I., Weißgärber, T., Röntzsch, L., & Meier-Haack, J. (2020). Green hydrogen from anion exchange membrane water electrolysis: A review of recent developments in critical materials and operating conditions. *Sustainable Energy & Fuels*, 4(5), 2114–2133. <https://doi.org/10.1039/C9SE01240K>
- Mondliwa, P., Roberts, S., & Ponte, S. (2021). Competition and power in global value chains. *Competition & Change*, 25(3–4), 328–349. <https://doi.org/10.1177/1024529420975154>
- Morgera, E., & Savaresi, A. (2013). A Conceptual and Legal Perspective on the Green Economy: The Green Economy. *Review of European, Comparative & International Environmental Law*, 22(1), 14–28. <https://doi.org/10.1111/reel.12016>

- Morris, D., Vanino, E., & Corradini, C. (2020). Effect of regional skill gaps and skill shortages on firm productivity. *Environment and Planning A: Economy and Space*, 52(5), 933–952.
<https://doi.org/10.1177/0308518X19889634>
- Morse, J. M., Barrett, M., Mayan, M., Olson, K., & Spiers, J. (2002). Verification Strategies for Establishing Reliability and Validity in Qualitative Research. *International Journal of Qualitative Methods*, 1(2), 13–22. <https://doi.org/10.1177/160940690200100202>
- Movahedian, H., & Norouzi, N. (2023). *Pragmatic Legal and Policy Implications of Environmental Lawmaking*: IGI Global. <https://doi.org/10.4018/978-1-6684-4158-9>
- Mukherjee, S., & Badola, S. (2021). Public Financing of Human Development in India: A Review. *Indian Journal of Human Development*, 15(1), 62–81.
<https://doi.org/10.1177/09737030211005043>
- Mulya Rizki Anugrah, C., Wulandari, R., & Zainuddin Hamidi, D. (2022). Building a Green Industry Based on the Sustainable Development Goals (SDGs) Reports of State-Owned Banks. *KnE Social Sciences*. <https://doi.org/10.18502/kss.v7i19.12466>
- Naidoo, D., Nhamo, L., Lottering, S., Mpandeli, S., Liphadzi, S., Modi, A. T., Trois, C., & Mabhaudhi, T. (2021). Transitional Pathways towards Achieving a Circular Economy in the Water, Energy, and Food Sectors. *Sustainability*, 13(17), 9978. <https://doi.org/10.3390/su13179978>
- Naoum, S. G., Harris, J., Rizzuto, J., & Egbu, C. (2020). Gender in the Construction Industry: Literature Review and Comparative Survey of Men’s and Women’s Perceptions in UK Construction Consultancies. *Journal of Management in Engineering*, 36(2), 04019042.
[https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000731](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000731)
- Napathorn, C. (2022). The development of green skills across firms in the institutional context of Thailand. *Asia-Pacific Journal of Business Administration*, 14(4), 539–572.
<https://doi.org/10.1108/APJBA-10-2020-0370>

- Ndedi, A. A. (2013). Challenges and perspectives facing the development of entrepreneurship education and training in South Africa. *World Journal of Entrepreneurship, Management and Sustainable Development*, 9(2/3), 126–132. <https://doi.org/10.1108/WJEMSD-01-2013-0009>
- Nethengwe, N. S. (2022). Transport Modes and the Green Economy. In J. O. Odiyo, P. B. Bikam, & J. Chakwizira (Eds.), *Green Economy in the Transport Sector* (pp. 21–36). Springer International Publishing. https://doi.org/10.1007/978-3-030-86178-0_3
- Nicolaides, A., & Austin, A. C. (2022). Community Engagement as an Ubuntu Transformative Undertaking for Higher Education Institutions. *Athens Journal of Philosophy*. <https://doi.org/10.30958/ajphil.1-4-1>
- Nieto, S., Matano, A., & Ramos, R. (2015). Educational Mismatches in the EU: Immigrants vs Natives. *International Journal of Manpower*. <https://doi.org/10.1108/ijm-11-2013-0260>
- Nikolov, G., Vasileva, E., & Lyubomirova, V. (2020). REGIONAL HUMAN CAPITAL MANAGEMENT – ASPECTS OF INTERACTION WITH THE ECONOMIC DEVELOPMENT OF THE TERRITORY. 253–260. <https://doi.org/10.31410/LIMEN.2020.253>
- Novikova, I. V. (2020). The development of a system of «green» skills in the strategizing of labor resources of industrial enterprises. *Russian Journal of Industrial Economics*, 12(4), 484–493. <https://doi.org/10.17073/2072-1633-2019-4-484-493>
- Nyawera, J. Xolani., & Haupt, T. C. (2020). Critical Drivers Towards Generative Process Health and Safety Culture. *Journal of Engineering Design and Technology*. <https://doi.org/10.1108/jedt-05-2020-0165>
- Oberschmidt, K., Grünloh, C., Nijboer, F., & Van Velsen, L. (2021). *Best Practices and Lessons Learned for Action Research in eHealth Design and Implementation: Literature Review (Preprint)* [Preprint]. Journal of Medical Internet Research. <https://doi.org/10.2196/preprints.31795>
- OECD. (2023). *Professionalising the public procurement workforce: A review of current initiatives and challenges* (OECD Public Governance Policy Papers 26; OECD Public Governance Policy Papers, Vol. 26). <https://doi.org/10.1787/e2eda150-en>

