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Faculty of Science

Department of Geography and Environmental Studies

PhD RESEARCH THESIS

THE ROLE OF SOCIAL IMPACT ASSESSMENTS IN SKILL DEVELOPMENT AND SUSTAINABLE COMMUNITIES IN SOUTH AFRICA'S JUST ENERGY TRANSITION FROM COAL: A STUDY OF CAROLINA AND KRIEL MINING COMMUNITIES IN SOUTH AFRICA

BY

THANDIWE CHIDZUNGU

Student number: 1312738

SUPERVISOR:

Dr. Alex Wafer

Ethics Clearance Number: H20/06/04

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DECLARATION

I, Thandiwe Chidzungu (student number: 1312738), solemnly declare that this thesis is my own, unaided work. It is being submitted for the degree of Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University. All the resources utilised or quoted have been indicated and acknowledged by a complete reference, according to the required Harvard referencing conventions.

Thandiwe Chidzungu: 

18th day of October 2023 at the University of the Witwatersrand

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While I have declared that this is my unaided work to abide by academic rules, this downplays how individuals and different organisations have helped me put this work together. While it is impossible to thank everyone individually, a few individuals stand out for their unwavering commitment to the completion of this degree and deserve special recognition.

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ABSTRACT

The study investigated the role of Social Impact Assessment (SIA) in addressing skill development needs and community sustainability issues in relation to a Just Energy Transition (JET) away from coal to the renewable energy sector in the Kriel and Carolina coal mining communities in Mpumalanga, South Africa. It had the following objectives: To explore the sustainability perspectives in the energy transition from coal to a low-carbon economy. Secondly, to examine the skill development needs within the energy transition from coal to the renewable energy sector in the coal industry in the two coal mining communities under study. Thirdly, to evaluate the potential of SIA as a strategy for assessing and addressing the social impacts of an energy transition from coal to the renewable energy sector on the two affected communities. Lastly, to recommend SIA as a policy entry point that the government can leverage in the Just Energy Transition policy framework in South Africa. A qualitative research approach, including quantitative techniques, was adopted. The primary data was collected through online and physical, semi-structured interviews and questionnaires. A desktop study was used to collect secondary data. 230 participants, comprised of 60 experts and 170 community members, were engaged in the study. The participants were sampled using systematic, purposeful, random, and convenient sampling techniques. The researcher attended six webinars, two conferences, and two community forums on coal mining and renewable energy, where she gleaned some of her data and met some of the study participants. The Theory of Change was used as the theoretical framework. Findings on community sustainability issues in the two study areas reveal a lack of public participation, an increase in unemployment, and poor policy enforcement in land reform, affecting agriculture as the energy shift from coal to the low-carbon economy unfolds. They also point to cultural disruptions linked to possible internal relocations to make way for Renewable Energy (RE) infrastructure and gender disparities in economic participation that can threaten community sustainability. On a positive note, findings alongside the reviewed literature point to the growth of new economic opportunities linked to JET both in the affected regions and elsewhere, further creating employment opportunities. However, jobs created elsewhere may see relocations of the active group, affecting community stability and hence sustainability in the sending coal areas. Findings also highlight the perceived improvement in

environmental sustainability linked to a reduction in pollution as clean RE technology is introduced, which improves health and agricultural yields as water, air, and soil quality are improved, thereby impacting community sustainability positively. With regards to skills development needs, the findings show low levels of educational attainment among the youth, a high rate of school dropouts coupled with poor school attendance, and a poor establishment of Science, Technology, Engineering, and Mathematics (STEM) fields, all of which will impact skill development during the energy transition. The study submits that the advocacy role of SIA can influence a rethink of curriculum design and fuel the creation of a skills needs assessment in line with the vocational system and Renewable Energy (RE) sector labour market demand. Moreover, it advocates for local action plans to support skills development through adult literacy centres for school dropouts and Conditional Cash Transfers (CCTs) to promote school attendance and the taking of STEM subjects targeted at females in schools and vocational colleges, who are disadvantaged compared to their male counterparts. With regards to the potential of SIA as an effective tool for addressing the social impacts of an energy transition, the study demonstrates that SIA can facilitate the identification of the social impacts and promote a deeper understanding of these impacts through its grassroot-level engagements. As well as facilitate the addressing of these social costs through sector-literate SIA teams, multistakeholder collaborations, and community engagements. Furthermore, in the evaluation of developmental projects, SIA highlights the gender and age constraints of the social change process that need to be considered in JET's socio-economic impact mitigation efforts. The findings further point to the consistency of SIA with the Grassroots Theory of Change, which articulates that change is made through collective action by communities regarding a problem or problems affecting their lives (Stachowiack, 2013). SIA is also demonstrated as a potential tool for strategic planning to identify current needs and opportunities that resonate with the "Policy Windows Theory of Change" by John Kingdon, which involves launching in-depth investigations of problems and providing constituent feedback as one application technique for advocacy (Coffman, 2007). All these attributes afford SIA the opportunity to fuel distributive, procedural, and rectificatory justice as the JET unfolds, making it better placed as an entry point to socially oriented policies. This positions SIA as a strategic tool that can assist with impact mitigation for JET-related social costs associated with skill development needs and community sustainability issues. The study, however,

condemns the once-off process accorded to SIA and advocates for its use as an ongoing process as the JET unfolds to allow for continued monitoring and assessments and, hence, effective impact mitigation.

Key words: Just Energy Transition, skill development, community sustainability, Social Impact Assessment, South Africa

ABBREVIATIONS

AMD	Acid Mine Drainage
AR5	Fifth Assessment Report
AREI	Africa Renewable Energy Initiative
CCTs	Conditional Cash Transfers
CISL	Cambridge Institute for Sustainable Leadership
COP21	21st Conference of the Parties
CSIR	Council for Scientific and Industrial Research
CSR	Corporate Social Responsibility
CSP	Concentrating Solar Power
Cwb	Subtropical highland climate
DBSA	Development Bank of Southern Africa
DEA	Department of Environmental Affairs
DFI	Development Finance Institution
DISCOM	Distribution Company
DMRE	Department of Mineral Resources and Energy
DoL	Department of Labour
EIAs	Environmental Impact Assessments
EU	European Union
FeS2	Iron Sulphide
FET	Further Education and Training
FF	Fossil Fuels

FOE	Friends of the Earth
FPIC	Free Prior and Informed Consent
GCF	Green Climate Fund
GDP	Gross Domestic Product
GPCIMP	Ghana Power Compact Internship and Mentoring Program
HRIA	Human Rights Impacts Assessments
IAIA	International Association for Impact Assessment
IASS	Institute for Advanced Sustainability Studies
IBA	Impact Benefit Agreement
IDB	Inter-American Development Bank
IDP	Integrated Development Plan
IEA	International Energy Agency
IET	International Energy Transition
ILO	International Labour Organisation
IPPC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
IRP	Integrated Resource Planning
ITC	International Training Centre
ITUC	International Trade Union Confederation
IUCMA	Inkomati Usuthu Catchment Management Agency
JEDI	Jobs and Economic Development Impacts
JET	Just Energy Transition
JTF	Just Transition Framework

KW	Kilowatt-Hour
LBPR	Lower Bound Poverty Rate
LED	Local Economic Development
LRA	Labour Regulatory Act
MCSA	Mineral Council South Africa
MEC	Mineral Energy Complex
MMSD	Mining Mineral and Sustainable Development
MPRDA	Mineral Petroleum Resources Development Act
MW	Megawatts
MWCB	Mine Water Coordinating Body
NASA	National Aeronautics and Space Administration
NCCRWP	National Climate Change Response White Paper
NEMA	National Environment Management Authority
NEPA	National Environmental Policy Act
NGO	Non-Governmental Organisation
NPC	National Planning Commission
NTC	National Trade Certificate
NVC	National Vocational Certificate
NWA	National Water Act
OEMs	Original Equipment Manufacturers
PEI	Power Engineering International
PhD	Doctor of Philosophy
PM	Particulate Matter

PV	Photovoltaic
RE	Renewable Energy
REIPPPP Programme	Renewable Energy Independent Power Producer Procurement
RENAC	Renewables Academy
RSA	Republic of South Africa
RSC	Renewable Skills Consultant
SACREEE	SADC Centre for Renewable Energy and Energy Efficiency
SAEON	South African Environmental Observation Network
SARATEC	South African Renewable Energy Technology Centre
SASSA	South African Social Security Agency
SDG	Sustainable Development Goals
SEDESOL	Secretaria de Desarrollo Social
SEFA	Sustainable Energy Fund for Africa
SIA	Social Impact Assessment
SJRP	Sector Jobs Resilience Plan
SLAPP	Strategic Lawsuits Against Public Participation
SLP	Social Labour Plan
SO2	Sulphur Dioxide
SSA	Sub Saharan Africa
SRD	Social Relief Distress
STEM	Science Technology Engineering and Mathematics
SUPRABHA	Sustainable Partnership for Rooftop Solar Acceleration in Bharat

SWOP	Society, Work & Politics institute
TESSA	Thermal Energy Storage and Saving Association
TVET	Technical Vocational Education and Training
UCTs	Unconditional Cash Transfers
UfU	Independent Institute for Environmental Issues
UK	United Kingdom
UN	United Nations
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
UNFCCC	United National Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNGP	United Nations Guiding Principles
USA	United States of America
USCEQ	United States Council on Environmental Quality
USD	United States Dollars
WHO	World Health Organisation
WRC	Water Research Commission
WWF	Worldwide Fund

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CHAPTER 1

Introduction

1.1. Background to the study

1.1.1. The Just Energy Transition

The Just Energy Transition (JET) involves the shift from a high-carbon economy towards a lower-carbon economy, enabling the creation of new employment prospects for those impacted by the transition (JET Fact Sheet, 2021). Furthermore, it is said to be legislated to decarbonise the high-carbon energy sector to mitigate the impacts of climate change and is linked to the Paris Agreement reached at the 21st Conference of the Parties [COP21] (Cambridge Institute for Sustainability Leadership [CISL], 2016; Cardoso and Turhan, 2018). One of the driving forces behind the JET is the increasingly unsettling reality of climate change, which leads to a world that will be more than 2 °C hotter in the future (Munnik, 2019).

Cardoso and Turhan (2018) assert that as coal production is phased out in some regions of the Global North, the global energy landscape is altering. Environmental conflicts, anti-coal movements, and climate change mitigation are all interconnected on several scales and have an impact on the decarbonisation of the coal industry. Food security in the Global South is threatened by ongoing droughts and decreasing crops brought on by climate change in Sub-Saharan Africa (Daniel, 2020; Koubi, 2019). These climate change risks also add to the growing justification for a move away from coal, and Africa has an abundance of renewable energy sources. For example, countries like Angola, the Democratic Republic of the Congo, Madagascar, Mozambique, and Zambia have hydroelectricity potential (Mbirimi, 2017). South Africa has wind energy in the eastern and northern Cape, and Mpumalanga has potential for solar energy (Ward and Sharma, 2020; Bulbulia, 2022; Semelane et al., 2018).

Studies further point to the low cost of these renewable energy technologies, as opposed to coal, as another significant driving force behind the energy transition. (Burton et al.,

2019; Africa Renewable Energy Initiative Technology [AREI], 2016; General Electricity Company, 2019). In 2016, the cost of solar photovoltaic (PV) was estimated at "7.5 US cents per kilowatt-hour (kWh), compared to 7-8 US cents per kWh for coal; also, the entire cost of solar installation may drop by 20% by 2040 [from USD 2,500 per kW in 2011 to USD 870 per kW in 2040]" (AREI, 2016). Battery storage costs have also dropped (General Electric Company, 2019).

However, the International Energy Agency [IEA] (2022) demonstrates that coal has become more competitive in several markets because of the steep increase in natural gas costs. Because of this, coal prices around the world have risen, hitting three record highs between October 2021 and May 2022. Markets have suffered because of sanctions and restrictions on Russian coal after Russia invaded Ukraine, and difficulties at other crucial exporters have further reduced supplies. This could result in a rise in global coal demand, but concurrently, the continued burning of enormous amounts of coal raises concerns about climate change (IEA, 2022).

Considering South Africa's vulnerability to climate change, its energy future calls for a less coal-intensive mix with significant increases in cleaner technologies (JET Fact Sheet, 2021). The old coal power stations in Mpumalanga should be closed as part of heeding the calls for a JET and reaching the end of life for some power stations, putting the country's energy security at risk (Faku, 2019). Studies imply that demand for imported thermal coal in all South Africa's present markets, namely India, Pakistan, South Korea, and Europe, is dropping or will decline (Ward and Sharma, 2020; Munnik, 2019). Mines that are now exporting coal might be able to sell some of it to Eskom, but they are unlikely to receive the premium earned on existing exports, which will threaten their viability (Simon and Buckley, 2019; Burton et al., 2019). This might drive up Eskom's coal prices or result in a coal shortage.

Apart from the viability issues, coal mining in Mpumalanga has experienced a slew of environmental issues, including elevated levels of sulphur dioxide emissions from the Kriel coal plant that contribute to climate change (Faku, 2019). The World Bank (2022) points to a heavy dependency on coal and related activities, which also cause water and soil pollution. This compromises food and water security and the overall health of the ecosystem. For example, the Olifants River, which serves some of the largest irrigation

schemes in South Africa, draws water from catchments in the coal belt region and is one of the most polluted rivers in the country (World Bank, 2022).

The studies mentioned above argue that policies associated with reducing climate change at the global and regional levels focused on strengthening environmental protection are the main drivers of JET. Others posit that the advent of low-cost RE technology, given the high prices of coal and dwindling markets, is also a reason behind the JET. Furthermore, others point to the need to improve people's health as another impetus for the JET. The World Bank Fact Sheet (2023) expresses that the JET will improve ambient air quality and surface and groundwater quality through the removal of several buildings, structures, and dams, as well as the rehabilitation and clean-up of contaminated areas. This will reduce the adverse impacts these can have on people's health. The JET, therefore, has a financial, ecological, and health case supporting it.

Nevertheless, the social costs of the energy transition for impacted workers and coal mining communities receive limited attention in JET scholarship (Glynn et al., 2020; Sovacool, 2014; Sanz-Hernandez, 2020). Burton et al. (2019) report that as the JET develops, a Sector Jobs Resilience Plan (SJRP) is underway and focused on the impacts of the JET on employment and the coal sector. However, it will largely focus on gathering data and not engage in modelling or suggest a timeline for the phase-out of coal. Given the grip on employment the coal sector has in the country’s political economy, transitioning to the renewable sector will adversely impact coal employees and their dependents, considering the job losses as the JET progresses (Burton et al., 2018; Strambo, 2019). In addition, over time, local communities and other stakeholders become overly dependent on the mining companies for a wide range of basic services and other benefits, which are lost as mines are closed (Joyce and MacFarlane, 2001; Kabir, 2021). This affects community sustainability.

On the other hand, JET will usher in new job designs, hence the demand for new skill development. Considering the repertoire of skills in the coal industry that has been built over the years, this will create skill shortages as the JET unfolds (Burton et al., 2018; International Labour Organisation [ILO], 2019). Moreover, the Science, Technology, Engineering, and Math (STEM) skills required in the low-carbon economy are scarce (Semelane et al., 2018), and this will widen the already existing skills gap as the transition unfolds.

This situation disregards the 2015 declaration, in which parties agreed to take into consideration "the imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities" (SLYCAN Trust, 2021, p. 1). According to Sovacool (2014), the scientific and quantitative frameworks that dominate energy studies depict a gap in JET literature that fails to address the social impacts, which require an interdisciplinary and human-centred approach. The studies done on JET in South Africa's coal mining sector have acknowledged the social cost of JET (World Bank, 2022; Munnik, 2019; Daniel, 2020; ILO, 2019). However, they have not looked at the possible role SIA could play as a mitigation strategy within the JET context.

SIA lies within the fabric of Environmental Impact Assessment (EIA), and it is an underappreciated environmental management tool focused on the social costs of development (Du Pisani and Sandham, 2006; Dendena and Corsi, 2015). The EIA is focused on the biophysical environment and is undertaken by natural scientists (Hildebrandt and Sandham, 2014). SIA's social profiling of communities and collaborations with industry, academia, and regulatory agents (Rose and McGee, 2006; Vanclay, 2003) could afford it the opportunity to support skills need assessments in line with labour market demands and community sustainability issues in the low-carbon economy that can bridge the social cost gap. This forms the basis of the research question presented in **Section 1.3** and allows for a deeper engagement with SIA as a social mitigation strategy within the JET context, discussed in **Chapter 2**.

1.2. Problem Statement

South Africa's highly coal-dependent power generation infrastructure is poorly maintained, ageing, unreliable, and one of the most polluting globally, with negative impacts on people's health (World Bank, 2022). On the other hand, the current power supply gap is estimated at 4-6 GW, causing load shedding of up to 10 hours daily, affecting people's everyday lives and the country's economic prospects (World Bank Fact Sheet, 2023). The Just Energy Transition from Coal to a Low-Carbon Economy will help provide clean, cheap, modern, and reliable electricity services (World Bank, 2022).

The Minerals Energy Complex (MEC), which broadly refers to industries related to mining, electricity, and infrastructure that are significant to South Africa's economy (Fine and Rustomjee, 1996), is what anchors the coal sector to the nation's political economy. It employed an estimated 91,649 workers in 2020, and this increased by 1% to 93,998 in 2021; a 2.9% increase in employment earnings from R30.5 billion to R31.4 billion was also recorded in that period (Minerals Council South Africa, 2021).

A shift away from coal to a low-carbon economy will have a negative impact on employment. Given that coal mining employs approximately 7% of the workforce in Mpumalanga and that coal miners typically support at least three dependents (Burton et al., 2019), this will raise poverty levels in Mpumalanga, which are already relatively high. Poverty entails a lack of money and productive resources, such as insufficient access to food, clean water to drink, sanitary facilities, health care, housing, education, and information to enable sustainable livelihoods (Mbombela Draft Integrated Development Plan, 2019–2020). Therefore, loss of income by the coal workers and their dependents will escalate poverty and have ramifications for social protection, which in Mpumalanga stood at R1 591 184 in 2021 (SASSA, 2021/22). As the energy transition unfolds, all these factors will have repercussions for community sustainability.

Due to power inequalities or a lack of resources linked to poverty, Aucamp and Lombard (2018) contend that these issues frequently have a direct impact on the social impact assessment process, which can impede the effective participation of impacted populations. Substantiating this is the World Bank (2022), which argues that to reconcile development and climate goals while addressing inequality, racial, and spatial exclusion, South Africa needs to pay special attention to its most vulnerable people in its efforts to adopt a low-carbon path and build a resilient economy. Zinecker et al. (2018) posit that the exclusion of local communities disrupts cultural practises, and this makes it harder to reach a consensus on any development endeavour, thereby affecting community sustainability and, hence, the success of a project.

Existing literature, on the other hand, depicts skill development shortages in the STEM fields as the energy transition takes place globally (Lankhuizen et al., 2022; Burton et al., 2018). Modern technology in the low-carbon economy will require engineers, technicians, information technology experts, and related fields in the sciences (Jain and Jain, 2017; Semelane et al., 2018). Existing studies show that South Africa’s higher

educational institutions and sectoral skill plans need to align their curriculum with the skills requirements of the sector (Institute for Advanced Sustainability Studies [IASS]; Renewables Academy [RENAC]; Independent Institute for Environmental Issues [UfU]; International Energy Transition [IET]; Council for Scientific and Industrial Research [CSIR], 2020; World Bank, 2022). Rasool and Botha's (2011) argument still holds true: that South Africa is failing to consider future skill requirements and is failing to create programmes in the school curriculum that would enable new skill acquisition.

A viable social mitigation strategy against the social costs is necessary considering the skills development shortages and community sustainability issues that the energy transition from coal to the RE sector will impose on affected people. The social impact assessment tool could be a viable mitigation strategy against the overlooked social cost of JET. SIA is a process that entails research, planning, and the management of social change—both intended and unintended, positive, and negative—caused by policies and related development initiatives (Kabir, 2021). It focuses on the social impact of developments beyond how they affect the physical environment (Joyce et al., 2018). This served as a springboard for the formulation of the primary research questions that directed the study.

1.3. Research Questions

Given the above observation, the following questions guided the research process:

I. What are the sustainability perspectives in the coal mining industry as it embarks on a Just Energy Transition in the Carolina and Kriel mining communities?
II. What are the skill development needs within the energy transition from coal to renewable energy in the coal industry in Kriel and Carolina mining communities in Mpumalanga?
III. To what extent can SIA be an effective strategy for the assessment and addressing of the social impacts of a shift from coal to a low-carbon economy on the affected communities in the Carolina and Kriel mining communities in Mpumalanga?

IV. To what extent can SIA provide an entry point into government policy for an energy transition from coal to the renewable energy sector in South Africa?

1.3.1. Research Aims and Objectives

This research aimed to investigate the mitigating role that SIA can play in the coal mining industry in South Africa as it transitions to a low-carbon economy, examining the current state of workers' skill development needs and community sustainability within the JET context. It interrogated the effectiveness of SIA as a strategy for the assessment and addressing of the social impacts of JET on impacted communities and its potential as an entry point to government policy within a JET context. The specific objectives of the study were to:

I. Explore the sustainability perspectives in the energy transition from coal to a low-carbon economy in the Kriel and Carolina coal mining communities in Mpumalanga, South Africa.
II. Examine the skill development needs within the energy transition from coal to the renewable energy sector in the coal industry in Kriel and Carolina mining Communities in Mpumalanga, South Africa.
III. Evaluate the potential of SIA as an effective strategy for the assessment and addressing of the social impacts of an energy transition from coal to the renewable energy sector on the affected communities in the Carolina and Kriel mining communities in Mpumalanga.
IV. Recommend SIA as a policy intervention entry point that the government can leverage in the Just Energy Transition policy framework in South Africa.

1.4. Theoretical Consideration

This section's main goal is to provide a brief overview of the reviewed literature described in **Chapter 2**. The literature review focuses on giving a quick overview of the background and role of SIA in large-scale development projects. It considers communities' and workers' needs for skill development in the wake of the energy transition to a low-carbon economy. It looks at sustainability perspectives with a focus on environmental sustainability in relation to the biophysical environment and community sustainability in relation to green jobs and public involvement in the JET context. The potential of SIA as a strategy to assess and address the social costs of large-scale development projects in impacted communities is reviewed. The last section reviews the potential of SIA as an entry point in JET policy decision-making.

This literature review's "backdrop" is the Mpumalanga region's concentration of coalfired power plants and upstream mines, which have an effect on the biophysical and social environment and are earmarked as a Renewable Energy Zone (Faku, 2019; McCarthy and Humphries, 2012; Munnik, 2019). The biophysical environment under coal and renewable energy as the JET unfolds is reviewed, considering the social implications therein. As the shift to a low-carbon economy takes shape, the literature on community sustainability is evaluated in relation to the current economic structures, cultures, and lifestyles of people living in the coal belt (Munnik, 2019). The study then investigates the impacts of the energy shift on skill development among coal industry workers who will require retraining to work in the RE sector, as well as the government’s and industry's education readiness for this radical shift in skill demand (Burton et al., 2018; ILO, 2019; Semelane et al., 2018). Against this backdrop of skills development and community sustainability issues within JET, a long-term approach to identify, analyse, and manage them is necessary, and a social impact assessment tool could be leveraged to span this gap.

1.5. Scope of the Study, Methodology, and Limitations

In the context of JET, the study examined how SIA could contribute to community sustainability and skill development. It looked at the likelihood of SIA as a useful strategy for assessing and addressing the social impacts of JET on the impacted Carolina and Kriel coal mining communities in Mpumalanga, South Africa, which were the two study sites. As well as SIA's potential to serve as a JET-specific entry point for government policy.

Community members from the two research sites were chosen as study participants due to their lived and work experiences in the areas. Experts from industry, government, and academia, including SIA consultants, were among the participants due to their knowledge of climate change mitigation policies, coal mining, the renewable energy industry, and SIA. Involving communities from two different sites in Mpumalanga and experts was assumed to give a more comprehensive, dependable, and valid picture of the social cost of JET. The participants were sampled using random, systematic, purposeful, snowball, and convenient sampling techniques as deemed fit. The researcher assumed an interpretivist and relativist philosophical position. The Theory of Change was used as an analytical framework. The study was primarily qualitative, with one-on-one, semi-structured interviews and questionnaires conducted online and in person. The Community Survey (2016) and Census (2011) data provided the demographic data. However, at the time of the study, the demographic information was outdated, so the Integrated Development Plans (IDPs) for the local municipalities in the study areas were used to obtain the most up-to-date information. The quantitative data, which were provided by the survey questionnaires, were analysed using Kent's four-step technique. To analyse qualitative data from interviews, the eight-step conceptual data analysis approach developed by Busch et al. (1994) was used. The two software packages used for data processing, visualisation, and analysis included ArcGIS 10.5 for creating the map and Microsoft Excel for the graphic presentations of the primary and secondary data collected. Getting the targeted number of participants was difficult due to the restrictions on interaction imposed by the COVID-19 pandemic. However, being qualitative research, saturation levels during data collection validated the study population.

1.6. Ethical Considerations

Ethical considerations were drawn up to guide the research. These adhered to the ethical codes of the University of the Witwatersrand. Research ethics, according to Fraenkel and Wallen (2006), is concerned with the rights and interests of research participants. According to Resnik (2015), there are several reasons to follow ethical guidelines in research, including honesty, reducing the number of errors so that researchers are held accountable for their findings, and promoting public support for research by instilling trust in the research's integrity and accuracy. Therefore, prior to data collection, all ethical considerations and protocols were considered. An ethics clearance for the research was sought from the University of the Witwatersrand, and an ethics clearance certificate was issued for the study (see **Appendix 5**). A participant sheet was issued, explaining the research and how it would be conducted. Important contacts at the university were supplied if there was a need for further questions or verification (see **Appendices 6 and 9**). During fieldwork, consent was sought from participants and respondents in the survey and interviews (see **Appendices 7, 8, 10,** and **11**). Participants were informed of their rights to refuse to take part, that confidentiality would be maintained, and that the data collected were strictly for academic purposes. The confidentiality of the information collected was preserved; general titles with numbers were used instead of names to protect the identities of the participants; and data was stored on a password-protected laptop.

1.7 Definition of Key Concepts

a). A Just Energy Transition is defined as “a gradual decarbonisation of the global energy mix implemented in accordance with the Paris Agreement reached at the 21st Conference of the Parties [COP21]” (Cardoso and Turhan, 2018). This definition is used in the study.

b). Social Impact Assessment deals with "analysing, monitoring, and managing the social consequences of development" (Vanclay 2003, p. 6). The study adopted this definition.

c). Skill development needs in the study are referred to as current and future labour market skill needs as the JET unfolds.

d). Community sustainability refers to the socio-economic impacts of JET on the impacted workers and communities in this study.

e). Environmental sustainability is *"the ability of the biophysical environment to maintain its functioning within natural parameters and cycles over time and to supply environmental goods and services to the economic and social spheres"* (van Weele and Maree 2016, p. 20). The study adopted this definition.

f). Climate change impacts refer to the effects that long-term changes in the climate impose on the biophysical and socioeconomic environment.

1.8. The Structure of the Thesis

The thesis consists of seven (7) chapters, each organised in the typical fashion of a traditional PhD dissertation. **Chapter 1** focuses on putting the research topic into context. The study questions, aims, and objectives are all stated in this chapter. The theoretical concerns and a literature review are presented in **Chapter 2**. This chapter examines the history and role of SIA in large-scale development projects, the skill development needs and community sustainability in a JET context globally, and SIA as an entry point into government policy within the JET policy framework. **Chapter 3** presents the methodology, research design, researchers' positionality, theoretical framework, study sites, reliability, validity, ethical considerations, scope, and limitations. A qualitative research strategy was used to collect data from a selected sample population of mining communities in Mpumalanga, South Africa, as well as from experts in academia, coal mining, and the energy industry, using quantitative techniques (semi-structured interviews and survey questionnaires). **Chapter 4** presents the empirical evidence for sustainability perspectives and skill development issues in the JET context,

the role of SIA in assessing and addressing these social costs, and SIA's potential as a policy entry point within JET policy decision-making. **Chapter 5** focuses on the discussion of the empirical evidence given in **Chapter 4**. **Chapter 6** provides a summary, a conclusion of the research, and suggested recommendations. **Chapter 7** is the reference section, where all materials and authorities used in the study are acknowledged using the accepted referencing system.

CHAPTER 2

Literature Review

2.0. Introduction

This chapter reviews relevant literature on sustainability perspectives and looks at environmental and community sustainability as the transition away from coal to the renewable energy sector unfolds across the global spectrum. It then investigates the skill development needs of developed and developing countries, as well as the skill development needs of South Africa's coal industry as it transitions. It then reviews relevant literature on the history of SIA and its potential as a strategy to assess and address the social impacts of development. It then ends with reviewing literature that ties into the role of SIA as a policy entry point in JET planning. The knowledge gap in the reviewed literature then justifies the study.

2.1. Sustainability Perspectives in a Just Energy Transition

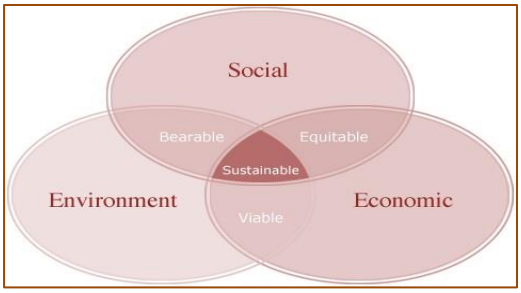
This section focuses on reviewing literature on the environmental sustainability perspectives of coal mining and the renewable energy sector, as well as the community sustainability perspectives centred on green jobs and public participation as the JET unfolds. Gaps in the reviewed literature are identified.

2.1.1. Environmental Sustainability within a Just Energy Transition

Environmental sustainability is a component of sustainable development; hence, it is one of the three interlinked pillars of sustainability. Van Weele and Maree (2016) define environmental sustainability as the capacity of the natural environment to sustain its functioning over time while remaining consistent with natural cycles and parameters and

supplying environmental products and services to the economic and social sectors. This shows the interdependence that exists within this tripartite system. See **Figure 1**.

Figure 1: The nested model of sustainability



Source: (Adapted from DEA, 2012)

Figure 1 shows that there is an absolute dependence of the social and economic pillars on the environmental component. The Department of Environmental Affairs [DEA] (2012) displays four attributes of this nested model of sustainability: equitable, bearable, sustainable, and viable.

According to the Fifth Assessment Report [AR5] and the Intergovernmental Panel on Climate Change [IPCC] (2014), equity is a fundamental component of sustainable development, and mitigation and adaptation can affect its objectives. Additionally, van Weele and Maree (2016) describe the trait of development as bearable by stating that coexisting nations and communities shouldn't unfairly put one another at risk by subjecting people to a degraded environment in the name of development. Sustainability points to the need to sustainably satisfy human needs, preserve and protect the environment, and be economically viable. Viability denotes the best possible interaction between the three pillars in a manner that is manageable.

The literature acknowledges that equality is a key component of sustainable development in a JET and that mitigation and adaptation strategies may have an impact on it. Additionally, it recognises that people should not be harmed by a damaged environment, as has typically been the case in the coal industry. The National Environmental Management Act 107 of 1998 and Section 24 of the South African Constitution both unambiguously demonstrate a prospect for sustainability thinking by highlighting the connections between the issues of poverty, environmental degradation, and quality of life (Republic of South Africa [RSA], 1996). Therefore, to understand the

role SIA could potentially play in JET, it is necessary to take cognisance of some of the challenges in environmental sustainability in the coal sector and the renewable sector as the shift unfolds.

2.1.1.1 Environmental Sustainability in the Coal Sector

According to Green Peace Africa, power plants and businesses using coal and oil are to blame for two-thirds of the anthropogenic sulphur dioxide emission hotspots observed by National Aeronautics and Space Administration (NASA) satellites globally, which is detrimental to environmental sustainability (Vlavinios, 2019). These greenhouse gases are essential for keeping our planet at a temperature where life can exist (British Geological Survey, 2022). However, anthropogenic activities have exacerbated this natural effect to the point that it has become detrimental to life on earth (IPCC, 2014).

The environmental impacts of fossil fuels have contributed to climate change, which has caused snowmelt, heat waves, floods, droughts, and decreasing yields across the globe (Koubi, 2019; Zemp et al., 2019). Several areas of Europe, Asia, and Australia have experienced an unusually high frequency of recent intense heatwaves (Koubi, 2019). The United States and the European Union have boosted their investments in renewable energy sources like solar and wind as a result of these effects (Olivier and Peters, 2018).

The Mediterranean region, North and South America, Southeast Asia, and Africa are all experiencing more severe droughts (Koubi, 2019). While precipitation has decreased in southern Australia and western Asia, the increase in global temperatures is also creating more frequent and heavy downpour events in Europe, North America, and Central America (Koubi, 2019).

With twelve coal-fired power plants, the South African province of Mpumalanga is one of the largest sources of sulphur dioxide emissions in the world (Vlavinios, 2019; Myllyvirta, 2019). According to Dr. Ranajit Sahu (a coal plant expert), most Eskom power stations regularly exceed the air pollution restrictions outlined in their licence. He posits that:

> *Over a 21-month period ending in December 2017, the power utility's coal power plants exceeded their already-weak licence conditions 3,200 times, and this related to all three regulated pollutants for coal plants: sulphur dioxide,*

oxides of nitrogen, and particulate matter, including soot and ash (cited in the Sunday Times, 2019).

The impact of air pollution is most visible in the eastern coal belt region of the Highveld, where there is a high concentration of coal mines and coal-fired power stations (World Bank, 2022). Heavy dependency on coal and related activities also causes water and soil pollution through Acid Mine Drainage, undermining food and water security and the overall health of the ecosystem (World Bank, 2022; McCarthy, 2011). AMD "is caused by pyrite (FeS2) [iron sulphide] (also known as fool's gold) found in underground rock formations reacting with oxygen and water" (Tempelhoff *et al.,* 2014, p. 82). All these environmental impacts affect the sustainability of the affected communities. For example, the SDG targets of ending hunger by 2030 (SDG 2), as well as the goals of eradicating poverty (SDG 1), promoting health and well-being (SDG 3), ensuring access to quality water supply and decent work (SDG 8), combating climate change (SDG 13), preserving aquatic and terrestrial ecosystems (SDG 14), and promoting peace [SDG 16] (Allen *et al.,* 2018; Perez-Escamilla, 2017).

The above literature illustrates the environmental costs of coal mining that impact environmental sustainability and have subsequent social costs. On the other hand, transitioning to the RE sector could potentially reduce these costs, considering the more environmentally friendly and cost-effective technologies used. The environmental sustainability of the RE sector is thus explored in the next section.

2.1.1.2. Environmental Sustainability in the Renewable Energy Sector

This section reviews literature on the environmental sustainability of wind and solar energy as part of the main renewable energy sources that South Africa and Mpumalanga are focused on.

Solar PV's water-saving features make it such that switching from dirty fossil fuels to clean solar energy is equivalent to annually planting about fifty trees (Durrenberger, 2015). The cost of electricity is lower with wet-cooled Concentrated Solar Power (CSP) technologies, which require more water per MWh than conventional technologies (Frisvold and Marquez, 2013). However, according to the U.S. Energy Information Administration (2022), some types of PV cell technologies use hazardous chemicals and heavy metals, and some solar thermal systems use potentially hazardous fluids to transfer the heat, and leaks of these materials could adversely affect the environment.

Notably, the benefits of using solar far outweigh the demerits of using fossil fuels, considering that it's cheaper, cleaner, and renewable, making an ecological case for a JET to renewable energy sources.

On the other hand, using wind turbines to produce energy reduces the release of other toxic by-products of burning fossil fuels, such as particulate matter and sulphur dioxide (UK Local Government Association, 2021). The American Clean Power Annual Report (2021) states that wind energy helps prevent 399 million metric tonnes of carbon dioxide emissions yearly in the U.S. However, wind turbine noise may be an issue, especially in rural areas with low background noise. If placed improperly, wind turbines may have an adverse effect on birds through collision, disturbance, or habitat loss. Wind turbine electromagnetic radiation was a problem in the past; the consequences, however, are minimal and do not endanger the local population's health (UK Local Government, 2021). These issues, however, are trivial compared to the benefits wind energy brings. According to the Eskom Fact Sheet (2021), wind is a clean form of energy without emissions or waste products, and it is a renewable, hence sustainable, energy resource. There is battery technology currently being developed that may in the future allow for the energy to be stored for use when required, for example during peak periods.

The reviewed literature emphasises how the switch to renewable energy has improved environmental sustainability as well as the harm coal causes to the environment. Although the RE sector has some environmental footprints, they are minimal compared to those from coal. However, there are social costs associated with the biophysical impacts, demonstrating the need to take both the social and physical costs into account when making JET policy decisions. If given equal weight in EIAs for JET environmental management, SIA could bring social costs to the forefront (Du Pisani and Sandham, 2006).

2.1.2. Community Sustainability within a Just Energy Transition

To establish the status quo and gaps in knowledge on community sustainability, the section reviews literature on green jobs and public participation, which brings the multifaceted social costs of the JET on communities and workers to the fore.

2.1.2.1 Green Jobs

This section reviews existing scholarship on JET-related green jobs across the globe and establishes gaps in knowledge therein in relation to the study. As JET unfolds in response to climate change mitigation policies, modern technologies, products, and services, as well as infrastructural development, will be ushered in. These will create new job designs in the green economy that will translate into jobs. The ILO (2016) describes green jobs as an essential means of achieving sustainable development and providing decent work for all, helping increase the climate resilience of countries and communities. It further states that green jobs can foster social inclusion and gender equality and contribute to the eradication of poverty if well planned and managed.

Notable is that these green jobs are diverse and may include wind energy technology, health and safety officers, wind turbine electricians, wind turbine mechanics, hydraulics, electro-mechanics, solar technicians, ecotourism, forestry, sales, marketing, etc. (RSC Academy, 2022; ILO, 2016). The ILO (2016) reports that several millions of jobs have already been created in the RE sector internationally in nations with different degrees of development. The International Renewable Energy Agency (IRENA) further predicts that some 25 million new green jobs will be created by 2030 globally, surpassing the 7 million lost due to the pandemic (Power Engineering International [PEI], 2021).

The PEI (2021) states that the number of jobs in the renewable energy sector scaled to 12 million in 2020 from 11.5 million in 2019, globally, despite the pandemic's detrimental effects. Most of the new jobs generated in 2020 were in China and the solar industry. In 2020, China was responsible for 39% of all jobs in the renewables industry, with solar accounting for 2 million of those positions. The hydroelectric sector created 3 million jobs, and the wind energy sector created 1,254 jobs. According to the People's Republic of China (2016), China's transition support comprises derelict mine reclamation and redevelopment, job placement,

reskilling, and unemployment compensation. China's transition approach advocates for public investments focused on green job creation in rehabilitation and conservation of natural resources while prioritising resilience to reduce the risk of relocation of people and businesses (ILO, 2015). This addresses environmental rehabilitation while generating alternative revenues and offering the possibility of ecotourism.

The Jobs and Economic Development Impacts (JEDI) model is used in South Africa to analyse how solar PV and wind technologies would affect the economy and create jobs (Semelane et al., 2018). Studies show that solar power and wind plants have the highest concentration of construction and maintenance jobs (Semelane et al., 2018; Sooriyaarachchi et al., 2015). COBENEFITS (2022) estimates that 43,000 jobs in Solar PV and 28,900 jobs in wind energy could be created in Mpumalanga by 2030. These jobs are, however, transient (IRENA and ILO, 2021), but the skills acquired could allow the workers to be redeployed elsewhere in similar projects.

From the studies done in different countries, it is apparent that there will be an increase in green jobs. The IRENA and ILO (2021) report that the energy transition leads to additional economic activity linked to other pillars of the energy transition, such as efficiency, grid enhancement and flexibility, storage, hydrogen, etcetera. However, some of the employment opportunities will be created outside the JET-impacted areas, which will mean the relocation of the impacted workers, which is another critical social cost. The SIA tool can facilitate an understanding of how to address social costs brought about by social change because of the JET and aim for sustainable outcomes as the low-carbon economy grows (Vanclay, 2002; Vanclay et al., 2015).

Aucamp and Lombard (2018) assert that SIA could facilitate dual communication between project proponents and the impacted communities, helping them comprehend the key concerns regarding proposed development projects and their ramifications. As well as how they can leverage available opportunities.

2.1.2.2. Public Participation in a Just Energy Transition

This section examines existing literature on public participation during JET, highlighting best practises and gaps therein.

In Australia, Port Augusta is a test case for effective public participation, where the community developed a JET strategy for shifting from coal to solar energy (Smith, 2017). The community engaged the local, state, and national governments and got three potential employers from the private sector interested in constructing this renewable alternative. However, the lack of explicit federal targets, policies, and funding for clean energy made the government's lack of interest even worse. SIA could have been used as part of the mainstream public consultation processes to avoid such drawbacks. Vanclay (2005) argues that SIA affords a public participation process that is implicit in communities as well as in the companies and government agencies that initiate planned interventions; it is also one that is fully participatory. Arguing along the same vein are Vanclay and Esteves (2011), who assert that SIA could potentially promote social dialogue between stakeholders, civil society, and government policymakers as the SIA teams work closely with regulatory bodies and grassroots communities. Vanclay (2005) goes on to say that the proposed reform or planned intervention is adjusted until the best balance of development objectives and known negative outcomes is reached. This is done while trying to predict all potential unanticipated consequences, keeping in mind that these consequences cannot always be foreseen.

In China, research by Lingxuan et al. (2012) found that the shift from coal to the renewable energy sector lacks public support due to a lack of public environmental awareness. This places a compromise on procedural justice as the communities that are involved in public participation may not be well informed or knowledgeable about the JET, Climate change, and related impacts and possible solutions. Aucamp and Lombard (2018) argue that SIA practitioners could be enlisted to facilitate collaboration with other professionals and refer pertinent information to the field that is best equipped to handle the problem. For instance, they could work with environmentalists and climate change specialists to provide social learning about environmental awareness and climate change.

In Kenya, communities maintain access rights to privately owned land, but a lack of public participation prevents these rights holders from managing human and biophysical impacts (Lieu, 2019). There was controversy surrounding the exclusion of the Masai communities from an RE project in 2014, when 150 Maasai families were relocated from their homes to make room for the Olkaria IV Geothermal plant and were vehemently

opposed by the neighbourhood (Collins, 2021). According to Collins (2021), the community also alleges that it was not informed of the Geothermal Development Company's (GDC) plans, which is illegal given the government's legal authority to purchase land. The Maasai assert that they were not notified of the plots of land that would be gazetted, the price at which they would be purchased, or the effects on the environment.

All of this indicates a lack of public involvement. While the GDC, the project proponents, assert that they have carried out an environmental impact assessment plan, the landowners are unaware of it and contend that the firm has not engaged in any public participation (Collins, 2021). If these impacted communities in Kenya are involved in decision-making through public participation, it should be an ongoing process, which is not usually the case.

Roping in SIA advocates for an iterative public consultation process, which comes in handy as it ensures continued community engagement throughout the project (Vanclay, 2005). Vanclay (2005) states that the 2003 International Association for Impact Assessments [IAIA] definition of SIA goes on to say that it guarantees an endogenous, ongoing collaborative process that focuses on improving sustainable livelihoods by involving stakeholders and an iterative redesign of the proposed policy. Additionally, the endogenous participatory process used to develop the proposed reform makes sure that the intended intervention is appropriate for the regional institutional, social, and cultural contexts (Vanclay, 2005).

In South Africa, the state in developmental projects such as the JET aligns more with industry than with its citizens, and the lack of time and resources for convening meetings, forum shopping, and lobbying outside of social dialogues impacts public participation (National Planning Commission [NPC], 2019). According to recent research, Eskom is determining, shaping, and influencing the Just Energy Transition pathway for South Africa through important stakeholders in the public and private sectors (Jet Fact Sheet, 2021). As the JET develops, deliberative forums that will include affected communities or members of civil society are crucial. SIA ensures that all stakeholders' opinions have been considered and that the development objectives have been adequately negotiated, as well as any potential negative effects have been taken into account (Vanclay, 2005).

From the Australia, Kenya, China, and South African experiences described above, the absence of political will by the government, the absence of communities in decision-making, and the state protecting industry interests rather than its citizens impede the public participation process in JET. Notably, there are still gaps in the literature on how procedural justice within the JET context would ensure an effective public participation process, which the study on SIA could potentially bridge. According to Aucamp and Lombard (2018), if people's basic needs aren't being met, it's difficult to secure their participation in external procedures like impact assessments, which suggests that their fundamental human rights are being violated. As a result, it is nearly impossible for poor communities and wealthy supporters to engage in dialogue on an equal footing. This makes the implementation of an informed SIA team-led public involvement method justifiable.