- Olurinola, I. O., Fadayomi, T., O. Amoo, E., & Ola-David, O. (2014). Occupational Health and Safety among Street Traders in Nigeria. *International Journal of Economics and Finance*, 6(4), p59. <https://doi.org/10.5539/ijef.v6n4p59>
- Oluwajodu, F., Blaauw, D., Greyling, L., & Kleynhans, E. P. J. (2015). Graduate unemployment in South Africa: Perspectives from the banking sector. *SA Journal of Human Resource Management*, 13(1), 9 pages. <https://doi.org/10.4102/sajhrm.v13i1.656>
- Onan, B., Aydin, U., Kadirogullari, E., Onan, I. S., & Sen, O. (2018). Totally Endoscopic Robotic-Assisted Cardiac Surgery in Children. *Artificial Organs*. <https://doi.org/10.1111/aor.13357>
- Orlovska, Y., Dryhola, K., Prydniprovsk State Academy of Civil Engineering and Architecture, & Baltaksa, D. (2020). Theoretical background of the green economy within the framework of the world paradigm of Sustainable Development. *Economic Scope*. <https://doi.org/10.32782/2224-6282/160-4>
- Otieno, B., & Ochieng, A. (2018). Green economy in the wastewater treatment sector: Jobs, awareness, barriers, and opportunities in selected local governments in South Africa. *Journal of Energy in Southern Africa*, 29(1), 50–58. <https://doi.org/10.17159/2413-3051/2018/v29i1a3379>
- Ozer, M., & Perc, M. (2020). Dreams and realities of school tracking and vocational education. *Palgrave Communications*, 6(1), 34. <https://doi.org/10.1057/s41599-020-0409-4>
- Paduraru, T., & Turcanu, G. (2022). Conceptual features of the green economy and the perspective of consumers in the Republic of Moldova. *EcoSoEn*, 3–4, 41–51. <https://doi.org/10.54481/ecosoen.2022.3-4.06>
- Paterson, A. D. (2005). Public Sector Training: A ‘Blind’ Spot in the 1999 South African National Levy-Grant Policy. *Journal of Vocational Education and Training*. <https://doi.org/10.1080/13636820500200300>
- Pavlova, M. (2014). TVET as an important factor in country’s economic development. *SpringerPlus*, 3(S1), K3. <https://doi.org/10.1186/2193-1801-3-S1-K3>

- Pavlova, M. (2019). Emerging environmental industries: Impact on required skills and TVET systems. *International Journal of Training Research*, 17(sup1), 144–158.
<https://doi.org/10.1080/14480220.2019.1639276>
- Peccianti, M. (2021). Grand Challenges in Photonics: Route to Light. *Frontiers in Photonics*, 1, 626728. <https://doi.org/10.3389/fphot.2020.626728>
- Pegels, A., & Lütkenhorst, W. (2014). Is Germany's energy transition a case of successful green industrial policy? Contrasting wind and solar PV. *Energy Policy*, 74, 522–534.
<https://doi.org/10.1016/j.enpol.2014.06.031>
- Phaladi, M. G., Mashwama, X. N., Thwala, W. D., & Aigbavboa, C. O. (2022). A Theoretical Assessment on the Implementation of Artificial Intelligence (AI) for an Improved Learning Curve on Construction in South Africa. *IOP Conference Series: Materials Science and Engineering*, 1218(1), 012003. <https://doi.org/10.1088/1757-899X/1218/1/012003>
- Pionorio, P., & Sebestyén, Z. (2022). The Influence of Human Capital on Construction Projects' Management. *Proceedings of the Creative Construction E-Conference 2022*, 197–201.
<https://doi.org/10.3311/CCC2022-026>
- Ponomarenko, T., Marin, E., & Galevskiy, S. (2022). Economic Evaluation of Oil and Gas Projects: Justification of Engineering Solutions in the Implementation of Field Development Projects. *Energies*, 15(9), 3103. <https://doi.org/10.3390/en15093103>
- Pouris, A., & Inglesi-Lotz, R. (2017). The Contribution of Higher Education Institutions to the South African Economy. *South African Journal of Science*. <https://doi.org/10.1590/sajs.2014/a0059>
- Prabhashwara, K. M. B. C., Waidyasekara, K. G. A. S., & Jayathilaka, R. D. W. W. (2022). An Assessment of Skill and Competency Gaps in the Construction Industry: The Case of Mechanical, Electrical, and Plumbing Workers. <https://doi.org/10.31705/faru.2022.20>
- Prinsloo, F. P. J., & Lategan, A. H. (2005). Identifying A National Leadership Skills Training And Development Strategy For Leaders Within Sector Education Training Authorities (SETAS). *SA Journal of Human Resource Management*, 3(2). <https://doi.org/10.4102/sajhrm.v3i1.54>