Aucamp and Lombard (2018) contend that when determining people's participation, their basic needs are more important than long-term, sustainable benefits. The reviewed literature demonstrates that public participation and green job creation feed into long-term community sustainability as the JET unfolds. Existing studies posit that skills development needs, given the demands of the new green jobs, are also an important consideration in the JET context (Haerer and Pratson, 2015; ILO, 2019).

2.2. The Skill Development Needs of the Labour Force in a Just Energy Transition

This section reviews the literature on the status quo of skill development needs in developed and developing countries in the JET context and the gaps therein. The JET will change the employment design and skill requirements of most jobs and create new job opportunities at the same time (ILO, 2019). As governments around the world respond to JET calls, a lack of skilled workers threatens to slow down the deployment of clean technology (Ferris, 2021).

2.2.1. The Skill Development Needs of the Labour Force in a Just Energy Transition in Developed Countries

The history of JET in developed nations made it possible to identify the gaps in the worldwide literature on skill development.

In Canada, some organisations, such as Canada's Iron and Earth, strive to provide training, road maps, and other resources to the fossil fuel industry (Beedell and Corka, 2021). However, the reskilling worker compensation schemes exclude women and migrants, preventing them from skill upgrades in the RE sector and absorption (Piggot, 2019). SIA could promote the inclusion of gender and underrepresented groups in assessments, which can inform JET decision-making regarding the local community's skill development (IAIA, 2003). In addition to SIA, UN Women and UNIDO (2023) state that gender statistics and de-identified data could be used to do a more thorough analysis of energy value chains. This would provide a framework of needs and impacts that make it harder for underrepresented groups to get access to energy. This demonstrates the need to take historical context into consideration, ensure local communities participate in planning and implementation, and ensure equitable burden and benefit allocations.

In the United States, Haerer and Pratson (2015) found that the fossil fuel industry provided adequate time for skill development needed in renewable energy industries. However, even though jobs in the RE sector were on the rise, they were not in the same place as jobs in fossil fuels. Postma et al. (2017) argue that SIA may bring to light in-situ economic opportunities post-mining through the social construction of technology, enabling the creation of new jobs in the JET-affected areas.

In Spain, Strambo et al. (2019) state that former mineworkers are skilled to take roles in the green economy and that access to entrepreneurship funding has been made accessible to workers leaving the coal industry. Halsey et al. (2019) say that workers' transitions away from coal have relied heavily on financial compensation, like unconditional pay-outs and redundancy packages, especially for younger workers who need to learn new skills to work in other economies.

In summary, existing literature describes concerted skill development efforts, which include retraining, career awareness programmes, reskilling compensation policies, redundancy benefits for younger workers, and entrepreneurial funding. However, there is still a need to address gender inequities that result in discriminatory reskilling and

compensation policies in a JET context. SIA includes a range of specialists in the evaluation process who can provide detailed information on reskilling, including inequalities between men and women, age cohort reskilling needs, and market dynamics (Vanclay, 2003).

2.2.2. The Skill Development Needs of the Labour Force for a Just Energy Transition in Developing Countries

This section looks at how developing countries are dealing with skills shortages as they transition to a low-carbon economy, which can provide lessons for South Africa given the contextual similarities that may exist and the gaps therein that should be identified.

In India, the Skill Council for Green Jobs has partnered with fourteen training institutions to train bankers, entrepreneurs, Distribution Company (DISCOM) officers, rooftop solar developers, and maintenance staff across 17 states (Ward et al., 2021). Large-scale and small-scale entrepreneurs in India interact mutually, with the former assisting the latter in building their capacity, both in terms of infrastructure and expertise, and the smaller ones providing local knowledge to the large-scale ones (ILO, 2019).

In Ghana, the government and businesses have invested heavily in human skills development in the high-carbon economy (ILO, 2019). As a result, as Ghana transitions to the green economy, reskilling fossil fuel workers for absorption in the RE industry should be easy, as they can shift from high-carbon jobs to low-carbon jobs due to overlaps in these jobs. For example, most jobs in oil and gas at least have some degree of similarity with skills in the low-carbon sector (Ferris, 2021). Semelane et al. (2018) state that labour from other high-carbon sectors in South Africa is upskilled and used for either PV or wind technology projects.

The 2015 Ghana's National Employment Policy states that marginalised groups, such as rural women, require the most support against the impacts of the energy shift on skill development (ILO, 2019). The Ghana Power Compact Internship and Mentoring Programme (GPCIMP) assists young women at academic and technical institutions by providing them with internships and mentoring to help them develop practical skills pertinent to the power sector (Trace, 2020). UN Women and UNIDO (2023), which support this growth, state that if a level playing field for access to opportunity and

treatment of women and men is created from the outset, there is significant potential for correcting gender imbalances as the JET and related green economies develop.

Addressing gender equality will bridge wage and skill gaps, improve working conditions, and enhance social protection within the green energy sector. According to Burdge (1994), SIA considers factors like gender and age in its assessments, which can highlight the needs of disadvantaged groups in JET social cost management and reduction.

The growing demand for a broad range of skills, including STEM, and the limitations imposed by poor education and gender disparities in education are noteworthy (ILO, 2019; Semelane et al., 2018). According to the ILO (2016), to maximise the job creation potential of a low-carbon economy, green occupations necessitate revising curricula, effective retraining and skill upgrades of the workforce, and entrepreneurial development. This fosters ecologically friendly workplaces and encourages investment in new green goods and services. SIA recognises the importance of social justice considerations alongside data from feasibility studies on skills, supported by experts from STEM fields, industry, government, and Indigenous people (Lockie et al., 2012; Usher, 2000).

Notable is that the above studies acknowledge the need for new skill development through updating and adapting the curricula to cater for the reskilling of workers fit for purpose in the RE sector. The importance of collaboration between the fossil fuel industry, the RE sector, and educational institutions is deemed necessary. However, developing ad establishing relevant accreditation and certification schemes should be emphasised. The studies acknowledge policy inadequacies in training and reskilling that require intensifying the reskilling of marginalised groups like rural women and migrants, which are common challenges across developed and less developed countries. A notable knowledge gap is the absence of up-to-date social profiles of impacted workers along the coal value chain, as well as a fully-fledged skill needs assessment of the affected areas.

2.2.3. The Skill Development Needs of the Labour Force in a Just Energy Transition in South Africa

This section reviews existing scholarship on the status quo in skill development in South Africa's energy transition from coal to the RE sector.

According to Arthur (2022), the skills required for a JET have three dimensions. Firstly, structural changes will cause demand for some competencies to increase while decreasing demand for others. Secondly, changes in business and existing skills under the energy transition will require training for absorption in new industries in the RE sector. Thirdly, the advent of alternative economies would require new skills, qualifications, and training frameworks.

The education, technical, and vocational education and training systems in South Africa do not yet provide people with the necessary skills to function in a low-carbon economy (World Bank, 2022). The educational system, the government, and the private sector should urgently address this gap in skills development. Through its multi-stakeholder collaborations with academia, government, and regulatory agencies, as well as with civil society, SIA could offer places to talk about how well the current education system can meet the expected rise in demand for skills related to the low-carbon economy.

A current list of professions and categories is necessary for South Africa to support the development of vocational training and should be given top priority in South Africa's critical skills list and attended to through a pro-expatriate skilled labour visa regulation system (World Bank, 2022). Moreover, Overy (2018) argues that unions should demand that the government commit to passing enabling legislation that would guarantee that employees who lose their jobs due to a JET receive the training necessary to work in the RE sector. Gueye (2018) argues that failure to reequip the local labour force can retard project efficiencies, increase overhead costs, and lead to substandard installations.

According to COBENEFITS (2019, p. 23),

> *A portion of the workforce in Mpumalanga's coal mines will be approaching retirement age by 2040, when the bulk of coal-fired power plants will be*

reaching the end of their assumed technical lifespan and the associated mines will be decommissioned.

These will require compensation packages, while the younger ones need retraining. According to ILO (2016), the International Training Centre (ITC), ILO, and the Green Fund of South Africa collaborated to undergo a two-year training course and instruction and learning advisory programme to equip 160 local and national stakeholders with knowledge and resources. This assisted them to analyse the potential for green job creation, develop and put into practise encouraging policies and strategies, talk about investment and technology choices, and track and evaluate the development of the green economy's job creation sector. The ITC-ILO Green Jobs Learning Cluster has been expanded to include more industry-specific courses on renewable energy, sustainable building, and gender equality in green job promotion (ILO, 2016).

According to a study by Ward et al. (2020), Eskom is developing its skills hub at the Sere Wind Farm in the Western Cape in South Africa. The Sere Wind Farm is located on the Atlantic coast, near the towns of Koekenaap, Lutzville, and Vredendal (Eskom Fact Sheet, 2021). Grants and scholarships are provided to selected college students within the Western Cape, and Eskom delivers the training, skills, and knowledge necessary to maintain and manage a wind farm. Following on-the-job training, local employees have taken over the upkeep and management of the Sere wind farm.

Forlano (2020) draws attention to the South African project located in the Northern Cape, the Xina Solar One's skills development initiative, which focuses on the continuity created between early childhood development, after-school care, the standard of primary education, and post-school education opportunities, including on the-job training. Young interns can gain knowledge while working on one of the Concentrated Solar Power (CSP) projects attributable to the international Company Abengoa, which applies innovative technology solutions for sustainability in the infrastructure, energy, and water sectors.

Many solar-related jobs are anticipated to be created in Mpumalanga; therefore, skills for rooftop solar developers and technicians, among other RE-related skills, will be necessary (Bulbulia, 2022). According to Semelane et al. (2018), Technical Vocational Education and Training (TVET) institutes and universities could facilitate skills transfer to help coal sector workers get retrained for employment in the RE sector. According to

their research, the Mineral Council team participates in skill development at all levels, from adult education and training to training for all levels of mining companies' employees.

Existing studies show that the diversity of skills required in South Africa in the green economy has been recognised, and investments in reskilling programmes have begun (Forlano, 2020; Trace, 2020; Ward et al., 2020; ILO, 2016). However, studies show that skill development programmes were not designed with the JET framework in mind, are more focused on project-level responsibilities than national-level responsibilities and are still in their infancy phase (World Bank, 2022; Trace, 2020). The lack of JET policies and programmes on strong financial investments to identify significant gaps between the human and financial resources and those available to fulfil new climate-related obligations and seek creative methods to close those gaps is another apparent deficiency (World Bank, 2022).

SIA teams, through their work with regulatory bodies, the private sector, labour organisations, academia, and civil society, may be able to mobilise support from a broad coalition of stakeholders to bring overlooked issues of skill development to a national level through the information contained in their reports.

2.3. The History of Social Impact Assessment and its Role in Assessing and Addressing the Social Impacts of Development

This section examines the literature on the history of SIA and its role in addressing the social impacts of development. SIA is a component of development that has evolved over time from the necessity of including active citizenship in development efforts (Ross, 1992). SIA encompasses the assessment of all human influences as well as how people and communities engage with their socio-cultural, economic, and biophysical settings (Vanclay, 2002).

Thus, environmental, and human well-being are fundamental prerequisites for ensuring sustainability. SIA dates to the implementation of the National Environmental Policy Act (NEPA) legislation in the United States in 1970, when it became a component of EIA (Burdge and Vanclay, 1996). The focus of EIA is on the biophysical environment, while

the focus of SIA is on the social implications of development (Dendena and Corsi, 2015). In line with the 1998 South Africa report, SIA is fully incorporated into EIA in terms of the definition of the environment in the National Environmental Management Act (NEMA), where the environment includes people (Kruger and Sandham, 2018).

Existing studies in JET scholarship are more focused on carbon emission reduction to combat climate change, and little if any attention is given to the social cost despite the socio-economic nature of the JET (Glynn et al., 2020; Sovacool et al., 2018). The World Bank (2022) points out that the JET in South Africa is taking place in an unequal society with high poverty rates and exclusion in terms of race and gender, which would exacerbate existing social tensions. It further states that between 150,000 and 200,000 jobs, or roughly 18 percent of the employed provincial labour force in Mpumalanga, could be under threat, and this will affect community sustainability. Therefore, community sustainability issues associated with job losses, exclusion of communities, and skills needs development issues, as well as other social change-imposed impacts as the JET unfolds, will be realised, and these have not been robustly dealt with in energy studies (Strambo, 2019; Glynn et al., 2020; Sovacool et al., 2018).

On the other hand, as the JET ushers in a new low-carbon economy, the existing skill repertoire of workers exiting the fossil fuel industry will need to be upgraded, while others will need complete retraining (ILO, 2019). Substantiating the need for skill upgrades is the World Bank (2022), which states that job losses are expected in sectors with large

proportions of unskilled or low-skilled employees, mostly in Mpumalanga, where there is the highest concentration of coal mines.

A strong social mitigation strategy that SIA can provide should support assessing and mitigating the social effects of the move away from coal in Mpumalanga as a top priority. SIA is participatory, and it helps impacted communities, stakeholders, and regulatory agencies understand and adapt to the socioeconomic implications of change (Vanclay 2002; Vanclay 2003; Howitt, 2011; Vanclay and Esteves, 2011). Aucamp and Lombard (2018) express that the SIA process assists with multistakeholder engagements, which may create conducive platforms for regulatory agents to help with community concerns on developmental issues.

The government recently adopted the Just Transition Framework (JTF), which prioritises people in the JET and is founded on the idea that measures for mitigating climate change benefit from inclusive development (Presidential Climate Commission, 2022). SIA, with its grassroots-level engagements with communities and multistakeholder collaborations, can provide relevant input on the real concerns people have as the transition unfolds and could inform the JTF. Notable at the heart of SIA is the need to improve the lives of society's most vulnerable and disadvantaged members through developmental initiatives (Vanclay, 2003). SIA is central to the need to meet the Sustainable Development Goals (SDGs), which integrate environmental policies, development initiatives, and social issues (United Nations General Assembly, 1987). The focus on social costs could position SIA as a viable strategy for assessing and addressing the social costs of development programmes and could possibly be an entry point into JET policies.

2.4. Social Impact Assessment as an Entry Point in a Just Energy Transition Policy Context

This section examines the literature on SIA as a possible entry point into JET policy decision-making, with an emphasis on JET skill development and community sustainability issues as the JET evolves.

Notably, in the JET context, climate mitigation policies are focused on the biophysical impacts of burning coal and limiting carbon emissions (Burton et al., 2019; Glynn et al., 2020). South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and the Carbon Tax, which went into effect in 2019 and aims to reduce carbon emissions; the National Climate Change Response White Paper (NCCRWP), which sets a standard for reducing carbon emissions; and the Integrated Resource Plan (IRP) for the electricity sector, which includes an emissions constraint and is the basis for the state's procurement of renewable energy investment" (Burton et al., 2019, p. 10).

The above statements show that climate change JET policies are geared towards reducing carbon emissions. They do not go far enough in addressing the social costs of the energy transition (Glynn et al., 2020). This necessitates a social impact mitigation

strategy that SIA can provide for policy decision-making. Studies show that SIA exhibits a deep comprehension of the social costs brought by developmental projects through a collaborative approach involving affected stakeholders, which improves their comprehension of how change occurs and how to react to it (Howitt, 2011; Vanclay, 2002; Vanclay, 2003; Vanclay and Esteves, 2011).

South Africa is lagging in terms of investments in training and skills development, which are required in the low-carbon economy, as it is continuing with its current labour-intensive model of energy production (Trace, 2020). Adopting policies that promote financial investments in curriculum redesign to reflect the new low-carbon sectors being formed and that embrace climate-based education and learning is a crucial component of this (Work Bank, 2022; SLYCAN Trust, 2021). SIA could suggest funding for infrastructure development, networking capacity, linked skill development programmes, and a rethinking of curriculum design through the contributions of the energy and mining sectors and educational institutions to policymakers as part of social impact mitigation (Aucamp and Lombard, 2018; Vanclay, 2003).

The ILO and IRENA (2021) state that the JET will mostly affect male-dominated, medium-skill occupations, which will perpetuate existing occupational gender disparities in the energy sector. It further states that women will occupy only a small portion of the jobs created unless they are trained for relevant skills so that they can be absorbed into the new green jobs. Piggot (2019) argues along the same vein, stating that women are still side-lined in skills development and employment in the RE sector. Studies demonstrate that SIA takes gender concerns into account in all assessments, improves the status of females and other socially disadvantaged individuals, and helps these groups grow their competence (Vanclay, 2002; Vanclay et al., 2015).

To create a workforce that reflects society, it is also necessary to promote gender parity, provide suitable opportunities for youth, and increase the involvement of minorities and marginalised groups (ILO and IRENA, 2021). In Mpumalanga, most current coal workers will have reached retirement age by the time coal mines close beyond 2030 (COBENEFITS, 2019); hence, these older groups need to be financially compensated and prepared for life after retirement. This also includes all other workers in different age groups who will be affected by retrenchments as the JET unfolds. Age considerations are included in all SIA evaluations; for example, older workers' future aspirations and the

future of their children may be left hanging in development projects (Vanclay, 2002; 2003), and while these may appear trivial, they must be considered in policy decisions if the JET is to be just and inclusive.

In South Africa, there is a general lack of local context-specific policies and regulations that are consistent, equitable, effective, inclusive of all stakeholders, and that provide social protection for affected employees and communities (World Bank, 2022; SLYCAN Trust, 2021). The larger social protection and health systems in South Africa do not adequately incorporate climate adaptation measures to protect human health and vulnerable livelihoods in the face of intensifying climate shocks, despite the existence of social protection policies like the Social Assistance Act that use the Social Relief of Distress (SRD) grant in response to natural disasters (World Bank, 2022). By profiling communities in accordance with their varied needs, the SIA technique makes it easier to administer policies, programmes, plans, and projects adaptively (Vanclay and Esteves, 2011; United Nations Development Programme [UNDP], 2011).

To address inequality and racial and spatial exclusion among the underprivileged and marginalised groups, South Africa must balance development and climate goals as the JET develops (World Bank, 2022). Existing social, political, and economic unrest, as well as violations of human rights, would be made worse by an unjust climate transition. Social security programmes for JETs should be egalitarian, inclusive, and able to adapt to the long-term effects of climate change and shifting economic situations to prevent human rights violations. The coexistence of SIAs and HRIAs serves as a reminder of the state's obligation to stop abuses of human rights committed by companies and other outside parties (Ruggie, 2008). According to Esteves et al. (2012), the growing acceptance of the idea of Free, Prior, and Informed Consent (FPIC) has brought human rights issues to the forefront of the SIA process. According to these principles, SIA practitioners have a legitimate mandate to influence policy so that it considers socio-economic and cultural aspects of a development programme like JET (Esteves et al., 2012).

Furthermore, SIA recognises the need to improve planning for social and physical infrastructure as part of business benefits to assess and manage the social impacts of impacted stakeholders (Vanclay and Esteves, 2011). This can influence rural-urban planning policies within the JET context in terms of infrastructural development,

leveraging existing post-mining infrastructure to reequip the low-carbon economy. SIA professionals collaborate with regulatory bodies to provide information for the project's continuous regulation and development approval process (Vanclay and Esteves, 2011). The reviewed scholarship in this section on SIA demonstrates that it can influence socially oriented policies within the JET policy environment.

2.5. Research Knowledge Gaps and Study Relevance

The energy shift from a high-carbon economy to the renewable energy sector is seen as a viable climate change mitigation strategy. Considering this focus, JET studies tend to focus more on emissions reduction, overlooking the socio-economic impacts of JET (Burton et al., 2019; Glynn et al., 2020). Moreover, studies on JET have focused on the macro-level scale and not the micro-level scale (Strambo, 2019). Thus, the focus has been on the developed world, like Australia, Germany, China, Spain, the United States, Poland, etcetera, and studies on the developing world are lagging (Sanz-Hernandeza, 2020).

In South Africa, the Mpumalanga mining belt is set aside as a Renewable Energy Zone (Munnik, 2019). However, a gap still exists in research on assessing mitigation options for impacted workers and communities as the JET unfolds. South Africa’s coal industry exhibits gender disparities, which could encroach on the new economy post-coal mining (COBENEFITS, 2022). According to COBENEFITS (2022), women are underrepresented in South Africa's RE sector, with females making up only 14% of the workforce, which supports this viewpoint. It is crucial to conduct a thorough study on the gender gap in reskilling and hiring practises. If included in mainstream energy transition impact analyses that inform JET decision-making, SIA could facilitate consideration of gender concerns (Vanclay, 2002; 2003; Vanclay et al., 2015).

There is emerging research on affordability, quality of access, solar e-waste, and other RE-related issues that speak to community sustainability issues (Samarakoon, 2021). According to Sovacool (2014), these socio-economic problems require more human-centred methods and interdisciplinary collaborations that go beyond the scientific and quantitative frameworks that often dominate energy studies. The studies done on the

JET in South Africa's coal mining sector have alluded to the social cost of the energy shift (Munnik, 2019; Daniel, 2020; ILO, 2019). However, they have not looked at the possible role SIA could play as a mitigation strategy within the JET context.

According to Rose and McGee (2006), the interdisciplinary approach of SIA, which attracts a wide range of practitioners such as psychologists, planners, anthropologists, and human geographers, to name a few, could fill the social cost gap in the JET literature given the socio-economic character of energy demand.

JET in South Africa, just like in countries such as China and Kenya, does not facilitate active citizen participation for affected workers and communities, thereby affecting social dialogue and contributing to the exclusion of impacted stakeholders' voices in policy decision-making (Lingxuan et al., 2012; Casey, 2020; National Planning Commission [NPC], 2019). In order to reach a negotiated agreement with a developer based on free, prior, and informed consent, SIAs create participatory processes and democratic spaces to facilitate community discussions about envisioned futures, the acceptability of likely impacts and proposed benefits, and community input into the SIA process. As a result, they can promote policies that take stakeholders' interests into account and show a strong sense of justice for affected workers and communities.

Therefore, a mix of policy tools for a just transition must address skill development related to technological deconstruction or replacement by others but also meet all actors' concerns from a social standpoint (Sanz-Hernandez, 2020). The research contributes to the discussion of social costs, which is currently in its early stages in JET studies.

2.6. Conclusion

The reviewed literature demonstrates numerous social costs associated with community sustainability and skill development within a JET context. However, it shows that JET-related climate change mitigation policies are geared towards reducing carbon emissions and do not go far enough in addressing the social costs of the energy transition. A deeper understanding of the social impacts—their nature, extent, and intensity—as well as how they develop and how to respond to them, as well as the

relationship between the JET's biophysical and social impacts, according to reviewed studies, is facilitated by SIA.