- Pulcini, C., Binda, F., Lamkang, A. S., Trett, A., Charani, E., Goff, D. A., Harbarth, S., Hinrichsen, S. L., Levy-Hara, G., Mendelson, M., Nathwani, D., Gunturu, R., Singh, S., Srinivasan, A., Thamlikitkul, V., Thursky, K., Vlieghe, E., Wertheim, H., Zeng, M., ... Laxminarayan, R. (2019). Developing core elements and checklist items for global hospital antimicrobial stewardship programmes: A consensus approach. *Clinical Microbiology and Infection*, 25(1), 20–25.
<https://doi.org/10.1016/j.cmi.2018.03.033>
- Quiñones, M. A. (1995). Pretraining context effects: Training assignment as feedback. *Journal of Applied Psychology*, 80(2), 226–238. <https://doi.org/10.1037/0021-9010.80.2.226>
- Rafiq, K. R. M., Hashim, H., Wahab, J. A., & Yunus, M. Md. (2019). Educational Theories and Issues in Human Capital Development. *Creative Education*, 10(12), 2689–2700.
<https://doi.org/10.4236/ce.2019.1012195>
- Rajagopaul, A., Ekeji, C., Runeyi, T., & Barendse, R. (2020). *Driving economic recovery in South Africa's BPO industry*.
- Ramirez, M. D., & Nazmi, N. (2003). Public Investment and Economic Growth in Latin America: An Empirical Test. *Review of Development Economics*, 7(1), 115–126.
<https://doi.org/10.1111/1467-9361.00179>
- Ramonyai, I. P., Marumo, M. L., Skhephe, M., & Matashu, M. (2022). Challenges of Transformation in Higher Education Curriculum Development in South Africa During Time of Decolonisation. *Jurnal Penelitian Dan Pengkajian Ilmu Pendidikan E-Saintika*.
<https://doi.org/10.36312/esaintika.v6i3.703>
- Rash, E. M. (2008). Clinicians' Perspectives on Motivational Interviewing-Based Brief Interventions in College Health. *Journal of American College Health*. <https://doi.org/10.3200/jach.57.3.379-384>
- Rasool, F., & Botha, C. J. (2011). The nature, extent and effect of skills shortages on skills migration in South Africa. *SA Journal of Human Resource Management*, 9(1), 12 pages.
<https://doi.org/10.4102/sajhrm.v9i1.287>

- Rasool, H. (2021). *New Forms of Work: Skills demand and supply in the changing world of work*.
- Rasoulinezhad, E., & Taghizadeh-Hesary, F. (2022). Role of green finance in improving energy efficiency and renewable energy development. *Energy Efficiency*, 15(2), 14. <https://doi.org/10.1007/s12053-022-10021-4>
- Rogerson, C. M. (2008). Tracking SMME Development in South Africa: Issues of Finance, Training and the Regulatory Environment. *Urban Forum*, 19(1), 61–81. <https://doi.org/10.1007/s12132-008-9025-x>
- Sadik-Zada, E. R., & Gatto, A. (2023). Grow First, Clean Up Later? Dropping Old Paradigms and Opening Up New Horizons of Sustainable Development. *Sustainability*, 15(4), 3595. <https://doi.org/10.3390/su15043595>
- Salas-Velasco, M. (2021). Mapping the (mis)match of university degrees in the graduate labor market. *Journal for Labour Market Research*, 55(1), 14. <https://doi.org/10.1186/s12651-021-00297-x>
- Samaniego, J. A. R., Maramag, C. C., Castro, M. G., Zambrano, P., Nguyen, T. V., Datu-Sanguyo, J., Cashin, J., Mathisen, R., & Weissman, A. (2022). Implementation and Effectiveness of Policies Adopted to Enable Breastfeeding in the Philippines Are Limited by Structural and Individual Barriers. *International Journal of Environmental Research and Public Health*. <https://doi.org/10.3390/ijerph191710938>
- Sanjoyo, S. (2019). Peran Sektor Publik dalam Akumulasi Human Capital dan Kapasitas Research & Development. *Jurnal Ekonomi, Manajemen Dan Perbankan (Journal of Economics, Management and Banking)*, 2(2), 70. <https://doi.org/10.35384/jemp.v2i2.104>
- Santiago-Vela, A., & Hall, A. (2023). Distinguishing challenging and overchallenging jobs: Cognitive and affective skills mismatches and their impact on job satisfaction. *Research in Comparative and International Education*, 18(1), 55–78. <https://doi.org/10.1177/17454999221116486>
- Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., Burroughs, H., & Jinks, C. (2018). Saturation in qualitative research: Exploring its conceptualization and