The reviewed literature shows an improvement in environmental sustainability as the transition from coal to the low-carbon sector progresses, which results in improved water and air quality and, hence, community health. However, there will be impacts ranging from issues of a lack of appropriate solar PV material disposal or recycling after the useful life of the solar PV and harmful emissions during the manufacture of the solar PV films to habitat disruption and noise pollution through wind turbines. Nevertheless, it is asserted that these adverse effects are negligible in comparison to coal's negative impacts. Loss of work, gender inequalities in hiring that favour men over women, different impacts on different age groups as the JET develops, and the transitory nature of construction jobs are just a few of the social costs of community sustainability, hence requiring a social mitigation strategy. The reviewed literature posits that age and gender considerations are included in all SIA evaluations, and it advocates for social protection for impacted workers and communities who lose their jobs. There is also a lack of public participation, which subsequently leads to cultural disruption. SIA incorporates socio-cultural and economic considerations of the developmental project as well as promotes community social dialogue about the anticipated impacts of the project. On the other hand, the social costs of skills development include gender disparities in the reskilling of workers in favour of men, a shortage of skills in the STEM fields linked to an inadequate education system, and the recruitment of expatriate expertise in the STEM fields, preventing skills transfer among the locals. Through the involvement of the energy, mining, and educational sectors, SIA might promote financial investments for JET-related skill development projects and a restructuring of the school curriculum. Moreover, SIA could facilitate the development of socially oriented policies, which are currently lacking in existing JET studies and policies due to their biophysical bias on climate change mitigation.

CHAPTER 3

Methodology

3.0. Introduction

The research methodology is presented in this chapter. Crotty (1998) defines methodology as a research strategy that determines the selection and application of specific research methodologies in a study. It outlines the theoretical ideology underpinning the research and the techniques therein. The theoretical framework, the researcher's positionality, the research design, consisting of the study site, the target population, the sampling procedure, the data instrumentation, the data analysis, ethical considerations, the research's reliability and validity, the limitations, and a conclusion, are presented.

3.1. Theoretical Framework: The Theory of Change

According to Stein and Valters (2012), the Theory of Change emerged in 1990 as a tool to improve evaluation methods in the United States. It has been referred to as an *"evaluator"* due to the extensive work on evaluating and monitoring programmes. This makes it compatible with SIAs that are focused on assessing and addressing the social impacts of developmental programmes (Esteves *et al.,* 2012).

The Theory of Change (ToC) explains the internal operational dynamics of an initiative (Weiss, 1995). Implicit in the definition is that it demands that the ways through which the outcomes of the initiative are to be established are made clear.

James (2011, p. 27) articulates the following about the Theory of Change:

> *The Theory of Change is an iterative process that tracks change and its effects on individuals or groups in a specific context. It identifies a developmental project within a wider analysis of how change takes place and taps into external learning about development, expressing our understanding of change while simultaneously giving us an impetus to further interrogate the process.*

The Theory of Change's emphasis on the change drivers within the context of a project meshes well with SIA's identification of project impacts, which guides the researcher in unravelling key focus areas from the key research questions.

Connell and Kubisch (1998) assert that the Theory of Change emphasises the significance of understanding an initiative's how and why throughout the programme in addition to its outcomes. The study's questions helped establish how and why community sustainability and skill development would be affected as the JET unfolded, as well as the implications of this.

Interrogation of the causes and effects further enables the development of trustworthy knowledge about what functions in what situations. The United Nations Development Group (n.d.) documents that the Theory of Change affords learning within and between programme cycles. This, however, necessitates the active participation of impacted communities; thus, the research questions inquire to what extent communities engage in public participation in energy projects. Public participation is at the heart of SIA, alongside multistakeholder collaborations that support SIA's social learning approach. SIA's social learning includes capacity-building, community mobilising, awareness-building, and democratisation [a strategy by which individuals are given more power to influence political decisions] (Esteves *et al.,* 2012; Stachowiack, 2013; Vanclay, 2002). Reed *et al.* (2010) confirm that social learning spreads within communities or groups through interpersonal interactions and allows stakeholders to participate in critical adaptation decisions.

Furthermore, Vogel (2012) asserts that establishing a theory of change requires a team effort that demands the involvement of people with local knowledge and considers the different perceptions the stakeholders have of the change process. This is like SIA's grassroots initiatives, which are in line with Alinsky Saul's 1971 Grassroots Theory of Change. The Grassroots Theory of Change articulates that change is made through collective action by communities regarding a problem or problems affecting their lives (Stachowiack, 2013).

The study participants were made up of two groups: community members and experts who were to be impacted by the energy shift. The community group was made up of

local people and coal workers from the two study sites, Kriel and Carolina, in Mpumalanga, South Africa. The expert group was made up of academics, coal and renewable energy industry experts, and national and local government officials.

Questions based on the Theory of Change and SIA allow for a more in-depth examination of the hows and whys throughout the JET. The study's key questions elicited information on the problems that will arise and the opportunities from the existing status quo in the coal industry and the new low-carbon economy as the energy shift unfolds. The critical role that SIA as social management tools could play in assessing and mitigating these effects, as well as providing an entry point for JET policy decisions, was also one of the key questions.

This positions SIA as a potential strategic planning tool for identifying current needs and opportunities that are consistent with the Theory of Change's strategic planning (Rogers, 2014). SIA's strategic planning speaks to the "Policy Windows Theory of Change" by John Kingdon, which involves launching in-depth investigations of problems and providing constituent feedback as one application technique for advocacy (Coffman, 2007). The JET context takes into consideration the problem's characteristics, status, level of awareness, and whether it is perceived to be solvable with reasonable alternatives (Stachowiak, 2013).

Collecting the right data by asking the correct questions is important. The Theory of Change, just like SIA, facilitates the identification of the kind of data to be collected. For example, IDPs, the 2016 community survey, and the 2011 Census were used to collect statistical data on the demography and social profiles of communities in the different local municipalities housing the two study sites. Semi-structured, in-depth interviews and survey questionnaires also provided qualitative and quantitative data on the SIA and the JET. Existing articles on SIA and JET reports provided information on the current situation in the energy transition space as well as changes to date. The Theory of Change guides how data collected during impact evaluation is analysed, thus providing a framework for reporting (Rogers, 2014).

The Theory of Change tracks the change process right from conception to its climax, and this complements the SIA process. The final phase of transition that involves replacing the old methods of thinking and operating is known as the "freezing stage" in

Lewin's Theory of Change Model, where people start to feel more at ease with this new situation, bringing permanence to the new situation. In this case, as the JET progresses, people should understand the social change process to embrace it (Burnes, 2020). Aucamp and Lombard (2018) state that SIA facilitates a better understanding of the social change process.

Despite most of its positive approaches to change, the Theory of Change usually ignores the external environment and only internally concentrates on the goals of the organisation rather than how potential external factors can affect those goals (Forti, 2012). However, when used in conjunction with the SIA tool, this gap of overlooking external factors is bridged through SIA's grassroots and multistakeholder collaborations, which bring both internal and external factors to the fore during assessments.

In conclusion, the Theory of Change is the best theoretical framework for the investigation because it complements SIA. The Theory of Change facilitates collective thinking, resulting in a comprehensive decision-making process best suited to achieving the desired change. It also directs focus on historical and present evidence alongside predictions and social learning. It enables a more agile strategy and supports continuous learning throughout the project's life. Given these attributes, the Theory of Change is also compatible with the qualitative research methodology that includes quantitative techniques and, in turn, is compatible with the researcher's positionality in the study.

3.2. The Researcher's Positionality

This section presents the positionality of the researcher within the study. The researcher established her position at the genesis of the research. The researcher assumed only two positions from the following four classifications (Banks, 1998; Dwyer & Buckle, 2009; Subedi, 2007).

i). An Indigenous insider: despite not being from the area, the person is a full-fledged member of the community and a researcher with some cultural literacy.

ii). An Indigenous outsider is a member of the community who migrated to and integrated into a foreign cultural setting.

iii). An External or adopted insider is someone who has been assimilated into the community under study from an outside community.

iv). An external outsider is a person from a different community who is not familiar with the norms or culture of the community being studied.

The researcher's positionality was better placed as an adopted insider (iii). Since she has been living in the country for over ten years, she is well conversant with some of the languages and cultures. Moreover, she has been doing ethnographic research in Mpumalanga for the past 4 years and is familiar with the people, their way of life, and some of the socio-economic challenges therein.

Considering the researcher's positionality, the study applied relativist and interpretivist ontological and epistemological philosophical positions. Relativism is a philosophical position that contends that reality is subjective, and that different people view it in different ways (Guba and Lincoln, 1994). Thus, apart from assuming insider positionality, the researcher perceived the lived reality differently from the locals during the study. Asserting this is Crotty (1998, p. 43), who says that:

> *"According to relativism, reality "emerges when consciousness engages with objects that are already laden with meaning."*

Thus, the way our senses process things or perceive reality is also a function of how we have been nurtured or socialised. She perceived the reality within the JET context as slightly different from the impacted communities because she was an academic and an international student with influences from academia and her home country. Hence, her relativist philosophical positionality is supported by her adopted or external insider positioning.

Alongside the relativist positionality is the interpretivist positionality, which Scotland (2012) defines as a philosophical positionality that is subjective and based on real-world phenomena. The interpretive approach has its philosophical basis in phenomenology. Phenomenology involves our lived experiences, embodied in the passive experiences of sensory perception, imagination, emotion, thought, and action (Mastin, 2009). The researcher observed and engaged with certain things in the study areas but never experienced them first-hand. For instance, the researcher could identify with some of the lived experiences of communities in that setting in terms of their existing plights

emanating from coal mining and the anticipated impacts of the energy transition, linked to her short ethnographic experiences in the area during fieldwork research.

The relativist ontological positioning afforded the researcher the ability to engage, interrogate, discover, and gain a greater comprehension of the issue under study and the chosen theoretical framework. The impacted communities are aware of the social costs associated with the drastic transition from the current, highly carbonised production system. It is argued that the world does not exist apart from our understanding of it (Grix, 2004). As a result, studies contend that how people interact with one another and with broader social and economic structures affects how they perceive and experience the world (Bogdan & Biklen, 1992; Merriam, 1988).

The researcher assumed that the issue of a JET in Mpumalanga was a subjective reality that warranted investigation and discovery through engagement with different stakeholders, existing literature, and statistics. The networks the researcher has built with community leaders, the Inkomati Usuthu Catchment Management Agency (IUCMA), and other stakeholders have afforded her the ability to be trusted and to be regarded as an insider. This enabled her to get the true and uncensored sentiments that communities and other stakeholders had on the issue of the energy transition away from coal to the RE sector.

Qualitative methods such as in-depth, semi-structured interviews and survey questionnaires were used alongside a desk study to gather research data. The study had research questions that could be answered through the chosen methods. The study participants' perceptions of the energy transition, how it will affect their livelihoods, how vulnerable they are to the energy transition, and the role SIA could play to mitigate the impacts were examined. Therefore, it included open-ended questions in the survey questionnaires and interviews with relevant stakeholders. The use of secondary data allowed for an improved comprehension of the two communities' socioeconomic profiles and the potential impacts of the coal energy transition on them.

This made interpretivism a relevant philosophical position that the researcher assumed. The research was highly inductive, and it enabled the researcher to look at the problem in retrospect. The only drawback to this kind of philosophical positioning is when the researcher attempts to interpret the given narratives in such a way that it distorts the

truth (Cresswell, 2003). In this case, the researcher gave the narratives as they were given during interviews without letting her worldview or past experiences in the study area influence her interpretations of the phenomena under study.

3.3. Research Design

The research design provides the framework for the steps and techniques that are essential to achieving the research's objectives (Babbie and Mouton, 2007). In this study, qualitative and quantitative research were adopted. Information from participants on the impacts of the energy transition was gleaned through semi-structured interviews and survey questionnaires. Skill development needs and sustainability perspectives within the JET context were explored. The role of SIA as a strategy for assessing and addressing the social costs of JET and its potential as a policy entry point within the JET context were examined. This was gathered from experts working in the coal industry, renewable energy sector, academia, and SIA practitioners, as well as from community participants who live and work in the Kriel and Carolina mining communities, which were the study sites, as described in **Section 3.3.1.**

Online questionnaires and interviews with experts, as well as physically administered questionnaires and interviews with community members, provided quantitative and qualitative data. A desk study of the local municipality's IDPs, the Census (2011), and the Community Survey (2016) statistical reports, as aforesaid, were also used to provide quantitative data that supplemented the qualitative data. Photographs were used to capture information on various aspects of the biophysical and social environment that could be impacted as the energy transition unfolds.

The ethics clearance had to be obtained before data collection could commence. All the participants were over the age of 18 and depending on the data collection tool and the participants' preferences, their consent to participate was either verbal or written. The questionnaires and the semi-structured interview process were explained to the participants to ensure maximum comprehension. The questionnaires were written in isiZulu and English, and the interviews, likewise, were done in either isiZulu or English, depending on the participant's level of comfort with the use of a particular language. Zulu

questionnaires were used instead of Swati, which is the main language used. This is because the researcher is more conversant with Zulu and personally translated her questionnaires and interview schedules, given the academic isiZulu that Google Translate gives and is beyond the comprehension of the locals. Similarly, if SiSwati, which is the first dominant language, was used and translated through Google Translate, the meaning could have been lost through translation, as the researcher was not going to be able to directly translate English to written SiSwati. However, the researcher has been doing research in the area for the past 4 years and has used Zulu questionnaires and interview schedules with great ease and success in Mpumalanga, given that the dominant languages SiSwati, IsiZulu, and Xhosa all fall under the Nguni languages and are closely related.

Qualitative research helps to provide a framework for the analysis of existing empirical research from public data repositories, making data collection cost-effective and timesaving for the researcher (Bryman and Bell, 2003; Bowen, 2009). It also allows for comparison between the existing empirical data from existing research and the empirical data from the current study that tracks change over time, making it compatible with the Theory of Change. This method, which combines quantitative and qualitative data, gave credible and valid results that were based on the participants, existing literature, and statistics without any other biases, making it more likely that the results could be used in other contexts or mining communities (Bode, 2013). The two study sites are described in the next section.

3.3.1. Study Sites

The chapter provides a description of the social profile and the spatial analysis of the study areas. Both Kriel and Carolina are in the Mpumalanga Province, which is South Africa's coal mining belt, but they are in different districts and local municipalities.

Carolina

Carolina Town is situated in the Chief Albert Luthuli Local Municipality, in the Mpumalanga Province of South Africa, on the eastern escarpment (Chief Albert Luthuli Final IDP, 2020–2021). It is housed under the Gert Sibande District Municipality. It is

situated on the main arterial road from Johannesburg to eSwatini, which is linked to N12, N4, R33, and N17 [Chief Albert Luthuli IDP, 2020/2021] (in the Chief Albert Luthuli Municipality, n.d.). Carolina has a total area of 14.6 square kilometres and an estimated population of 16846 (Chief Albert Luthuli's Final IDP, 2020–2021). According to the Global Historical Weather and Climate Data—Carolina (2022b), Carolina has a dry winter climate and a sub-tropical highland climate (classification: Cwb). The district's average annual temperature is 0.57% higher than South Africa's average, at 21.79 °C (71.22 °F), and it experiences 117.15 rainy days (32.1%) each year and receives about 69.95 millimetres (2.75 inches) of precipitation.

The socio-economic analysis from StatsSA (2011) indicates that Carolina had an estimated population of 16,846 people. According to the Chief Albert Luthuli Final IDP (2020/2021), the overall unemployment rate within the local municipality of Chief Albert Luthuli is estimated at 36.4%; youth unemployment is also soaring high at 45%, fuelled on the one hand by a shortage of economic prospects and a lack of jobs and on the other by a lack of skills needed by the labour market (Chief Albert Luthuli Municipality, n.d.). The proportion of people in low-skilled employment was estimated at 44%, and the poverty rate, which is the minimum monthly income necessary to support households with incomes below the poverty line, was projected to be 51.7% (Chief Albert Luthuli, Final IDP, 2020–2021). The socio-economic analysis thus depicts a struggling economy with a youthful population marked by high unemployment, low skill development, and high poverty rates.

Carolina is an area of mixed farming: cattle grazing, crop production, smallholder dams, and small-scale coal mining (Chief Albert Luthuli, Draft Integrated Development Plan, 2023–24). Some coal mines operating within the Carolina study area include Msobo Coal, Tselentis, and Verkeerdepan, to name a few, and some coal mines have already closed while others are facing imminent closure (Hallowes and Munnik, 2016). Carolina is affected by acid mine drainage, which is produced from pyrites, or fool's gold, composed of iron sulphates present in the rocks surrounding the coal seam and sometimes in the coal itself (Hallowes and Munnik, 2016). The AMD presents threats to land and water resources, with subsequent impacts on community well-being.

Kriel

Kriel Town is located about 12 km from the Kriel Colliery, with Thubelihle Township 19 km away, and is the second study site (Kriel Social Labour Plan, 2014–2018). It falls under the Emalahleni Local District Municipality, which falls under the authority of the Nkangala District Municipality in the Mpumalanga Province in South Africa (Kriel Colliery Social and Labour Plan, 2014–2018). See Figure 2 below.

With an average height of 1540 m and several streams and wetlands running through it, the Kriel region is primarily gently sloping. Sandstones, siltstones, gritstones, and mudstones are interbedded in the lithology, and there are a few dolerite intrusions and minor faults (SRK Consulting Scoping Report, 2012). According to the Global Historical Weather and Climate Data-Kriel (2022a), Kriel has a moderate tropical highland climate with a dry winter (classification: Cwb), with the district's average annual temperature at 1.05% higher than South Africa's average, at 22.27 °C (72.09 °F), and it experiences 119.75 wet days (32.81% of the time) with an average yearly precipitation of 71.51 millimetres (2.82 inches).

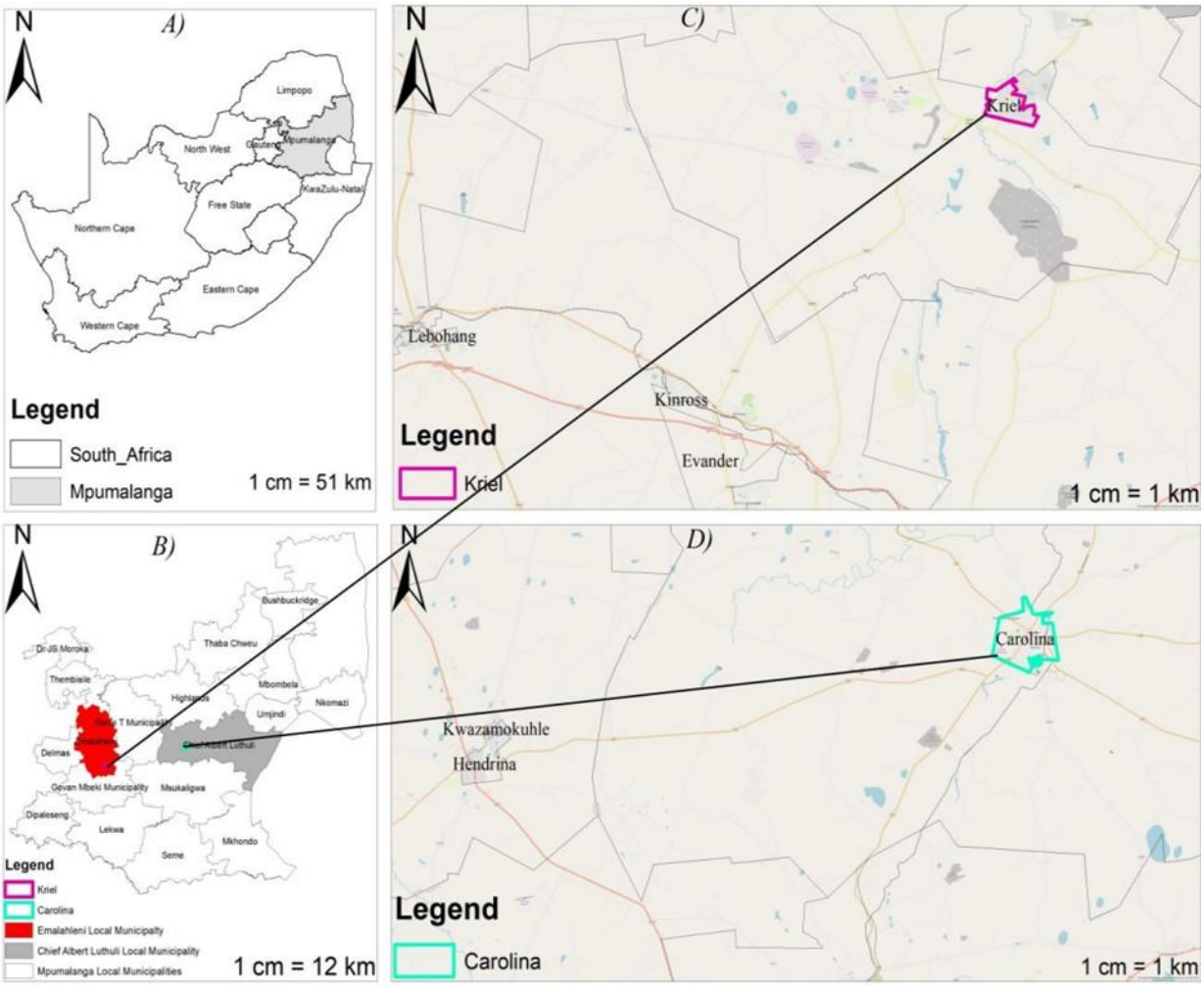
The Kriel (2014–2018) SLP projected Kriel's population to be 15,237 as of 2011, with fewer than 86.1% of all households earning less than the minimum living monthly wage of $211.57 (R4000) (AngloAmerican n.d.). Kriel has an estimated 55.0% of the economically active population, with just 72.7% of people employed (Stats SA, 2016). The Kriel SLP 2014–2018 estimates place the youth population in Emalahleni at 65.6% of the overall population (AngloAmerican, n.d.). These employment statistics, considering the significant youth population proportion, indicate the necessity of aggressive measures to create new jobs.

Coal-based energy generation is the main economic activity, but agriculture and mining are also substantial (Kriel SLP 2014–2018, in Anglo-American, n.d.). According to McCall et al. (2019), Hendrina, Arnot, Camden, Komati, and Kriel Power Stations will all be decommissioned before 2030. Kriel experiences high levels of air pollution because of the significant number of coal-fired power plants in the area (Vlavianos, 2019). According to a study by Greenpeace India that used data from NASA's satellites to estimate anthropogenic sulphur dioxide (SO2) emissions from hotspots around the

world, Kriel in Mpumalanga ranks as the second worst SO2 emission hotspot in the world (Vlavianos, 2019).