- operationalization. *Quality & Quantity*, 52(4), 1893–1907. <https://doi.org/10.1007/s11135-017-0574-8>
- Scott, E., Alger, R., Pequeno, S., & Sessions, N. (2002). *The Skills Gap as Observed Between IS Graduates and the Systems Development Industry: A South African Experience*. <https://doi.org/10.28945/2571>
- Sen, S., Nayak, N. C., & Mohanty, W. K. (2021). Long-term forecasting of tropical cyclones over Bay of Bengal using linear and non-linear statistical models. *GeoJournal*. <https://doi.org/10.1007/s10708-021-10543-x>
- Senkrua, A. (2021). A Review Paper on Skills Mismatch in Developed and Developing Countries. *International Journal of Sustainable Development & World Policy*. <https://doi.org/10.18488/journal.26.2021.101.8.24>
- Setyadi, A. (2019). Does green supply chain integration contribute towards sustainable performance? *Uncertain Supply Chain Management*, 121–132. <https://doi.org/10.5267/j.uscm.2018.10.012>
- Shafiee, M., Animah, I., Alkali, B., & Baglee, D. (2019). Decision support methods and applications in the upstream oil and gas sector. *Journal of Petroleum Science and Engineering*, 173, 1173–1186. <https://doi.org/10.1016/j.petrol.2018.10.050>
- Shah, Y. T., & Perrotta, A. J. (1976). Catalysts for Fischer-Tropsch and Isosynthesis. *Product R&D*. <https://doi.org/10.1021/i360058a005>
- Sharlanova, V. (2021). European Policies and Practices for the Development of Career Management Skills. *Педагогически Форум*. <https://doi.org/10.15547/pf.2021.008>
- Sharma, P., & Sahni, P. (2015). Human Capital and Economic Growth in India: A Co-integration and Causality Analysis. *Ushus - Journal of Business Management*, 14(2), 1–18. <https://doi.org/10.12725/ujbm.31.1>
- Sharpe, S. A., & Martinez-Fernandez, C. M. (2021). The Implications of Green Employment: Making a Just Transition in ASEAN. *Sustainability*, 13(13), 7389. <https://doi.org/10.3390/su13137389>

- Shawcross, J., & Ridgman, T. (2012). Manufacturing Excellent Engineers: Skill Development in a Masters Programme. *Engineering Education*. <https://doi.org/10.11120/ened.2012.07020038>
- Shen, J., Sun, H., Yang, R., & Shao, J. (2022). An Empirical Study of China's Environmental Economic Policy and the Effect of Industrial Green Transformation—Based on Data Envelopment Analysis Model. *Proceedings of the International Conference on Information Economy, Data Modeling and Cloud Computing, ICIDC 2022, 17-19 June 2022, Qingdao, China*. Proceedings of the International Conference on Information Economy, Data Modeling and Cloud Computing, ICIDC 2022, 17-19 June 2022, Qingdao, China, Qingdao, People's Republic of China. <https://doi.org/10.4108/eai.17-6-2022.2322872>
- Shi, B., Yang, H., Wang, J., & Zhao, J. (2016). City Green Economy Evaluation: Empirical Evidence from 15 Sub-Provincial Cities in China. *Sustainability*, 8(6), 551. <https://doi.org/10.3390/su8060551>
- Shinkevich, M. V., Ershova, I. G., Ishmuradova, I. I., Prasolov, V. I., Prokopyev, A. I., & Cherezova, Y. A. (2021). STATE PRIORITIES IN THE PETROCHEMISTRY OF RUSSIA: SUSTAINABLE DEVELOPMENT, "GREEN" INDUSTRY AND ENERGY EFFICIENCY. *International Journal of Energy Economics and Policy*, 11(4), 59–68. <https://doi.org/10.32479/ijeep.11364>
- Shtaltovna, Y. (2021). Can a Skill Be Measured or Assessed? *Gile Journal of Skills Development*. <https://doi.org/10.52398/gjsd.2021.v1.i1.pp12-24>
- Smentyna, N. V., & Fialkovska, A. A. (2019). Planning 'Green' development of the economy of amalgamated territorial communities. *Economic Innovations*, 21(2(71)), 130–138. [https://doi.org/10.31520/ei.2019.21.2\(71\).130-138](https://doi.org/10.31520/ei.2019.21.2(71).130-138)
- Solikhah, I. (2018). Revising EAP Programs in Indonesia: Where to Go? *Proceedings of the 5th International Conference on Community Development (AMCA 2018)*. 2018 3rd International Conference on Education, Sports, Arts and Management Engineering (ICESAME 2018), Quezon City, Philippines. <https://doi.org/10.2991/amca-18.2018.115>