Considering the number of environmental, social, and economic challenges Kriel and Carolina face, these issues make them rich study sites for the JET, from coal to the RE sector. **Figure 2** shows the location of Carolina and Kriel in the Chief Albert Luthuli and Emalahleni Local Municipalities in Mpumalanga Province, South Africa.

Figure 2: The Location of Kriel and Carolina in the Two Local Municipalities in the Mpumalanga Province in South Africa



Source: Selahle, 2022

3.3.2. Target Population and Sampling Procedure

a). Target Population

Bryman and Bell (2003, p. 572) define a population as *"the universe of units from which the sample can be gleaned."* Within the Kriel and Carolina study sites, the target

population is estimated at 15237 at Kriel and 16846 at Carolina, and they are mostly dependent on coal as the main economic activity. To ensure that the samples chosen are representative of the target population and would provide data that are dependable, replicable, and relevant to the study, a margin of error of 10% was used to draw the study population. This gave 1524 for Kriel and 1685 for Carolina. The target population was thus comprised of the Carolina and Kriel communities, whose lived experiences in the coal mining communities made them better placed as study participants, as well as the participants from the Experts group, who were comprised of individuals who have researched or who work in Mpumalanga in the coal sector and its allied industries, as well as academics within the coal and renewable energy spaces. Five types of sampling techniques, namely, systematic, random, purposive, snowball, and convenience sampling, were used to select these study participants as deemed fit.

b). Sample Size and Sampling Techniques

3.3.2.1. Systematic Sampling

Given the size of the study populations, a systematic sampling strategy was employed to make it easier to check for errors. The 1524 study population was then used to create the sample population, which had a 10% margin of error. Consequently, this led to

$$\frac{10}{100} \times 1524$$

$$\therefore Sample \qquad Population = 153$$

The starting point was established via random sampling, and the participant was then chosen. It was crucial to determine the interval, or the value at which respondents were chosen for interviews from the sample population, given the sample size of 153.

As a result, the study used the following equation: Where N

is the study population, *n* is the sample population.

K is the interval.

$$\frac{1524}{153}$$

$$\therefore K = 10$$

An interval of 10 was used to carry out a systematic sampling procedure. To implement the data collection process, the first household was purposefully chosen, which kicked

off the interviews. Therefore, every tenth household, starting from the purposively sampled starting point (the first household), was to be interviewed in Kriel Town to give the sample population of 153 respondents. However, this was not feasible as some households were locked while others did not want to entertain visitors due to the COVID-19-imposed fear of other people who were not family. Convenient sampling had to be used, and neighbours who were outside and were willing to participate in the study were identified and spoken to.

In Carolina, the same procedure was followed, whereby a 10% margin of error was also used to obtain the sample population from a study population of 1685. This gave us

$$\frac{10}{100} \times 1685$$

$$\therefore Sample \qquad Population = 169$$

Given a sample population of 169, it was important to identify the interval, which is the k^{th} value at which the respondents were picked from this sample population. The study, therefore, adopted the following equation:

Where *N* is the study population. *n*

is the sample population.

K is the interval.

$$\frac{1685}{169}$$

$$\therefore K = 10$$

A sampling interval of 10 was used to carry out a systematic sampling procedure in Carolina. The first household was purposefully chosen, where the researcher identified the first respondent whom she interviewed, and the sampling of every 10th household was done to draw the sample population of 169 from the study population. However, challenges were also encountered, as not all the targeted households were interviewed. This method was, therefore, not followed on both sites, and convenient sampling had to be used to get the anticipated numbers.

3.3.2.2. Convenience Sampling

It was necessary to use convenience sampling to increase the number of participants. In this sampling technique, participants are sampled because they are administratively or spatially located around the research site where the researcher is doing the data collection, which is why convenience samples are known as *"accidental samples"* (Etikan, 2016). In this case, people the researcher met in the streets in the study areas who were willing to engage were interviewed and, in some cases, given the questionnaire to fill out. 170 community participants were obtained. Participants' hands were disinfected by spraying them with sanitiser as per the COVID-19 regulations from the World Health Organisation (WHO), before and after the completion of the questionnaires. While experts were purposively sampled based on their work experience, areas of expertise, and research interests, 60 participants from this group were obtained, plus 170 from the communities, for a total of 230 participants who took part in the study overall.

3.3.2.3. Purposive Sampling

Purposive sampling is a non-random technique that involves the deliberate selection of a key informant due to the expertise on the issue under study that the informant possesses (Tongco, 2007). The study purposefully sampled key informants from the researchers' existing contacts in the IUCMA, Carolina and Kriel Mining officials, Mine Water Coordinating Body (MWCB) officials, coal researchers from the Witwatersrand University, and SIA practitioners working in Mpumalanga. This group then provided a basis for snowball sampling.

3.3.2.4. Snowball Sampling

Snowball sampling involves selecting a small sample of participants from a specified group and then expanding the sample through a series of referrals (Berg, 2004). Snowball sampling allowed the researcher to use the existing personal network to gain access to more participants (Ojeda *et al.*, 2011). The researcher recruited more participants from the IUCMA, Eskom, and the University of the Witwatersrand through her personal network. However, this presented some challenges due to the homogeneity of the samples and their similar experiences (Lu and Gatua, 2014). This potentially compromised the attainment of comprehensive data. However, the global virtual and digital platforms through LinkedIn and webinars were also leveraged, and this afforded more diverse samples, allowing for some degree of heterogeneity. **Table 1** below shows

the key research questions, sampling techniques, and sampling criteria, as well as the research instruments employed.

Table 1: The key questions, participants, sampling criteria, techniques, and data collection tools

Key research questions	Participants	Sampling criteria.	Population sampling methods	Tools for data collection
1. What are the sustainability perspectives in the coal mining industry as it embarks on a JET in the Carolina and Kriel mining communities? **2.** What is the skill development needs within the JET from coal to renewable energy in the Carolina and Kriel mining communities? **3.** To what extent can SIAs be a strategy for the assessment and addressing of the socio-economic impacts of a shift from coal to a lowcarbon economy on the affected communities in the Carolina and Kriel mining communities in Mpumalanga? **4.** To what extent can SIAs provide an entry point into government policy for an energy transition from coal to the renewable energy sector in South Africa?	**1. Communities** Community Members Coal Workers **2. Experts:** Academics Coal researchers and SIA Practitioners Climate Change and Renewable Energy Researchers Leaders from the industry Local Regional Global.	**Residency in the two towns:** Lived experiences in the coal industry. Activism. **Academics:** Conducting Research on Energy Transitions Coal and Renewable Energy Experts Government Officials and SIA Practitioners: Knowledge of Social Impact Assessments, Climate Change JET, and Environmental Policies.	**1**. Purposive **2**. Snowball Sampling **3.** Systematic Sampling **4.** Convenient Sampling	**1.** In-depth, semi structured-interviews **2.** Questionnaires **3.** Photography

Source: (Compiled by the researcher, 2021)

3.3.3. Methods of Data Collection

Methods are approaches and procedures used to gather and assess data, according to Crotty (1998). Semi-structured interviews and survey questions were employed in this investigation.

3.3.3.1. In-depth, Semi-structured Interviews

In-depth, semi-structured interviews were conducted based on an adaptable structure consisting of open-ended questions demarcating the area to be studied. These were done during visits to the study sites between 2020 and 2021. The interviews afforded the researcher the opportunity to gather more information than survey questionnaires could, due to the closed nature of the questions. An interview schedule was used, and the interviews took 20–30 minutes with the experts, and these were virtual. For the community members, only a maximum of 10–15 minutes were spent considering that they were one-on-one physical interviews to reduce prolonged interaction during the COVID-19 pandemic. A total of fifty interviews, twenty with experts and thirty with community members, were conducted. See **Table 2** overleaf.

The in-depth, semi-structured interviews gathered information on some demographic aspects, including gender and age. To gain a clear understanding of their broader perspectives on JET, questions about the social impacts of the energy transition came next. The views that participants have on the state of policy and how it can be improved within the energy industry were also examined. It also afforded the expert participants the opportunity to express the importance of SIA in energy transition policy decisions, their influence on new curriculum design that would feed into skills needs within the RE sector, as well as their role in assessing the existing impacts vis-à-vis expected improvements in the environment.

The social dimensions covered in the interview questions made the comprehension of the social world through the lens of the lived experiences of the social actors easy (Cohen *et al.,* 2000). They also allow for probing to elicit additional information if the interviewee mentions something intriguing or novel (Baskarada, 2014). The in-depth, semi-structured interviews allowed the researcher to glean more information from body language and tones, especially among the community groups.

Code names were used to ensure participant anonymity and confidentiality, such as Expert 1 (E1), Interviewee 1, or Community Interviewee, C2 or K2, depending on whether they were from Carolina (C) or Kriel (K), and the recordings were kept on a password-protected laptop. Language nuances were also considered during the interviews. All the participants from the communities were given the option of being interviewed in either English or IsiZulu, and the final language choice was based on the participants' preferred languages. Some participants code-switched between Zulu, SiSwati, and English, while experts were interviewed in English. Lu and Gatua (2014), in their studies in China and Kenya, successfully used the same approach where language nuances were observed, and the final language choice was based on the participants' preferences. To beef up the data collected through interviews, questionnaires were used.

3.3.3.2. Survey Questionnaires

Bird (2009) defines questionnaires as methods for gathering data in social science studies that allow information to be extracted based on participants' opinions and expected behavioural norms regarding the issue being researched. At the two study sites, the questionnaires were distributed and administered physically during fieldwork. Some were left and collected the following day, as participants seemed busy at the time of the visit. This enabled the researcher to collect all the questionnaires without losing any. Online survey questionnaires came from the expert group; these included filling in responses and ticking boxes. A total of 170 questionnaires were administered. See **Table 2** overleaf.

The first part of the questionnaire was based on demographic information about the participants and therefore asked about gender, age, and type of employment. This gave the researcher a snippet of information about the types of people who responded to the questionnaires. Gender was particularly important in determining the level of female participation in developmental projects. Questions related to the current status quo of environmental impacts from coal and the anticipated environmental improvements as the transition progresses to cleaner energy sources were asked. Moreover, participants were asked questions on educational curriculum design and anticipated socio-economic impacts as the transition unfolds, as well as their views on SIA and government policy as far as the energy shift is concerned. This afforded different views on policy from all

groups that could be compared. **Figure 3** below shows the researcher administering questionnaires in Kriel's Thubelihle Township.

Figure 3: Questionnaire administered in Kriel's Thubelihle mining community

Source: (Fieldwork Material, 2021)

COVID-19 protocols were followed during data collection. **Figure 3** attests to this. A breakdown of the participants who took part in the study is shown in **Table 2** below.

Table 2:Showing Study Participants

Participants	Data collection instrument	Total number of participants
Carolina community	A survey questionnaire	80
Carolina	Face-to-face interviews	20
Kriel community	A survey questionnaire	60
Kriel	Face-to-face interviews	10
Experts	Online surveys	40
Experts	Online interviews	20
Total		**230**

(Source: Researcher, 2021)

With the advent of online communication, the researchers also leveraged webinars. Webinars are online seminars that convert a presentation into a dialogue that may take place anywhere in the world, allowing huge groups of users to take part in online discussions or training sessions and share audio, documents, or slides (Cambridge Dictionary, 2021).

Webinars on the JET were carefully selected, registered for, and attended through social media platforms such as LinkedIn. A total of six webinars were registered for and attended. The webinars provided a platform to source some experts on the JET for either interviews or invitations to participate in surveys. There were video recordings of the webinars, which were available and gave the researcher enough time to glean information from the different presentations at her own pace. See **Table 3.**

Table 3: Webinars Attended

Organiser	Topic	Dates
1. Resilient 40 Virtual Summit	Tunakutana for climate change resilience in Africa	16–23 September 2020
2. Enlit Life Cycle Management Hub Series Season 2 Episode	Reskilling the power sector workforce for tomorrow's challenges	September 30, 2020
3. GDP (SACREE/DBSA)	Expanding Renewable Energy for Access and Development: The Role of Development Finance Institutions (DFIs) in Southern Africa	November 19, 2020
4. SEFA Webinar	Sustainable Energy Fund for Africa (SEFA)	December 14, 2020
5. DBSA	District Development Model Dialogue Section (DBSA)	January 27, 2021
6. Enlit	Repurposing power plant infrastructure	February 18, 2021

Compiled by the Researcher, 2020/2021

The researcher also attended community forums in Mpumalanga as well as the WindAc Conference on Renewable Energy (Wind Energy) in Cape Town in 2021 (see **Figure 4** below).

Figure 4: A WindAc presentation session at the academic conference in Cape Town

Source: (Thandiwe Chidzungu, 2021)

The second conference was the 3rd Inkomati Basin Conference on Women in Water, where the researcher was one of the speakers focusing on SIA's role in solving the socio-economic impacts of AMD from coal mining on the Carolina community in Mpumalanga, South Africa. See **Figure 5** below.

Figure 5: A presentation session by the researcher at the 3rd Inkomati Basin Women in Water Conference 2021 in Mpumalanga, South Africa

Source: (IUCMA Media Team, 2021)

Using two distinct data analysis tools suitable for qualitative and quantitative parts of the data, the data collected using the various instruments was then analysed to determine arising themes that provided structure to the research findings.

3.4. Data Analysis

Data analysis in qualitative research facilitates comprehending participant viewpoints and responding to the research questions (Marshall and Rossman, 1999). As a result, it entails categorising, planning, conceptualising, honing, and interpreting data to get meaning from the vast amount of gathered data (Thorne, 2000). To start off with, all the interviews conducted in Zulu were first transcribed into English. The use of recording

helped capture every detail, as it could be replayed. The findings were written on an Excel sheet under suitable categories as determined by the research questions and objectives. This was in line with conceptual data analysis.

Finding research questions and selecting phrases that are representative of the research questions to be classified into themes are the first steps in conceptual data analysis (Busch *et al.,* 1994). It facilitated the selective elimination of texts to allow for coding.

The researcher also used inductive methods to analyse each interviewee's response. The inductive method entails observing the reactions, identifying a pattern between the facts being seen, and then generating ad hoc hypotheses (Thomas, 2006). The steps in the coding process are shown in **Table 4**.

The first step involved the researcher deciding on the level of analysis, whereby phrases were drawn from the interview narratives and questionnaire responses that were indicative of responses to research questions. In the second step, the researcher was able to study a text for particular things due to the research questions that served as its foundation and the themes that needed to be coded. To achieve the greatest results, a degree of flexibility could be used to incorporate emerging, important themes in the coding process (Busch *et al.,* 1994). Thus, the researcher gleaned the main themes from the collected data in line with the main research questions.

Step three involved the coding of themes based on the frequency of the phrases. The higher the frequency of a phrase, the more significant it was in the study. Step four involved coding, separating the data into segments that were then assigned codes that related to the analytic themes that were developed. Due to the analytical themes, the researcher was able to code not only the exact phrases but also other phrases that implied the same meaning. For example, the need for new skills development in the RE sector as the energy shift unfolds and the need for vocational training centres feed into the same theme of skill development.

Step five involved the use of translation rules for the coding process to allow for its consistency, thereby ensuring the validity of the interpretation obtained from the data. In step six, there was the elimination of data that did not address the study questions. Step seven involved the coding of texts and attaching values to the results. The eighth step required analysing the pertinent data, drawing conclusions from the data that had been

coded, organising them into research themes, and comparing them to examples from the literature.

The use of conceptual data analysis alongside interviews, photography, existing IDP reports, and archival records gave important cultural and historical perspectives over time (Columbia Public Health, 2021). Moreover, it allowed for both qualitative and quantitative analysis. For example, the coded form of the text could be statistically analysed (Busch *et al.,* 1994). This was done for the online surveys and the physically administered questionnaires.

According to Columbia Public Health (2021), this method of data analysis is, however, difficult to computerise. If there is an error in spelling and it is computerised, this might result in categorisation under the wrong theme. Separating synonyms is also important; for instance, the term "mine" might also refer to a personal pronoun, an explosion, or a large hole dug into the ground to retrieve ore. The software can accurately count the usage of that word and its frequency, but it won't be able to give an exact accounting of the meaning that each usage carries (Columbia Public Health, 2021). This drawback can compromise validity. Therefore, content analysis for the study was done manually, which was not affected by this bias. Although it is time-consuming, it has the advantage of being readily understood and being an inexpensive research method.

Table 4: Steps in the Thematic Content Analysis

	Procedure
1.	Establishing the level of analysis
2.	Establishing how many concepts to code for
3.	Establishing whether to code for the presence or frequency of the concept
4.	Establishing how to distinguish between concepts
5.	Establishing rules for the coding of texts
6.	Establishing what to do with less relevant information
7.	Coding texts
8.	Analysing results

Source: (Adapted from Busch et al., 1994)

A survey questionnaire analysis

The analysis of quantitative data for survey questionnaires involved the steps shown in **Figure 6** overleaf.

Figure 6: Data preparation process

Source: (Adapted from Kent, 2015)

Checking involved determining whether the questionnaires that were completed provided relevant responses in terms of the question asked and the instructions thereof. For instance, answers to questions with a single response requirement may have been given two or more times (Kent, 2015). Such an incident renders the response invalid because the researcher cannot guess the correct answer, which defeats the whole exercise of collecting data from participants.

Editing entails examining the consistency and accuracy of responses, correcting anything that must be fixed, and choosing whether some or all of a questionnaire should be rejected (Kent, 2015). Colleagues evaluated the questionnaire at the beginning of the study, and their responses demonstrated consistency and accuracy, and they were similar in the field. This exercise was important as it reduced the odds of having compromised data that could adversely affect the study findings.

Open-ended qualitative responses to questions are categorised or grouped using codes (Kent, 2015). The highest code number was assigned by the ordered categories to the highest or most positive value. This gave the researcher the chance to identify the primary themes and related sub-themes, as well as to create supporting graphs.

Data assembly entailed gathering all the completed questionnaires that had been reviewed, updated, and coded, as well as entering the values for each variable for each case into the data matrix. Transforming involved regrouping the values and establishing class intervals that were used to classify ranges of values on metric measures to enable the researcher to get an overview of the distribution. Microsoft Excel was used to show the demographic information. Participants' views on the importance of SIA as a sustainable strategy in the shift and perceptions about the shift from coal to the renewable energy sector were presented through pie charts and bar graphs.

Throughout the research process, from the research proposal through data collection and analysis, ethical considerations were observed.

3.5. Ethics

The researcher was subject to ethical requirements as a student at the University of the Witwatersrand. According to their requirements, the Witwatersrand University Ethics Panel received an ethics application along with the pertinent permission letters, research tools, and other necessary documentation. The Ethics Clearance Certificate was granted in July 2020, after which the data collection began in earnest. See **Appendix 5.** In response to observing and adhering to ethical standards, the study ensured that people's dignity and right to privacy were respected. This was done by obtaining verbal and written consent from the participants after explaining explicitly what the research entails. They were also given the right to choose not to participate or to end the interviews if they felt uncomfortable sharing certain information. Moreover, the anonymity and confidentiality of the participants, as well as the data collected, were guaranteed in the case of interviews and surveys. Codes were used to refer to the respondents in the study. Images were taken and used with the participants' consent. The information shared through audio and print media during interviews and surveys was safely stored on a password-protected laptop known only to the researcher. Thus, in the study, both *"ethics in practise,"* which is field-based and focuses on data collection and the information provided by participants, and *"procedural ethics,"* which is concerned with whether the modus operandi is followed, were used (Ellis, 2007). Observing high ethical standards also feeds into the reliability and validity of the research.

3.6. Research Reliability and Validity

To ensure the reliability of the research results, errors were corrected as the research progressed before the analysis stage (Morse *et al.,* 2002). The researcher changed the framing of some of the questions in the survey for both community and expert groups during the first survey. The Zulu questionnaire that was first translated from English using Google Translate to isiZulu used academic Zulu, but participants during the pilot questionnaire did not understand it; hence, the researcher did the translation herself and

replaced some terms using the local dialect with the help of the local community activist. However, the Zulu questionnaire was not used during the fieldwork because participants preferred the English questionnaire.

Furthermore, the format used to write out each chapter in the research report allowed the researcher to revisit previous chapters to modify specific components to ensure alignment in all the chapters. Reliability is proving that the same outcomes can be acquired by repeating the data gathering process (Baskarada, 2014). In theory, this means that other researchers should be able to follow the same process and get the same findings.

Morse *et al.* (2002, p. 15) articulate that *"qualitative research should be dependable, credible, transferable, and exhibit confirmability for it to prove its quality."* According to Elo *et al.* (2014), dependability is the consistency of data across time and under various circumstances. Given the two study sites, Carolina and Kriel in Mpumalanga, the choice of participants who have similar lived experiences in these areas and the expert group who have worked in coal mining areas and energy as well as researched mining and energy can ensure the stability of data over time. The participants' opinions regarding the perspectives of SIA in addressing AMD's socioeconomic impacts in coal mining areas from Chidzungu's (2019) Carolina study, which they continue to express in this current study two years later, also support this. According to Yin (2009), a second researcher should use the same or similar subjects in the same environment to replicate the findings of an investigation.

The criteria used to select participants in the study, which included expertise in mining, energy, and environmental policies as well as the lived experiences of the participants, can be used to inform interdisciplinary research in other fields, thus indicating transferability (Merriam, 1988).

According to Merriam (1988), credibility deals with the question of whether the findings are consistent with reality. The credibility of the research was established using different sampling techniques that complemented each other and were suitable for qualitative research. Moreover, the criteria used to sample participants in the study were explained. For example, in the case of the expert group, the online sampling of a range of people in different organisations and geographical areas in coal mining and energy provided

varied perspectives on the issue under study that provided credibility to the findings. This supports the concept of circling reality, that Dervin put forward in 1983, where reality is built from a wide range of viewpoints observed from different locations (Shenton, 2004).

Elo *et al.* (2014) contend that while the sample size is thought to be important to assure the validity of the data, there is no established sample size for qualitative studies. The goal of the study, the depth of the data, and the research questions can all help establish the ideal sample size. The saturation of the data may be a factor in determining the best sample size (Guthrie et al., 2004). Saturation of data in the study was established when there was a repetition of the same answers and interlinks between categories. For example, some of the responses to themes could easily be linked to other themes, which reflected a clearer understanding and wholesomeness of the data. Also, the size of the sample used in the study gave a lot of information that helped the researcher learn more about the social costs of JET, especially those related to skill development and sustainability, as well as the role of SIA as a possible strategy to reduce the social costs and an entry point into the JET policy environment.