- South Africa: Integrating Development and Climate Goals Requires a Transition that is Low-Carbon, Climate-Resilient, and Just.* (2022, November 1). [Text/HTML]. World Bank.
<https://www.worldbank.org/en/news/press-release/2022/11/01/south-africa-development-and-climate-goals-can-be-achieved-by-adopting-a-low-carbon-climate-resilient--just-transition>
- Srivastava, S., Dey, S. K., Sharma, S., & Ratilla, M. (2023). Adoption of sustainable practices by Asian hotels: Gaps in academia. *Worldwide Hospitality and Tourism Themes*, 15(3), 220–230.
<https://doi.org/10.1108/WHATT-01-2023-0009>
- Stoiko, N. (2016). GREEN ECONOMY – THE PARADIGM OF SUSTAINABLE DEVELOPMENT OF AGRO-ECOSYSTEMS IN UKRAINE. *International Journal of New Economics and Social Sciences*, 3(1), 90–99. <https://doi.org/10.5604/01.3001.0010.4709>
- Stoner, G., & Milner, M. M. (2010). Embedding Generic Employability Skills in an Accounting Degree: Development and Impediments. *Accounting Education*.
<https://doi.org/10.1080/09639280902888229>
- Strachan, S., Greig, A., & Jones, A. (2023). Going Green Post COVID-19: Employer Perspectives on Skills Needs. *Local Economy: The Journal of the Local Economy Policy Unit*, 026909422311516. <https://doi.org/10.1177/02690942231151638>
- Strauss, A. C., & du Toit, A. (2010). Competitive Intelligence Skills Needed to Enhance South Africa's Competitiveness. *Aslib Proceedings*. <https://doi.org/10.1108/00012531011046925>
- Strietska-Ilina, O. (2011). *Skills for green jobs: A global view: synthesis report based on 21 country studies*. International Labour Office.
- Stroud, D., Fairbrother, P., Evans, C., & Blake, J. (2014). Skill development in the transition to a 'green economy': A 'varieties of capitalism' analysis. *The Economic and Labour Relations Review*, 25(1), 10–27. <https://doi.org/10.1177/1035304613517457>

Studer, D., & Kemkar, S. (2012). *Job/Task Analysis: Enhancing the Commercial Building Workforce Through the Development of Foundational Materials; Preprint.*

<https://doi.org/10.2172/1051931>

Subramaniam, M., Noordin, M. K., & Nor, H. M. (2021). Eight Discipline-Problem Based Learning in Industrial Training Program to Develop Future Proof Skills Among Graduate Engineers. *International Journal of Online and Biomedical Engineering (iJOE)*, 17(12), 38–51.

<https://doi.org/10.3991/ijoe.v17i12.25481>

Suutari, V., & Viitala, R. (2008). Management development of senior executives: Methods and their effectiveness. *Personnel Review*, 37(4), 375–392.

<https://doi.org/10.1108/00483480810877561>

Tandlich, R., Ngqwala, N. P., Boshoff, A., Madikizela, P., Srinivas, C. S., Pyle, D. M., & Oosthuizen, R. (2018). Challenges and Curriculum Transformation in the Higher Education Sector in South Africa: A Case Study in WASH to Improve the Training of Pharmacists. *Acta Educationis Generalis*. <https://doi.org/10.2478/atd-2018-0001>

Taylor, S. (2004). Knowledge Circulation: The ‘Triple Helix’ Concept Applied in South Africa. *Industry and Higher Education*. <https://doi.org/10.5367/0000000042317382>

Teixeira, A. A. C. (2009). Strategic Complementarities Between Innovation and Human Capital. The Neglected Role of Human Capital Demand. *Revista Brasileira de Inovação*, 3(1), 169.