Shenton (2004) defines conformability as ensuring that other researchers can verify results, entailing the qualitative investigator's comparable concern for objectivity. In this research, interviews and online surveys were used as the main methods of data collection, which can be verified through the Qualtrics survey system and recordings. Some of the information used came from webinars and conferences about JET and the renewable energy sector. This demonstrated a form of triangulation that facilitated the reduction of any bias. The researcher also recognised that the main data collection tools have shortcomings. Hence, in some cases, she had to depend on Stats SA, the Community Survey 2016, the Census 2011, and local IDPs for Chief Albert Luthuli Emalahleni local municipalities to provide statistics on skills and education profiles that the survey questionnaires could not collect due to the complex planning involved in carrying out such an exercise.

Sasivongpakdi and Wang (2014, p. 17) define validity as "the issue of whether an indicator being used can measure the concept or not." It can have internal or external validity. To establish the internal validity, one questionnaire was for the expert group and another for both community groups from Kriel and Carolina. The fact that the two mining communities and the expert group members agreed on some of the causes and effects

of the energy transitions demonstrated consistency. This resonates with Kaya (2015), who states that internal validity is concerned with whether the outcomes presented justify the claims of cause and effect and afford the researcher the opportunity to meaningfully interpret the research results. Reverse-coded questions were adopted in questions 4 and 5 of the Expert Online Survey and the Community Questionnaire (see Appendices 2 and 3). Reverse-coded questions, which reword a positive item in a negative fashion, are thus a typical validation approach for surveys. This can be used to check if respondents are giving similar responses (Cooper *et al.,* 2006).

External validity "refers to whether the findings can be generalised to the whole population or not" (Sasivongpakdi & Wang, 2014, p. 17). For the study, getting the same responses pointed to *"data saturation,"* which indicated a sufficient sample size (Guthrie *et al.,* 2004) and provided a form of validity. However, while the study exhibited validity and reliability, some drawbacks from the different instruments used and from the nature of the study were encountered during data collection.

3.7. Research Limitations

The research topic of transitioning away from coal is politically charged and makes people a little bit uncomfortable. Moreover, what comes to mind are the large-scale job losses that coal mining communities and workers associate with the energy transition. Participants, therefore, wanted assurance that the research was purely for academic purposes with no political implications. They were assured that the research was purely academic and that adherence to the University of the Witwatersrand Code of Research Ethics, which included confidentiality, anonymity, and consent, would be observed. Cooperation and trust among the participants were gained, and data collection proceeded well. It was anticipated that 329 participants would take part in the study. However, only 230 respondents participated due to the upper limit COVID-19 imposed on social interaction, both physical and virtual. At work, people were inundated with online meetings; hence, at times, scheduled interviews had to be cancelled. However, attempts were made to reschedule some online interviews where it was possible. Load shedding and poor Internet connections also affected some of the interviews that were scheduled. Participants who were reluctant to interact with strangers for fear of

spreading COVID-19 had an impact on systematic sampling for the physical interviews and questionnaire administration. Attempts were made to assure participants that social distancing would be maintained, masks would be kept on, and we would all sanitise as per the COVID-19 Protocols during the interviews, and they were comfortable with that. The webinars and LinkedIn profiles were leveraged to purposefully sample the expert group, and this provided global input to the study. The only drawback of online questionnaire surveys was that some participants did not complete the surveys; they would omit one or two questions, and this varied the number of the expected total participants in the expert group in some instances during data presentation. For instance, instead of having 40 participants, there would be 38 or 39. However, this was negligible and did not make much of a difference in the end. The Zulu questionnaire was not used because participants preferred the English questionnaire. Being qualitative research, the problem of not receiving the required sample size was solved by reaching *"data saturation,"* whereby the interviews and survey questionnaires began yielding the same responses.

3.8. Conclusion

The research used a qualitative strategy and applied some quantitative techniques to obtain comprehensive findings. The qualitative approach chosen provided the level of engagement required to obtain information on impacted stakeholders' perceptions of this novel energy shift from coal to renewable energy. Using statistics from reviewed documents, data on the social dynamics on the ground in terms of skill needs and community sustainability was obtained from South Africa's coal sector. Moreover, the qualitative approach was compatible with the theoretical framework, the Theory of Change, the SIA, and the philosophical positionality of the researcher in the study. The research procedures and methods used to collect primary data involved semi-structured interviews and surveys. The respondents were sampled using purposive, systematic, random, snowball, and convenient sampling techniques. Ethical considerations, data reliability and validity, as well as research limitations, were considered throughout the study. The empirical findings obtained are presented in the next chapter.

CHAPTER 4

Empirical Findings

4.0. Introduction

This chapter presents the findings of the study, collected between July 2020 and October 2021, which are structured and categorised around the key research questions that feed into the research objectives. As a result, the following categories or themes emerged: (i) Sustainability perspectives in a JET context; (ii) Skill development needs in a JET context; (iii) Social Impact Assessment as an effective strategy for assessing and addressing the social Impacts of a JET; and (iv) SIA as an entry point into government policy in a Just Energy Transition.

Before presenting the key empirical findings from the key themes, it was critical to first determine how experts and affected communities perceived the concept of a JET based on these key questions.

4.1. Participants' Perceptions of the Just Energy Transition

Participants gave quite interesting narratives on their perceptions and understanding of the energy shift, which depicted their lived and work experiences in these coal mining regions. Firstly, perceptions from the expert group were presented, and then those of the participants from the two communities were reconciled. Experts gave the following perceptions of JET:

> *It is a justified shift because you cannot run away from the notion of exclusivity into inclusivity in our region, which has a history of the haves and have-nots in all facets of the economy, and in a JET, we are shifting to a new economy where those people who were not participating in the previous economy are included and afforded a chance to be involved in the new economy* (Expert Interviewee 14, 2021).

> *The idea of a JET comes from efforts made by civil society, environmental justice organisations, and trade unions around the world to ensure that the shift from a coal-dependent economy to a low-carbon economy is fair and reasonable (Expert Interviewee 18, 2021).*

Other experts expressed that:

> *JET manages all socioeconomic impacts of the coal value chain with a focus on all value chain stakeholders; it examines how community sustainability will be managed and how to manage the decommissioning of large coal plants* (Expert Interviewee 11, 2021).

> *The JET is needed in South Africa; however, the government is still grappling with what it should encompass, whether it should include women's empowerment, community empowerment, safe drinking water, or hunger alleviation. I believe it should be linked to all the SDGs* (Expert Interviewee 2, 2020).

These expert participants perceived it as involving issues of social justice, a lack of active citizenship, and sustainable development issues. Other expert participants perceived it through technological and climate change lenses:

> *The transition to a low-carbon energy path will have an impact on the technical and economic structure of South Africa's energy system, specifically the nature of the energy generation mix, centralised or decentralised energy systems, ownership patterns, and society's social, economic, technological, environmental, and welfare structures* (Expert Interviewee 18, 2021).

> *It involves a shift from traditional coal technologies to low-carbon-intensive technologies; it is not only confined to the renewable energy sector, as there are other low-carbon technologies that are involved but are not necessarily renewable* (Expert Interviewee 11, 2021).

> *It is a necessary shift that should have gained momentum many years ago, but it has only gained impetus recently with the climate change targets and the pending Paris Climate Agreement compliance of a decrease in temperature of*

> *1 degree, and coal itself has given it some impetus* (Expert Interviewee 11, 2021).
>
> *The JET will involve industry implementation of carbon capture and storage, and this will be the most effective move as it can alleviate the impacts of these pollutants. A key climate strategy that has not been fully implemented yet due to financing* (Expert Interviewee 9, 2021).

Experts view it as a key climate change strategy centred on the improvement of the biophysical environment by shifting from coal to renewable and clean energy sources. They are also cognisant of the fact that it is a technological shift and that it manages the social and economic consequences of the energy transition. The recognition of the socio-economic aspects illuminates the pivotal role of SIA in managing sustainability issues within the JET context.

Impacted communities expressed the following perceptions:

> *A Just Energy Transition means less pollution from coal but will lead to job losses as a lot of people in the community work in the mines, and there are small businesses that service mine workers* (Community Interviewee C4, 2021).
>
> *The shift from coal to solar energy will improve the conditions on the farms as water pollution is reduced, and so we support it* (Community Respondent C3, 2021).
>
> *The energy transition from coal to the renewable energy sector will improve health conditions, considering that children are always coughing due to dust from the coal mines* (Community Interviewee C5, 2021).
>
> *Our livelihoods have been centred on the coal mines. Imagining a life without coal is impossible because these energy transitions want to take away coal and bring solar energy, which will not employ as many people* (Community Interviewee C10, 2021).

Several participants expressed that they cannot live without coal, so *JET is a joke*, as all the jobs come from the coal mines, and they owe their presence in the area to the mines.

Other participants explained it from a business angle:

> *A JET means the closure of coal mines to make way for solar energy. It will affect my business, which is coal-dependent, because I supply bricks to the local people who cannot afford transport costs to buy bricks in Gauteng* (Community Interviewee C7, 2021).
>
> *I am concerned that if the coal mines close, we will not have customers, and our businesses will close as people will go to look for jobs very far away and no one will buy our stock* (Community Interviewee C16, 2021).

Most of the community respondents perceived the JET as a "recipe" for job losses in the coal industry and allied industries along the coal value chain, with some pointing to improvements in the biophysical environment and community health.

In conclusion, the experts understood it better from an **environmental sustainability** standpoint, while the impacted communities understood it best from a socio-economic **community sustainability** standpoint, although both were cognisant that the two factors are at play and somehow equally important. This illuminates the equal importance of the social and biophysical costs of JET that the SIA tool brings to the fore if used in mainstream JET mitigation decision-making. With this background information on the participants' perceptions of the JET, it was imperative to examine the sustainability issues that both the experts and community participants alluded to, which takes us to the sustainability issues within the JET context.

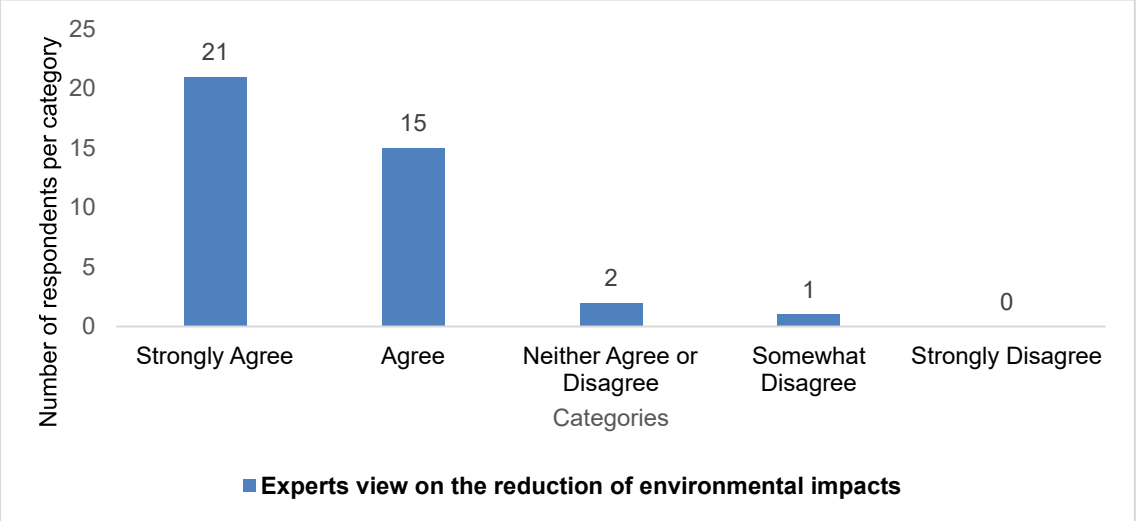
4.2. Sustainability Perspectives in a Just Energy Transition

Sustainability perspectives from the collected data provide answers to the first key research question*:* ***What are the sustainability perspectives in the coal mining industry as it embarks on a Just Energy Transition in the Carolina and Kriel mining communities?***

To tackle this key question, it was best to divide it into two parts, namely, environmental sustainability and community sustainability. The state of environmental sustainability within the coal sector was investigated and compared to the anticipated state of environmental sustainability in the renewable energy sector.

A poll was conducted among the respondents to determine to what extent they think transitioning from coal to the renewable energy sector will solve coal mining's imposed environmental problems. The following poll results were obtained: See **Figure 7.**

Figure 7: Experts' views on the reduction of environmental impacts during the Just Energy Transition

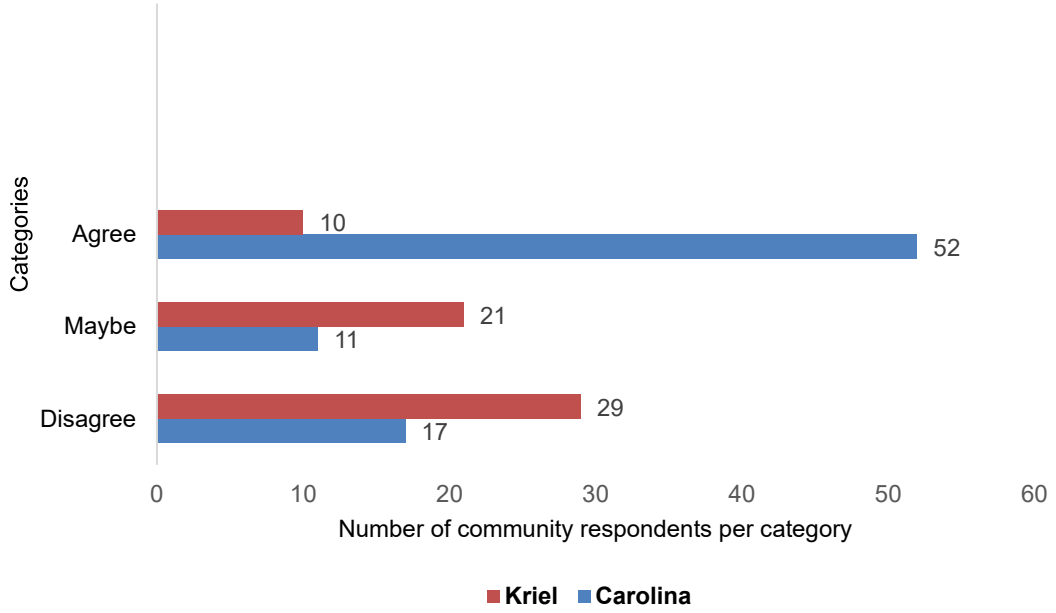


Source: (Based on Online Surveys, 2021)

39 experts responded to this question in the online survey. 21 (53.85%) say they ***strongly agree,*** while 15 (38.46%) ***agree***, giving validation that environmental impacts will be reduced. Only two (5.13%) are neutral, meaning they ***neither agree nor disagree***, with only one (2.56%) ***somewhat disagreeing*** and none ***strongly disagreeing*** that energy transitions away from coal will reduce environmental impacts.

Thus, the poll results show that most experts who responded to the survey perceived that environmental sustainability could improve as the transition away from coal took place. A survey was then carried out with the community participants, and it produced similar results on the reduction of environmental impacts as the transition from the coal sector to the renewable energy sector progresses. See **Figure 8**.

Figure 8: Community views on the reduction of environmental impacts during the energy transition



Source: (Based on Field Surveys, 2021)

Figure 8 shows that 52 (65%) of the people in the Carolina community and 10 (16.7%) of the people in the Kriel community ***agree*** that the environmental effects will be lessened, while 17 (21.25%) in the Carolina community and 29 (48.30%) in the Kriel community ***disagree***, and 11 (13.75%) in the Carolina community and 21 (35%) in the Kriel community say ***maybe*** they will be lessened. The overall percentage of the community group, which stood at 81.7%, ***agreed*** that the environmental impacts would be lessened, confirming what the experts expressed. However, the Kriel group exhibited some strong reservations about the environmental impacts being lessened, as shown by only 10 out of the 60 participants who agreed with that view.

To validate these survey results, open-ended questions were asked on the questionnaires, online surveys, and interview schedules to find out the realities of the state of environmental sustainability within the fossil fuel industry and the renewable energy sector, using evidence from the lived experiences of participants, reinforced by the concrete realities on the ground.

4.2.1. Environmental Sustainability in the Coal Sector

Participants from Carolina, who included some experts who live in the community and on nearby farms, had this to say about the state of environmental sustainability within the coal sector:

> *There is surface and underground water pollution caused by AMD, as well as air pollution, and the environment is degraded, especially when it comes to open-cast mining. There are also high carbon emissions and other toxic gases affecting the ozone layer* (Expert Online Survey 8, 2021; Expert Online Survey 20, 2021).
>
> *The water is so bad to the point that it affects our reproductive health to the point that we end up developing vaginal infections due to the acidity levels caused by the AMD pollution, which interferes with the pH of the water* (Community Interviewee C10, 2021).
>
> *Our crops were affected by Acid Mine Drainage and cannot be sold to the people because they are not good for eating; we lost the whole field, and the soil is no longer suitable for crop cultivation* (Community Interviewee C11, 2021).
>
> *Underground water is contaminated, and we do not trust even the borehole water, as it has never been tested because we cannot afford to test it; those who have money buy bottled water from the shops* (Community Interview C13, 2021).

From the above comments from the Carolina community participants, water pollution problems dominated the environmental sustainability issues they seemed to experience under coal mining.

Some participants from Kriel pointed to the following impacts of coal mining:

> *Since there is only a road separating our homes from the mine, the dust pollution from coal mining is a concern for us, and the blasting from the mine is causing cracks in the walls (Community Interviewee K1, 2021).*

See **Figures 9** and **10** below, showing the dust-filled atmosphere and the proximity of the houses to the coal mine.

Figure 9: A dust-filled atmosphere in Kriel's Thubelihle Township

Source: (Thandiwe Chidzungu, 2021)

Figure 10: A road separates the mine from the residential houses in Kriel

Source: (Thandiwe Chidzungu, 2021)

Other participants pointed to health issues, underground water pollution, and poor road conditions, expressing that:

> *Mines only spray water to reduce dust twice a day, but the coal trucks move all day, causing a lot of dust. Even hanging your clothes is impossible* (Community Interviewee K8, 2021).

Several participants from Kriel complained about respiratory diseases, such as lung cancer, while others complained about underground water pollution and potholes on the roads due to coal trucks.

Most of the participants from the Kriel community complained about the issue of dust as the most dominant problem that impacts air quality, hence the environmental sustainability problems, which in turn affect community health.

Apart from community participants, experts had this to say about the impacts of coal mining on environmental sustainability and the subsequent social costs thereof:

> *Land degradation, water contamination and depletion, damage to plants, and waste rock mountains all make the environment less aesthetic* (Experts Online Survey, 3, 7, 31, 32, 2021).
>
> *Coal has had impacts on terrestrial and aquatic biodiversity, air quality, negative and positive socio-economic impacts on heritage resources, changes to the landscape, and rangeland reduction* (Expert Online Survey 2, 2021).
>
> *Air pollution from coal combustion activities; water pollution from coal residues and ash disposal activities; health issues such as silicosis from ash inhalation; and other respiratory-related health issues from ash dust fallout* (Expert Interviewee 1, 2020).

Most of the responses were similar across the community and expert participants; hence, only a few deemed representative and comprehensive were used.

Some participants highlighted climate change as one of the environmental sustainability issues and had this to say:

> *Climate change caused by the burning of fossil fuels and their greenhouse gas emissions has affected the socio-economic livelihoods of humans across the globe through irregular climate migration, environmental and animal health losses, and biodiversity losses, which have been the mainstay of economic and natural ecosystems* (Expert Online Survey 4, 2021).
>
> *These fossil fuels are causing climate change and its consequences, as well as water and air pollution, habitat degradation and fragmentation, vegetation loss,*

and the subsequent loss of arable land. Agriculture is also suffering, and jobs are being lost in agriculture, so they are resorting to illegal mining in Mpumalanga, causing more land damage (Expert Interviewee 19, 2021).

Coal is the primary source of carbon emissions that contribute to climate change. We are seeing a whole lot of destruction attributed to climate change: frequent droughts and floods have become more severe, causing increased hunger, poverty, and loss of livelihoods due to destruction caused by droughts, floods, and the spread of diseases (Expert Interviewee 14, 2021).

Excessive degradation of environmental health due to high carbon emissions contributes massively to climate change and air quality pollution (Expert Online Survey 4, 2021).

Nevertheless, some of the participants pointed to the opportunities that the low-carbon economy can leverage in the coal sector to bring about much-needed environmental sustainability as the energy transition unfolds.

One participant said:

Scientific research and development on crops that can thrive in coal-impacted environments, such as mushroom farming, are underway, and the low-carbon economy can leverage these new economic activities" (E. interviewee 5, 2020). Another posited that *"there are various other things that coal can be used for without being burned, such as fertilisers, and further research is being done to see if coal can be used for graphite* (Expert Interviewee 4, 2020). One participant expresses that:

The government must set policies that force the mining industry to leverage land and water resources to create alternative economies and identify inexperienced players in the renewable energy sector to rehabilitate brownfields impacted by mining activities (Expert Online Surveys 8, 2021).

As a result, participants from both groups concurred that coal mining has an impact on environmental sustainability, as seen in the degradation of the land, air pollution, and deterioration of water quality. Moreover, they pointed out that it has contributed to climate change, which has its own share of impacts that compromise environmental

sustainability. However, they also acknowledged the opportunities that the low-carbon economy can leverage from the landscapes and waterscapes left behind by coal mining as the transition unfolds. Nevertheless, with all these environmental problems in the coal sector, a shift to the renewable energy sector is warranted.

4.2.2. Environmental Sustainability in the Renewable Energy Sector

Environmental sustainability in the renewable energy sector is one of the key considerations in the energy transition away from coal, as it relates to climate change and the effects of fossil fuels, as well as how these can be mitigated. Participants expressed the following:

> *Yes, the transition to renewable energy sources such as solar and wind will reduce environmental impacts, as science indicates, but it also indicates that we are a little late, so we must act quickly to reverse and eliminate them* (Expert *Interviewee 14, 2021).*
>
> *Definitely, the environmental impacts will be less; however, the transition will depend on the political will and willingness of the coal industry to participate in a Just Energy transition (Community Interviewee C13, 2021).*
>
> *It will bring cleaner and cheaper energy and have a positive impact on climate change, air and water pollution, and people's health (Community Interviewee K3, 2021).*
>
> *Switching from a very dirty fuel to systems that work without fuels (e.g., wind, solar, water) replaces all the pollution from mining, storing, and transporting coal (Expert Interviewee 1, 2021).*

Others pointed out some issues that could be associated with renewable energy sources:

> *The renewable photovoltaic panels come from the mining of sand and processing it into silicon, manufacturing the cells into panels, and shipping them, all of which cause pollution. Considering that there are very few countries*

that manufacture them, this whole value chain has environmental impacts; nevertheless, the level of emissions is far less than emissions from coal (Expert Interviewee 14, 2021).

Yes, renewables have some environmental impacts, but the extent is minimal. However, when you look at the solar panel value chain and life cycle, if after 25 years you want to repower these, do you have recycling facilities (Expert Interviewee 14, 2021)?

Wind turbines cause noise pollution and damage to birds with their blades. Wind energy viability is affected by wind strength as determined by seasonality and weather conditions and will have to rely on coal if it fails (WindAc Conference Presentation, 2021).

Most of the participants from both groups acknowledge the improvement in environmental sustainability. Although some are sceptical about the environmental impacts that modern technologies in the renewable energy sector might have, they have the possibility of further impacting community well-being. Nevertheless, they are negligible. However, with the close link that environmental issues have with social issues, the impacts of JET on community sustainability are presented in the next section.

4.2.3. Community Sustainability in a Just Energy Transition

Community sustainability issues affected the dependents and workers, who are both community members. These two groups are at the centre of the energy transition to the renewable energy sector. Their livelihoods, professions, skills, and long-term investments in family and property are at the centre of the energy transition.

4.2.3.1 Communities

Expert participants had this to say about the sustainability perspectives of the energy shift in communities:

Coal mines are some of the biggest employers, and where these mines are built, whole towns are built, communities are formed, and children who are born

there go to pre-schools right up to university. These are rooted-in communities with a rich history, and the way the shift to renewable energy is coming in is going to be a blow to these communities because the central

activity around which these communities were built was coal mining, as well as all other economic activities along the coal value chain; this has the potential to break families (Expert Interviewee 14, 2021).

Other respondents expressed that there will be a loss of economic livelihoods and population migration to other areas in search of alternative sources of income, and the JET will lead to the loss of socio-economic projects from coal projects, marked by reduced investments in SLP projects (Expert Online Survey 1, 2021; Expert 16 Online Surveys, 2020).

Another respondent expressed that *"the local economy might lose investments and opportunities that mining brings, and benefits from mining through Social Labour Plans (SLP) will also be lost"* (Expert Online Survey, 32, 2021).

Experts identified a more technical side of community sustainability issues that have socio-economic implications that may arise during the energy transition from coal to the renewable energy sector.

Community members expressed that if coal mines are closed to make way for solar energy, there will be fewer job opportunities. Another participant posited that:

"The coal mines are doing little to serve the communities; the road networks within the Thubelihle township are dilapidated and are hardly repaired; will small renewable solar companies do better? (Community Interviewee K10, 2021)

See **Figure 11** overleaf.

Figure 11: The dilapidated state of the roads in Thubelihle Township in Kriel

Source: (Chidzungu, 2021)

One participant echoed similar concerns in the RE sector, expressing that:

> *As we change to the renewable energy sector, the sector will find poor infrastructure, and the renewable energy companies may not do much as they are not as big as coal mines* (Community Interviewee, C13, 2021).

Another participant had this to say about infrastructure and service delivery:

> *Most small mining communities depend on the mine for their water supply. Once the mines are closed to open the way for renewables, either these inexperienced players will take this up or the local government will render these services. Emalahleni is one good example where mines provide water for the local communities* (Expert Interviewee 1, 2021).

Local municipalities, along with the renewable energy sector, need to deal with these legacy impacts by taking up this aspect of service delivery. SIA teams work with regulatory bodies; hence, they are better placed to influence decision-making on infrastructural development.

Other participants also complained about relocations from their traditional homes and gravesites that have impacted their cultural practises in Kriel's Thubelihle Township during coal mining. See **Figures 12 (i) and 12 (ii).** They posit that this may not be different if large-scale renewable energy infrastructure is to be erected across the land.

Figure 12: (i) and (ii): Mining activities across a graveside in Thubelihle Township in Kriel

Source: (Thandiwe Chidzungu, 2021 i) (Wandile, 2022 ii)

The SIA tool and its consideration of cultural heritage in the assessment process can guide and recommend to the transition planning team not to overlook traditional aspects such as the presence of sacred sites, the general attachment people have to a place, and livelihoods ingrained in the place (Burdge and Vanclay, 1996). All these cultural factors ensure community sustainability. Participants, further identified the current problems with displacements that may encroach on or be experienced in the RE sector:

> *We were relocated from the farms and plots near Mbulelo mine and resettled some 10 km away from the mine; new homes were built, but there is a problem with the running water, and our cattle have been relocated far from the grazing areas, so we have problems with the provision of salt and cattle feed such that we are forced to take them back to the grazing lands* (Community Interviewee, C 5, 2021). *See Figure 13.*

Figure 13: Cattle grazing on degraded slopes in one of the mining communities

Source: (Thandiwe Chidzungu, 2021)

The impacts of relocations under coal mining may not be different from the impacts that displacements under the renewable energy sector will have on communities. Alluding to the issue of water, one participant turned it political and said, "*This new area where the mine moved us has problems with running water. "We need to change the people who rule us"* (Community Survey C.15, 2021).

This speaks to the political economy and poor governance in these communities, and this will encroach on the new economy under the renewable energy sector. Confirming the above view on the political economy were discussions during the 3rd Inkomati Basin Women in Water Conference (2021) that the researcher attended. Women raised the following inherent issues in the political economy of resettlements that have deep roots anchored within the land reform process in Mpumalanga that will impact the energy transition process, expressing that:

> *There is a separation of land and water rights in the land reform process. People were given land on which they have neither land nor water rights. There should be a way in which land rights can be linked with water rights, and the people with the most rights are the minority white farmers* (3rd Inkomati Basin Women in Water Conference Discussion, 2021).
>
> *While women want to leverage land and engage in farming as an alternative economy post-coal mining, it is only when you own land that you can qualify for a water rights licence* (3rd Inkomati Basin Women in Water Conference Discussion, 2021).

Alluding to the above narratives, another participant during the conference posited that:

> *We still have challenges in policy that need some amendment and, in some cases, simply enforcement. We still have challenges that are a legacy of apartheid land ownership and water rights that women face* (3rd Inkomati Basin Women in Water Conference Discussion, 2021).

The existing land reform policies will not change overnight but will encroach on the new low-carbon economy powered by renewable energy in Mpumalanga, which is at the centre of the energy transition in South Africa's coal industry.

Adding to the issues on grazing land, some large structures of solar panels were spotted near Kriel Power Station in Mpumalanga on arable land, and that gave a preview of how the situation might be under a fully-fledged solar panel installation programme as renewable energy is established. See **Figure 14.**

Figure 14: Solar panels on arable land in Mpumalanga

Source: (Fieldwork Material, 2022)

If these clusters of solar panels are to cover huge stretches of land, environmental sustainability and community sustainability may be compromised, as this may affect the availability of arable land, impact terrestrial ecosystems, and lead to further displacements of communities.

Elaborating on these potential displacements linked to the energy transition to the renewable energy sector, other participants expressed the following:

> *Communities affected by this transition to the renewable sector will have to be prepared to be uprooted to where they can be sustained, but this will have impacts on culture; there will be capital flight; technologies will be imported that will not absorb our people due to the specific skills required to use them* (Expert Interviewee, 14, 2021).

> *The energy transition from coal to solar will cause serious anxiety as rumours of massive job losses will be circulating; others may suffer from depression. Although this may be speculation, this will potentially result in a major job bloodbath, especially in the Mpumalanga region* (Expert Interviewee 11, 2021).

> *As coal companies' transition, there will be job losses, economic impact in terms of loss of production, loss of government taxes, slow economic growth,*

decreased household wealth, migration in search of opportunities, ghost towns, vandalism, devaluations of properties, family breakup, decreased household wealth, increased crime, increased unemployment, decreased standard of living, decreased quality of life, and closure of businesses (Expert Online Survey 18, 2021).

Schools nearby where we went as kids have been closed due to coal; however, we remained because we were born and raised here, we are comfortable here, and no one can just move us (Community Interviewee, C 2, 2021).

There is no doubt that social injustice and social inequity will be deepened in a just transition, from a responsibility perspective, in terms of human sustainability, not environmental sustainability. For example, a low-carbon economy is not human resource intensive; hence, there is a need to look at the issue of job losses so that you do not deepen poverty in the communities (Expert Interviewee 11, 2021).

Evident from these narratives is compromised community sustainability that will encroach on the renewable energy sector and be further deepened. This is likely to cause resistance from communities for several socio-economic reasons, especially the loss of jobs for coal workers. Hence, the impacts of the energy transition on this group were interrogated.

4.2.3.2. Coal Workers

With regards to the community sustainability perspectives of coal workers emanating from the energy shift, participants had this to say:

There are three types of coal workers: the settled workers (40–60-year-old age group), who have sent kids to universities, bought houses, and are well established, will be the most affected; the younger ones have portable skills, so they can find work anywhere; and the general workers will also be affected as competition for semi-skilled and unskilled labourers is rife in South Africa (Expert Interviewee 1, 2020).

Mirroring similar views on workers, one participant articulated that:

There will be job losses, which will deepen poverty. If the job losses are not mitigated, there will be implications for the labour force for both old and young

> *(40–50-year-old age group) workers. Older workers (60+ age group) will need pensions as they go for early retirement; retraining these workers will not be feasible. Middle-aged and young workers (below 40) will need to be compensated and retrained for absorption into new economic activities* (Expert Interviewee, 11, 2021).

In the case of age cohorts and skills needs, SIA can provide information on the population dynamics and skills profiles of communities that energy transition planners can use.

Other participants pointed out that:

> *There will be a potential loss of jobs and social and economic stress, but it is best to watch those countries already making this transition to see how they have dealt with it, then anticipate and mitigate these potential negative effects on workers by reskilling if possible* (Online Surveys Expert 3, 2021).

Other participants argued that *"socially, it will mean coal workers, who are also the main breadwinners, are not employed, which will call for the government to start issuing social grants that can help these people"* (Expert Interviewee 11, 2021), while *another expressed that "people will lose jobs and never get an opportunity to work again"* (Community Questionnaire K5, 2021).

Other participants argued that it will not only affect coal workers but will extend to workers along the coal value chain.

> *The Exxaro companies have set up small transport companies that transport coal from the coal plants to the secondary users, and these people come from the communities; if coal mines are closed, what happens to such businesses* (Expert Interviewee 11, 2021)?

> *If coal mines are closed, people will not get jobs. I work in town, and I notice people have lost their jobs through COVID-19, and even where I work at the guest house, we no longer get clients from Matla and Exxaro who will book there for 3 months, but now this month we only had two clients, and my boss did not pay me* (Community Interviewee K3, 2021).

> *Mining has a vast value chain; we are not only looking at engineers, miners, and artisans but other professions that benefit the mining industry and support the industry, for example, some professionals from the medical fields, education, and agriculture; for example, some of the mines have hospitals, clinics, and horticultural industries nearby; it is a complex sector* (Expert Interview 3, 2020).

In support of this view, another participant said:

> *South Africa must take leadership as its economy is coal-based, creating other avenues for income generation; the repurposing of these power plants is necessary; and the number of employees in the coal industry is too large. Not all of them can be realistically absorbed into the new economy* (Expert Interviewee, 14, 2021).

One community member in Carolina points to the large network of formal and informal businesses whose workers will be impacted along the coal value chain. See **Figures 15** and **16** below.

Figure 15: Informal kitchens in Carolina

Source: (Thandiwe Chidzungu, 2021)

Figure 16: Small-scale formal businesses

Source: (Thandiwe Chidzungu, 2021)

The photograph labelled "A" is of an informal kitchen/convenience shop that sells cooked food to the miners working nearby. It is just separated by the road from the mine. The photograph below A shows the researcher and an elderly lady who also sells cooked food to miners and other people who work in the city centre. The other photographs show a brickmaking company, a machinery selling and hiring company, and a transport company that provides trucks that ferry coal. Participants posit that all these economic activities will be impacted by the JET.

Some participants expressed the following on jobs and how they link to the coal industry:

> *This change to low-carbon technology will benefit us as a brick-making company, as we will have to reduce the number of employees if we change from the traditional coal-dependent methods of firing the bricks that require a lot of labour to using the kiln, which uses little coal but does not require a lot of workers; most of the workers will lose their jobs* (Community Interviewee C, 7, 2021).

Some participants in Carolina who were running food kitchens posited that coal mines are necessary because they also get to provide workers with food through their food kitchens, and it is a form of work, so they should not be closed.

Other participants then argued that "*if coal mines are closed, people will lose their jobs; as mines employ many people, it would be ideal if renewable energy were brought alongside coal mining to increase job opportunities"* (Community Interviewee C1, 2021). In addition to job losses, one participant said, "*The use of the new low-carbon technology in brick making is also dependent on electricity, and with Eskom's blackouts, it may affect productivity and impact negatively on jobs"* (Community Interviewee C, 7, 2021).

Other participants argued that another impact on coal workers was:

> *Employment conditions are going to be different under new management; new employers and conditions of employment will be different. Industries that were benefiting from coal will be shut down, and jobs will be lost. Support industries will collapse, such as boiler maintenance companies, as the shift may bring technologies that do not require boilers. Underutilisation of resources: coal plants operate 24 hours a day, but a photovoltaic power plant only operates during the day* (Expert Interviewee 3, 2020).

Other participants posited that:

> *There is nepotism, where "Abantu bangaphandle" (people from other provinces like KwaZulu Natal) with relatives in influential positions are being employed in the mines at the expense of the locals, and this will still happen with renewable energy* (Community Interviewee C2, 2021).
>
> *People have no jobs, and there is already a lot of corruption in employing people, full of nepotism, and solar power will reduce jobs if it comes and make things even worse for some of us* (Community Interviewee C6, 2021).

Alluding to the hiring of migrant workers and pointing to the reason the problem of hiring migrant workers exists is another participant from Kriel, who said:

> *The main problem with the mine is not jobs. The local people want jobs, but they do not have the qualifications, let alone a matriculation qualification, so jobs are given to people from other provinces, like the Limpopo Province* (Community Interviewee K9, 2021).

One participant then expressed the following about renewable energy:

> *It creates jobs where there were none, so let the migrant workers go back to their homes to start where they came from; you can have a solar plant in Limpopo or in the Sahara, where there are no jobs. It will make jobs more equitable* (Expert Interviewee, 5, 2020).

In conclusion, the myriad community sustainability issues that coal workers will face were identified. This also had a multiplier effect on workers along the coal value chain, both in the formal and informal sectors. Job losses, hiring of immigrants at the expense of locals, skills shortages, changes in employment conditions, and loss of business in informal and formal industries along the coal value chain. One major problem that was identified was the skills development gap among the workers as the JET introduced new job designs, and this aspect is presented in the next section.

4.3. Skill Development Needs in a Just Energy Transition

The skill development needs within JET were taken from the second key question: ***What is the skill development needs within the Just Energy Transition from coal to renewable energy in the coal industry in South Africa?***

After asking questions about the skill development needs of communities, perspectives on skill needs in educational institutions followed. Lastly, the role of industry and labour in the reskilling of the labour force to be fit for purpose within the JET context was interrogated.

4.3.1. Skill Development at the Community Level

It was critical to investigate the realities, challenges, and perceptions that impacted communities and workers have about skill development needs in the context of a JET. Participants had this to say:

> *There is a substantial change in the skills needed; people's attitudes need to change towards the coal energy system; it is important not to create new externalities; train people on climate change and the impacts of chemicals in the physical environment on people, animals, and even new ways of producing*

food; and the curriculum needs to simply feed into the green economy (Expert Interviewee 1, 2020).

Alluding to the same sentiments, one participant pointed out that:

> *Going forward, the jobs of the future may not be available for coal workers. Casual workers might not have jobs going forward because the jobs in the green economy will be skills-intensive, hence the need for educational institutions to redesign the curriculum* (Expert Interviewee 4, 2021).

One participant expresses another challenge of reskilling from a gender perspective:

> *As women, we find it difficult to get employed by the mines because, as diesel mechanics, we can only work under certain conditions in terms of the machinery that is compatible and appropriate. Mines do not want to incur additional expenses as these machines are expensive, and if they are found without them by safety officers, they are fined. So how would we be considered for reskilling in renewable energy if we were not employed by these mines* (Community Interviewee C1, 2021)?

Notable is that there are gender disparities that may encroach on the renewable energy sector's reskilling programmes. Other participants posited the following:

> *Why reskill someone who already has a job? Why not go to the unemployed youths and reskill them for purposes in line with the available employment opportunities? Go and skill people in Limpopo to produce power from the sun* (Expert Interviewee, 5, 2020).

> *If mines are closed, we will lose our jobs because mining is the only work we have ever known in Kriel, and if it is reskilling, it is reskilling to do what at 50 years of age?* (Community Interview K8, 2021).

> *One problem with coal mining is that it uses contractors, and we are employed under a contract. Hence, once the contract ends, it is the end of our jobs, and we cannot be absorbed by the company; hence, there is no way we could be reskilled* (Community Interviewee, C1, 2021).

> *There will be an increase in unemployment as most of the labour required for renewable energy projects is during the construction phase, in comparison to coal, meaning coal provides far more positive socio-economic opportunities in comparison to renewable energy* (Expert Interviewee 3, 2021).

Despite the challenges in reskilling that the workers are likely to face considering the age groups and the issue of contract work, those who will be involved in construction will gain new skills in this sector.

Another participant supported the idea of reskilling, expressing that:

> *Reskilling is something that we are interested in, but is it reskilling to do what? Other sectors can be investigated as well; for example, mine land can be used for agricultural businesses with AMD-impacted land for fibres, bamboo flooring, ham textiles, phytoremediation, and so forth; we need to compete with countries like China, but we need not be myopic* (Expert Interviewee, 4, 2020).

> *If the government gives in to climate mitigation policies and closes coal mines, workers must be reskilled. While power generation workers will be the most affected because they are highly specialised, coal miners are not highly specialised, so they are easy to retrain. If there is work for coal miners and mines are kept open, other economic activities that serve the communities will also be sustained (Expert Interviewee 5, 2020).*

One coal worker had this to say:

> *"We are experienced in opencast mining, not solar." "We, therefore, need training"* (Community Questionnaire, K1.2021). One participant argued that there may be challenges in getting training and expressed that, *"If coal mines close and they bring renewables, it will be worse as people are not educated and these jobs require skill* (Community Interviewee, C9, 2021).

One participant involved in security around the mine had this to say:

> *The main problem with our local people is that they want jobs, but they do not have the qualifications, let alone a matriculation qualification. After a heated employment protest, they were asked to bring their matriculation qualifications for consideration for employment the following day, but only a few managed;*

the big crowds did not turn up the following day, so where do you start training them without a simple qualification? (Community Interviewee K9.2021).

Most of the youth lack formal training, and the introduction of renewable energy will exacerbate the skills shortages because these modern technologies require a high level of skill (Community Interviewee, C19, 2021).

One expert during the WindAc conference presentations on wind energy posited that *"Because South Africa does not have a perfect way of integrating their energy systems, research and academia are needed"* (Professor F, 2021).

Considering the above comments, the skills needed within a JET context will require a serious rethink of the curriculum in institutions of higher learning.

4.3.2. Skill Development within Educational Institutions

The educational profiles of the two study areas were examined as a starting point to interrogate the status quo of the skill development needs within the educational institutions in the study areas. The official statistics used came from the Stats SA Community Survey (2016) and the Census (2011). This was also based on secondary data from the IDPs, SLPs, and profiles of Kriel and Carolina's local municipalities. These statistics provided credible and reliable statistics for the study that the researcher could not have gathered herself due to funding limitations, experience, and the magnitude of the exercise. The qualitative participant narratives gathered through interviews, surveys, and input from presentations and discussions during conferences the researcher attended supported them.

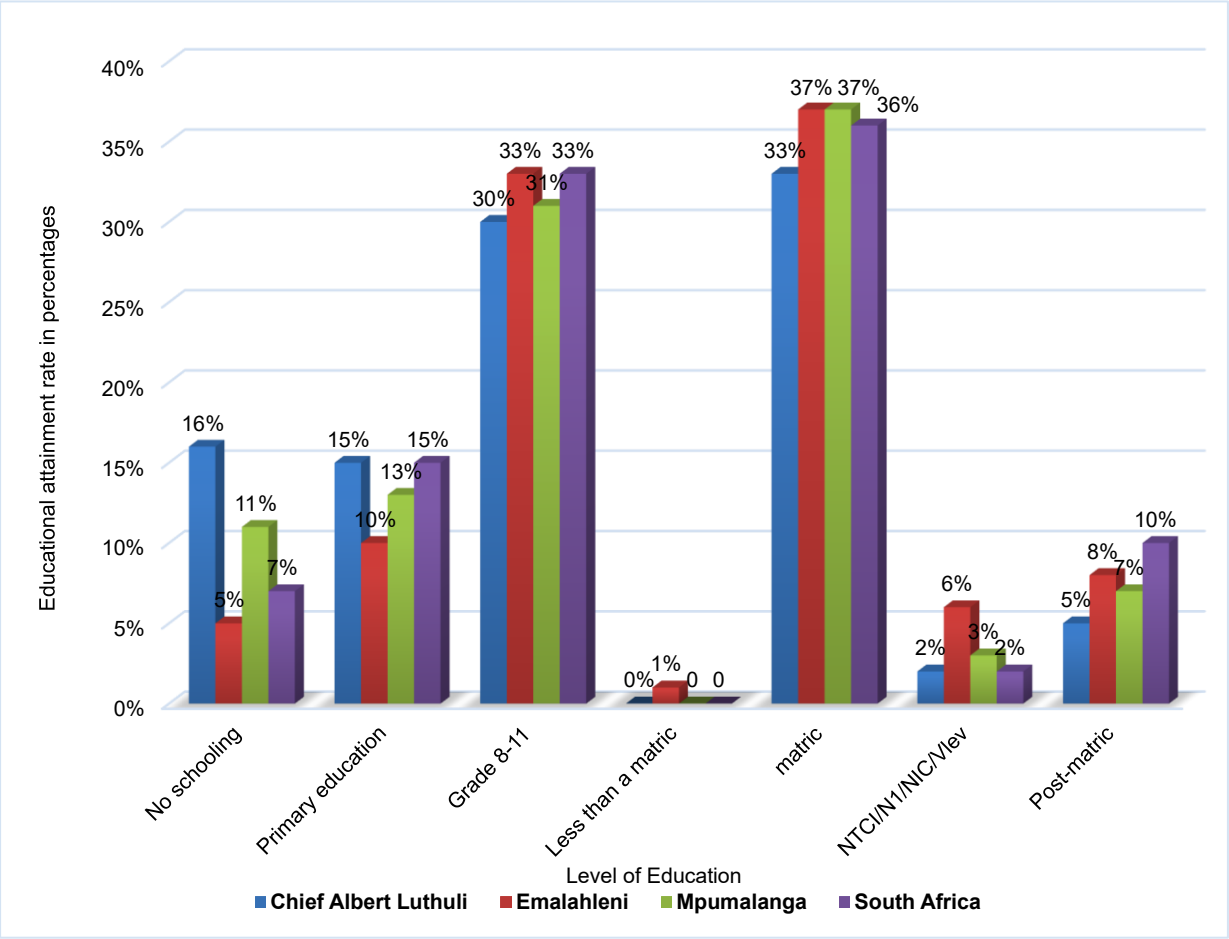
In the Gert Sibande District Municipality, which houses the Chief Albert Luthuli Local Municipality of Carolina, there is only one tertiary institution, the Gert Sibande TVET College, with six campuses located in the towns of Standerton, Perdekop, Evander, Balfour, Ermelo, and Sibanesetfu (Kisengese and Wangare, 2022). Gert Sibande TVET offers such courses as basic computer literacy, labour relations, business studies, and office administration, and these may not be the most relevant courses to feed into the JET skills development. Courses in mechatronics, electrical infrastructure, and

engineering are offered at the national certificate level, which requires further training (Kisengese and Wangare, 2022).