<https://doi.org/10.20396/rbi.v3i1.8648895>

Telukdarie, A., Munsamy, M., Mohlala, P. J., Monnapula, L. L., & Viswanathan, R. (2022). A predictive framework for sustainable youth skills development. *Higher Education, Skills and Work-Based Learning*, 12(4), 661–673. <https://doi.org/10.1108/HESWBL-01-2021-0002>

The Mail & Guardian. (2020, September). *Women in Construction*. <https://mg.co.za/special-reports/2020-09-02-women-in-construction/>

Thomas, J. G., Goldstein, C. M., Bond, D. S., Hadley, W., & Tuerk, P. W. (2020). Web-based virtual reality to enhance behavioural skills training and weight loss in a commercial online weight

- management programme: The Experience Success randomized trial. *Obesity Science & Practice*, 6(6), 587–595. <https://doi.org/10.1002/osp4.451>
- Thwala, W. D. (2008). Employment Creation Through Public Works Programmes and Projects in South Africa: Experiences and Potentials. *Acta Commercii*.
<https://doi.org/10.4102/ac.v8i1.72>
- Tillman, L. C. (2002). Culturally Sensitive Research Approaches: An African-American Perspective. *Educational Researcher*, 31(9), 3–12. <https://doi.org/10.3102/0013189X031009003>
- Tran, N. T. M. (2020). Declining returns to investment in tertiary education in Vietnam. *Science & Technology Development Journal - Economics - Law and Management*, 4(3), First.
<https://doi.org/10.32508/stdjelm.v4i3.590>
- Tsebe, A. (2022). Business Cycles and Growth of South African Steel Manufacturing Industry. *Journal of Economics and Behavioral Studies*, 14(1(J)), 6–22.
[https://doi.org/10.22610/jebis.v14i1\(J\).3256](https://doi.org/10.22610/jebis.v14i1(J).3256)
- Tshilongamulenzhe, M. C., Coetzee, M., & Masenge, A. (2013). Development of the Learning Programme Management and Evaluation Scale for the South African Skills Development Context. *Sa Journal of Industrial Psychology*. <https://doi.org/10.4102/sajip.v39i1.1080>
- Tsiklashvili, N., & Poladashvili, T. (2021). *Regional Sustainable Development Through Enhancing the Regional Graduates Employability; Case of Georgia*.
<https://doi.org/10.22616/esrd.2021.55.024>
- Tsotsotso, K., Montshiwa, E., Tirivanhu, P., Fish, T., Sibiya, S., Mlangeni, T., Moloi, M. L. B., & Mahlangu, N. P. (2017). Determinants of Skills Demand in a State- Intervening Labour Market. *Higher Education Skills and Work-Based Learning*. <https://doi.org/10.1108/heswbl-08-2017-0050>
- Turner, M., Halabi, M. K., Sartorius, K., & Arendse, J. (2013). An investigation of the efficiency of South Africa's sector education and training authorities (SETA's). *South African Journal of Business Management*, 44(2), 1–9. <https://doi.org/10.4102/sajbm.v44i2.151>

- Universitas Tanjungpura Pontianak, Indonesia, & Elyta, E. (2021). The Role of Non-Government Actors in Realizing Ecopreneurship Based on Environmental Security. *International Journal of Social Science and Human Research*, 04(09). <https://doi.org/10.47191/ijsshr/v4-i9-45>
- Van Langen, S. K., & Passaro, R. (2021). The Dutch Green Deals Policy and Its Applicability to Circular Economy Policies. *Sustainability*, 13(21), 11683. <https://doi.org/10.3390/su132111683>
- Vargas-Hernández, J. G. (2020). Strategic Transformational Transition of Green Economy, Green Growth and Sustainable Development: An Institutional Approach. *International Journal of Environmental Sustainability and Green Technologies*, 11(1), 34–56. <https://doi.org/10.4018/IJESGT.2020010103>
- Vasileiou, K., Barnett, J., Thorpe, S., & Young, T. (2018). Characterising and justifying sample size sufficiency in interview-based studies: Systematic analysis of qualitative health research over a 15-year period. *BMC Medical Research Methodology*, 18(1), 148. <https://doi.org/10.1186/s12874-018-0594-7>
- Vassileva, A. (2022). Green Public-Private Partnerships (PPPs) as an Instrument for Sustainable Development. *Journal of World Economy: Transformations & Transitions*. <https://doi.org/10.52459/jowett25221122>
- Vence, X., & Pereira, Á. (2018). Eco-innovation and Circular Business Models as drivers for a circular economy. *Contaduría y Administración*, 64(1), 64. <https://doi.org/10.22201/fca.24488410e.2019.1806>
- Vona, F., Marin, G., Consoli, D., & Popp, D. (2018). Environmental Regulation and Green Skills: An Empirical Exploration. *Journal of the Association of Environmental and Resource Economists*, 5(4), 713–753. <https://doi.org/10.1086/698859>
- Wahyuningrum, D., Gravitani, E., & Sartika, R. C. (2021). The Interrelationship of Sustainable Economic Value of Watersheds Using Contingent Valuation Method Approach with Circular Economy: A Literature Study. *IOP Conference Series: Earth and Environmental Science*, 940(1), 012036. <https://doi.org/10.1088/1755-1315/940/1/012036>

- Wang, D. (2022). Feasibility of the Development of Green Economy: Dualities in Exogeneity and Endogeneity. In Y. Jiang, Y. Shvets, & H. Mallick (Eds.), *Proceedings of the 2022 2nd International Conference on Economic Development and Business Culture (ICEDBC 2022)* (Vol. 225, pp. 1833–1844). Atlantis Press International BV. https://doi.org/10.2991/978-94-6463-036-7_274
- Wellner, A. M., Hungerford, D., & Anderson, D. (1966). Opinions of Maryland State Police Officers on Traffic Accident Causes and Prevention. *Public Health Reports (1896-1970)*. <https://doi.org/10.2307/4592869>
- Wen, W. (2022). Communication Channels for the Rule of Law and Environmental Sustainability: Reflections from a Green Economy Perspective. *Journal of Environmental and Public Health*, 2022, 1–8. <https://doi.org/10.1155/2022/1811896>
- Whittaker, J. G. (2016). Skills Gap – A Strategy for Increasing Knowledge Worker Supply & Demand. *Journal of Business*, 1(4), 13. <https://doi.org/10.18533/job.v1i4.42>
- Whittemore, R., Chase, S. K., & Mandle, C. L. (2001). Validity in Qualitative Research. *Qualitative Health Research*, 11(4), 522–537. <https://doi.org/10.1177/104973201129119299>
- Wimalaratne, P., & Kulatunga, U. (2022). A methodology to study the complexity of buildability in construction projects: Phenomenological research perspective. *Proceedings of 10th World Construction Symposium 2022*, 14–26. <https://doi.org/10.31705/WCS.2022.2>
- Winberg, C., Engel-Hills, P., Winberg, S., & Rip, A. (2014). *The Ethics of Curriculum Development: Engineers and Technicians in a Context of Development*. <https://doi.org/10.1109/ethics.2014.6893429>
- Windapo, A. O. (2016). Skilled labour supply in the South African construction industry: The nexus between certification, quality of work output and shortages. *SA Journal of Human Resource Management*, 15. <https://doi.org/10.4102/sajhrm.v14i1.750>

- Wu, S., Guo, D., Wu, Y., & Wu, Y. (2018). Future Development of Taiwan's Smart Cities from an Information Security Perspective. *Sustainability*, 10(12), 4520.
<https://doi.org/10.3390/su10124520>
- Wulandari, R., & Nurannisa, F. R. (2022). Effectiveness of Human Capital on Employee Performance in the Era of Disruption in the Health Sector. *Jurnal Kesehatan Masyarakat*, 18(2), 243–249.
<https://doi.org/10.15294/kemas.v18i2.37522>
- Xiaoxiao, J. (2016). Taking Coordinated and Joint Action to Promote the Green Development of the Economy and the Society. *Philosophy Study*, 6(10). <https://doi.org/10.17265/2159-5313/2016.10.005>
- Xu, X., & Gao, H. (2023). Effects of Urbanization on the Resources Allocation of Basic Education: A Regression Modeling Analysis Based on Panel Data. In A. El-Hashash, F. D. Hutagalung, A. S. Ghonim, & K. Zhang (Eds.), *Proceedings of the 2nd International Conference on Internet, Education and Information Technology (IEIT 2022)* (pp. 675–680). Atlantis Press International BV. https://doi.org/10.2991/978-94-6463-058-9_107
- Yaacob, N., Ali, D. F., Abdullah, A. H., Mohd Zaid, N., Mokhtar, M., & Ibrahim, N. H. (2021). Basic Refinery Training Courseware in Enhancing Technical Employees' Visualization Skills. *International Journal of Interactive Mobile Technologies (IJIM)*, 15(23), 45–56.
<https://doi.org/10.3991/ijim.v15i23.27591>
- Yeung, H. W. (1997). Critical realism and realist research in human geography: A method or a philosophy in search of a method? *Progress in Human Geography*, 21(1), 51–74.
<https://doi.org/10.1191/030913297668207944>
- Yıldırım, S., & Yıldırım, D. Ç. (2020). Achieving Sustainable Development Through a Green Economy Approach: In S. Patti & G. Trizzino (Eds.), *Advances in Finance, Accounting, and Economics* (pp. 1–22). IGI Global. <https://doi.org/10.4018/978-1-5225-9562-5.ch001>
- Yu, X., Pang, W., Xu, Q., & Liang, M. (2020). Mammographic image classification with deep fusion learning. *Scientific Reports*, 10(1), 14361. <https://doi.org/10.1038/s41598-020-71431-x>

- Zacchia, G., Cipri, K., Cucuzzella, C., & Calderari, G. (2022). Higher Education Interdisciplinarity: Addressing the Complexity of Sustainable Energies and the Green Economy. *Sustainability*, 14(4), 1998. <https://doi.org/10.3390/su14041998>
- Zamyatina, M. F., Gorin, E. A., & Fesenko, R. S. (2022). The main directions for achieving the Goals of Sustainable Production and Consumption and their perception by enterprises. *The Economy of the North-West: Problems and Prospects of Development*, 1(68), 67–80. <https://doi.org/10.52897/2411-4588-2022-1-67-80>
- Zen Fatro, M., Tri Sulisty, E., & Nugroho, S. (2019). Internalization of Local Wisdom Value through I-Spring Technology- Based Art and Culture Learning. *Lekesan: Interdisciplinary Journal of Asia Pacific Arts*, 2(1), 8–11. <https://doi.org/10.31091/lekesan.v2i1.748>
- Zhang, L., Xu, M., Chen, H., Li, Y., & Chen, S. (2022). Globalization, Green Economy and Environmental Challenges: State of the Art Review for Practical Implications. *Frontiers in Environmental Science*, 10, 870271. <https://doi.org/10.3389/fenvs.2022.870271>
- Zhang, P., & Hu, A. (2013). The Essence of Overeducation in China. *Proceedings of the 2013 the International Conference on Education Technology and Information Systems*. 2013 the International Conference on Education Technology and Information Systems (ICETIS 2013), Sanya, China. <https://doi.org/10.2991/icetis-13.2013.89>
- Zhao, Y., Zhang, Z., Wang, S., Zhang, Y., & Liu, Y. (2015). Linkage analysis of sectoral CO2 emissions based on the hypothetical extraction method in South Africa. *Journal of Cleaner Production*, 103, 916–924. <https://doi.org/10.1016/j.jclepro.2014.10.061>
- Zheng, G.-W., Siddik, A. B., Masukujjaman, M., & Fatema, N. (2021). Factors Affecting the Sustainability Performance of Financial Institutions in Bangladesh: The Role of Green Finance. *Sustainability*, 13(18), 10165. <https://doi.org/10.3390/su131810165>
- Zlatic, L., & Luković, S. (2020). *The Role of Teachers in the Development of Students` Socioemotional Skills*. <https://doi.org/10.46793/stec20.93z>

Zvarych, R., Masna, O., & Rivilis, I. (2023). Methodological principles of the formation the concept of green economy. *Herald of Economics*, 4, 131. <https://doi.org/10.35774/visnyk2022.04.131>

10 Appendices

11 Interview Questionnaire

Biographical Information

Name :

Current Role :

Research Question 1:

What are the Skills Development Programmes' weaknesses in addressing skill gaps in South Africa's green economy, in your experience?

1. Your view on Skills Development Programmes (SDP)?
2. Are your requirements for green skills and specifically within SDP being met?
3. Are your green skills needs included in a SDP for this sector?
4. What are the common shortcomings in important green skills among employees in South Africa's green economy, impacting the petrochemical & energy industries?
5. To what extent do current plans in the SDP for skill development in the green economy effectively meet the recognised gaps in skills in your organisation?
6. What obstacles have you faced in obtaining green skills through existing skill development programmes?
7. How important for you is investment in talent to improve productivity for your department and organisation?
8. Can you offer ideas on assessing the return on investment (ROI) for training personnel, specifically in relation to the development of human capital and skills?
9. How do your people development and skill-building programmes specifically tackle mismatches and gaps inside your organisation, based on your expertise? Could you provide examples of how these plans have developed to tackle potential anomalies?
10. What are the major obstacles related to the existing skills mismatch in South Africa's green economy, and what solutions do you think can effectively tackle these obstacles?

11. Based on your observations, are the skill gaps in South Africa's green economy, particularly in the petrochemical industry, more horizontally or vertically oriented? How have these trends affected both industry perspectives and organisational productivity and adaptability?