There is now one Further Education and Training (FET) college in the Nkangala District, which comprises the Emalahleni local municipality of Kriel, with five campuses: Steve Tshwete (Middleburg campus), Emalahleni (Mpondozankomo and Witbank), Dr. J. S. Moroka (CN Mahlangu), and Emakhazeni. In addition, the Nkangala Draft IDP (2017–2022) indicates that in order to ensure that the FETs contribute to filling the skills gaps in the province, a retention strategy incorporating, among other things, scholarships, employment possibilities, and internship programmes needs to be agreed upon with the business sector (Nkangala Municipality, n.d.). The current state of limited educational institutions poses a challenge in terms of skill development and educational achievement rates. Education levels were considered from primary school to tertiary education to determine progression and potential as we contemplated the JET.

According to the Community Survey (2016), the Chief Albert Luthuli Local Municipality, which houses Carolina, showed 16% with no schooling, 15% with primary education, 30% with grades 8–11, 0.2% with less than a Matric, 33% with a Matric, 2% with an NTCI/N1/NIC/Vlev, and 5% with a post-matriculation qualification (degree or higher). In Emalahleni Local Municipality, which houses Kriel, 5% had no schooling, 10% had primary schooling, 33% had Grades 8–11, 1% had less than a Matric, 37% had a Matric, 6% had an NTCI/N1/NIC/Vlev, and 8% had a post-matric qualification [degree or higher]. See **Figure 17** overleaf.

Figure 17: Educational levels within South Africa, Mpumalanga, Chief Albert Luthuli, and Emalahleni local municipalities in Mpumalanga South Africa



Source: (Adapted from Community Survey, 2016 in Wazimap, n.d.)

The introduction of the TVET college in both municipalities is argued to have progressed people from less than matric to having a TVET qualification, according to the Integrated Development Plan 2020–2021 (Chief Albert Luthuli Municipality, n.d.).

Data was further gleaned from available sources in Emalahleni's Kriel Colliery. Some figures depicting skills development efforts from a secondary source were obtained to get a glimpse of what learnership programmes are in place for the future needs of the energy industry. See **Table 5.**

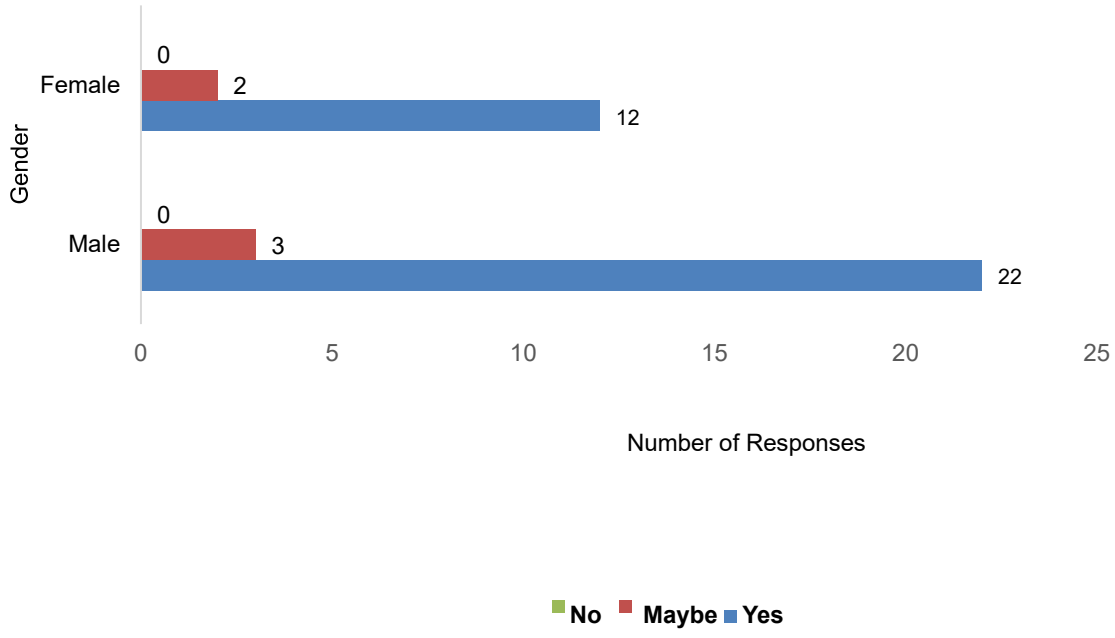
Table 5: Learnerships and other training plans at Kriel Colliery

Discipline	Target 2014	Target 2015	Target 2016	Target 2017	Target 2018
Electrician	15	15	15	15	15
Fitter	14	14	14	14	14
Boiler maker	3	3	3	3	3
Diesel mechanics	7	7	7	7	7
Mechanic	2	2	2	2	2
Rigger	3	3	3	3	3
Total	**44**	**44**	**44**	**44**	**44**

Source: (Adapted from Kriel SLP, 2014–2018 in AngloAmerican, n.d.)

It is notable that some of these skills may need some upgrades as they are transferable, although some will not be relevant. A new set of skills needs to be developed with the JET framework in mind. This raised questions about whether educational institutions need to rethink the curriculum to suit the Just Energy Transition context. A poll was conducted among the participants. See **Figure 18.**

Figure 18:A Rethink of the Educational Curriculum in a Just Energy Transition: Expert Responses According to Gender

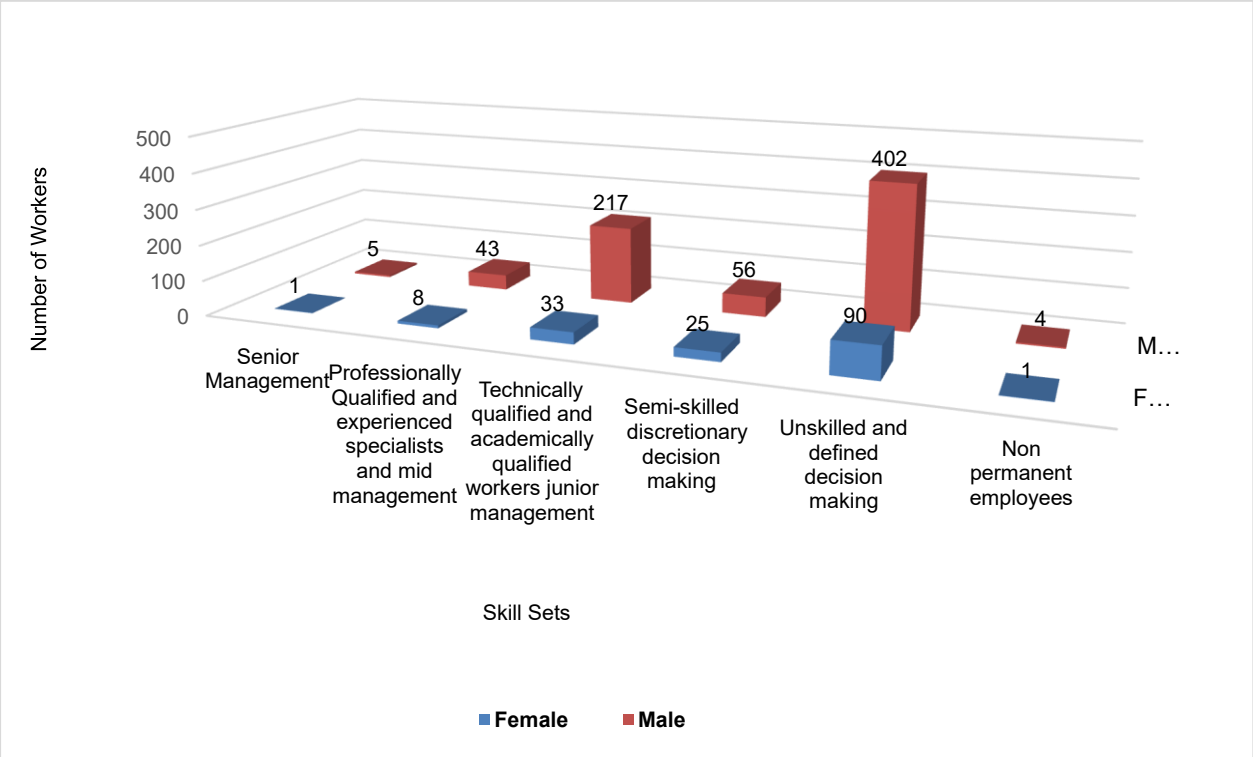


Source: (Based on Online Surveys, 2021)

34 of the participants out of the 39 experts who responded to this question said ***yes,*** there is a need to rethink the curriculum, while only 5 said ***maybe,*** and none were against this proposition. Of these respondents, only 14 were women, illustrating the nuances of gender inequalities in the active involvement of women or their interests in developmental matters.

It was, therefore, imperative to check the gender versus the skills in Eskom's Kriel's Colliery, which also depicts the systematic challenges for education in this context. See **Figure 19.**

Figure 19: Employment equity and skills distribution by gender for Kriel Colliery (Q1 2014)



Source: (Adapted from Kriel SLP, 2014–2018 in AngloAmerican, n.d.)

Figure 19 above depicts gender disparities, with the number of skilled male employees outweighing the number of skilled female employees.

The Kriel SLP (2014–2018) also points to racial disparities, with whites occupying more skill-intensive positions relative to black people and other races (in AngloAmerican n.d.).

Some expert participants expressed that:

Our country has a university structure that is reluctant to make our students industry-ready; for example, it is difficult for local universities in South Africa to collaborate with big turbine companies for wind energy, so there is a need for climate change education (Professor F, 2021).

We have been dealing with the conventional approach in the education system for quite a while, considering that the system is currently strained. Either we need a different sectoral approach to training for this transition or we need to set up institutions that will train for this transition only. We also need to find out what kinds of skills will be needed in a just transition economy. We need to be agile and adapt our education, which is currently strained in terms of dealing with basic things; hence, we need a different approach (Expert Interviewee 11, 2021).

We have a university model based on the European model that is more theory-based. However, we need universities that train students in practical skills at the university level, and students can take the initiative by volunteering (Professor F, 2021).

From these sentiments, one questions the readiness of the South African universities to tackle the energy transitions going forward in terms of curriculum development. This raised questions about what reskilling programmes are being put in place by the energy industry and government as JET unfolds.

4.3.3. The Role of Industry and Government in Skill Development in a Just Energy Transition in South Africa

The types of reskilling plans to meet the skill development needs that are in place in the industry and the government were presented. Participants expressed the following:

Yes, Eskom has been reskilling some of its employees in the power stations that will be closed soon for absorption in the RE sector as these power plants will be repurposed for renewable energy production (Expert Interviewee 15, 2021).

Eskom, as the focal point of South Africa's JET, has made efforts to reskill some of its employees in preparation for the inevitable decommissioning and repurposing of coal plants for renewable energy; however, there are still hurdles in the case of contract workers who must be incorporated into the reskilling programmes after the contract has ended, as well as the unemployed active group with qualifications that can be harnessed for purpose through upskilling in the renewable energy sector (Expert Interviewee 10, 2020).

Eskom, in its decommissioning plans, has indicated in the commercial engagement that they need to address skills development, so it is something in the pipeline (Expert Interviewee, 11, 2021).

Other organisations are also rallying behind Eskom. Participants said the following:

South Africa's National Energy Association is working to get grant funding to conduct an energy skill baseline for South Africa in partnership with the BRICS Business Councils, and the Africa Energy Leadership Centre is trying to get funding to help with the transition (Expert Interviewee 11, 2021).

The Mine Water Coordinating Board (MCWB), alongside its members, the Mineral Council of South Africa, Anglo American, South 32, the Department of Mineral Resources (DMR), the Water Research Commission (WRC), AGRIC, Exxaro, and the Mpumalanga Provincial Department, are looking at reskilling the labour force from the coal mining sector into jobs of the future, looking at mine water, mine land, and mine infrastructure as enablers of the new green economy (Expert Interviewee 2, 2020).

Other collaborations on JET reskilling programmes were also mentioned:

The South African Renewable Energy Master Plan is a good example of how the industry is collaborating with trade unions to look at vulnerable industries that are likely to suffer from the coal transition to the renewable energy sector (Expert Interviewee, 11, 2021).

Other sector organisations like the Mineral Council, the National Union of Metal Workers of South Africa (NUMSA), and the Thermal Energy Storage and Saving Association (TESSA) have had dialogues about what is necessary and what is

to be done for skills development in a just transition from coal to the low carbon economy (Expert Interviewee 11, 2021).

One participant then posited that:

> *The local government and municipalities will be the implementing agencies for the Circular Green Economy (energy transition from coal to the renewable energy sector); they will make sure that the projects happen at the national and provincial level, and then the municipality will ensure the sustainability of the projects (*Expert Interviewee 2, 2020).

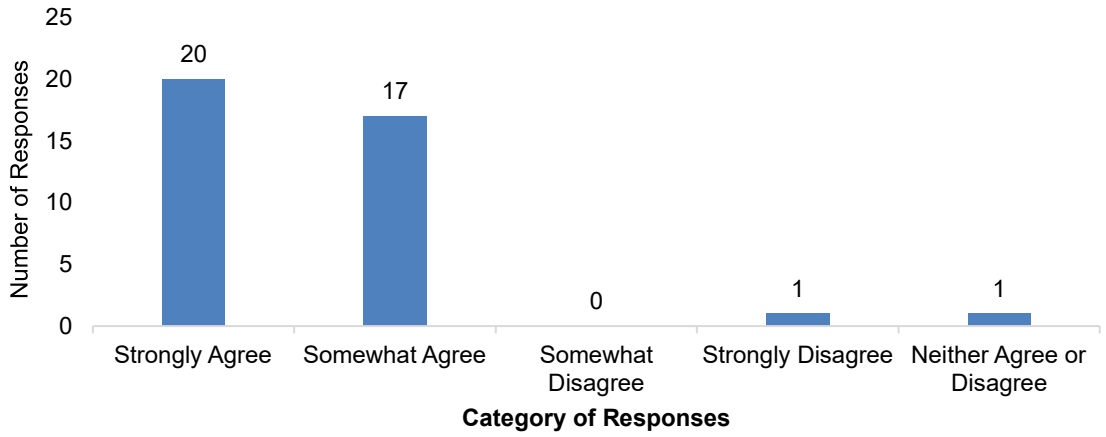
SIA teams are composed of several specialists, including those from academia, industry, and civil society, involved in the assessment of areas, so they can be better placed to influence skills needs and community well-being impact assessments. Nonetheless, the issue that arises is whether SIAs can effectively assess and address the myriad social costs of JET.

4.4. Social Impact Assessment as a Strategy for Assessing and Addressing the Social Impacts of the Just Energy Transition

This section attempts to answer key question **3:** ***Can SIA be an effective strategy for the assessment and addressing of the social impacts of a JET from coal to a low-carbon economy on the affected communities in the Carolina and Kriel mining communities in Mpumalanga?***

Initially, a poll was used to determine whether participants thought SIAs could effectively assess and address the social impacts of JET. See **Figure 20**. Interview questions, then explore how SIA does this.

Figure 20: The Respondents' View on Social Impact Assessment as a Possible Tool to Provide a Sustainable Strategy for Assessing and Addressing the Social Impacts of the Just Energy Transition



Source: (Based on Online Surveys, 2021)

According to **Figure 20**, 51.28% (20) ***strongly agree*** that SIAs could help develop a sustainable strategy in these transitions, followed by 43.59% (17) who ***somewhat agree***, 2.56% (1) who ***neither agree nor disagree***, 0.00% (0%) who ***disagree***, and 2.56% (1) who ***strongly disagree***.

The responses showed that most participants supported the idea of SIA as a sustainable strategy for assessing and addressing the social impacts of energy transitions. This was further verified through the responses given in the interviews and survey questionnaires.

The participants expressed the following sentiments about SIA's effectiveness in assessing and addressing the social impacts of JET: One expert articulated that:

> *To create an alternative economy, we need to understand the population, education, and skill sets of local people so that SIA, through its social profiling, can effectively assess and facilitate some understanding* (Expert Interviewee 1, 2020).

> *SIA helps address impacts by bridging the gap between project proponents and communities. As you cannot make decisions for people without consulting them, as you transition, you have an impact on their farms, land, way of life, culture, and even economic activities; therefore, as you understand these, effective*

assessments and the addressing of impacts are ensured (Expert Interviewee 7, 2021).

Alluding to the above view, one participant expressed that:

> *We need the buy-in of communities if any project is to work. Mines have learned that lesson over the past 20 years. Communities are complex in South Africa; we have native communities and communities that were brought in because of the mine. We, therefore, need to understand the structure of communities to effectively assess and address issues. Intensive public participation and SIA can help with this* (Expert Interviewee, 2, 2020).

Other participants expressed that active citizenship is a prerequisite for the effective assessment and addressing of the socio-economic impacts of JET, expressing that:

> *In the South African mining industry, people should be part of co-creation, they cannot, however, engage in contributing to solutions. SIA engagements can empower communities for active citizen participation* (Expert Interviewee 4, 2020).

> *SIA does away with the world of command and control. You must take people with you; they need to understand the decisions you are making, especially if they impact them. You get more educated employees and more informed communities, and they help you improve your value offering in terms of what you are doing* (Expert Interviewee 5, 2020).

> *SIA facilitates communication and open engagement with communities, as there is a need to be truthful and pragmatic about the fact that there will be job losses and not everyone will be absorbed* (Expert Interviewee 3, 2020).

One participant argued that:

> *SIA must be done deeply and by very experienced and knowledgeable entities to enable the navigation of such complex and uncomfortable issues as JET. Other tools that evaluate a business's value chain within a community must go along with them. Keep the space open for ideas, innovation, and suggestions as you are dealing with complex issues that need one to assimilate them* (Expert Interviewee 11, 2021).

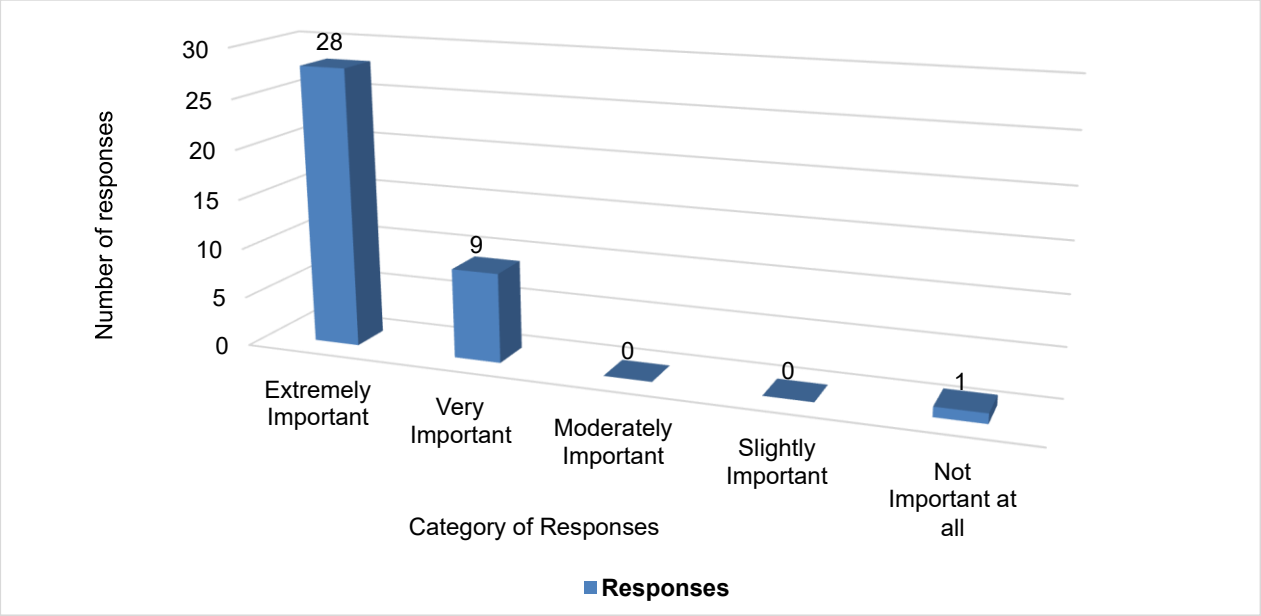
SIA is critical in assessing the benefits that local communities derive from the existence of mines or power stations. There are a lot of people who do not work in mines or power plants but whose businesses are thriving because of the personnel working in these areas. Shutting down the mines for renewable energy will also mean that a lot of livelihoods must be shut down; this will also translate to a sudden spike in crime around the area (Expert Interviewee, 15, 2021).

SIA is key to assessing all the issues and mitigation measures that can be implemented to better manage the challenges. SIA can also give an idea of whether the local community will resist the change and, therefore, sabotage it. Any corporate change that does not have the support of the community is non-existent (Expert Interviewee 15, 2021).

The ability of the SIA tool to help people understand the structure of complex mining communities and correctly identify impacts and opportunities is key to how well it can be used to measure and deal with the social effects of JET. As well as facilitating open engagement between project proponents and communities.

A survey was, therefore, carried out with the expert group on the importance of public participation in the SIA process. See **Figure 21.**

Figure 21: Importance of public participation in the SIAs process and expert views

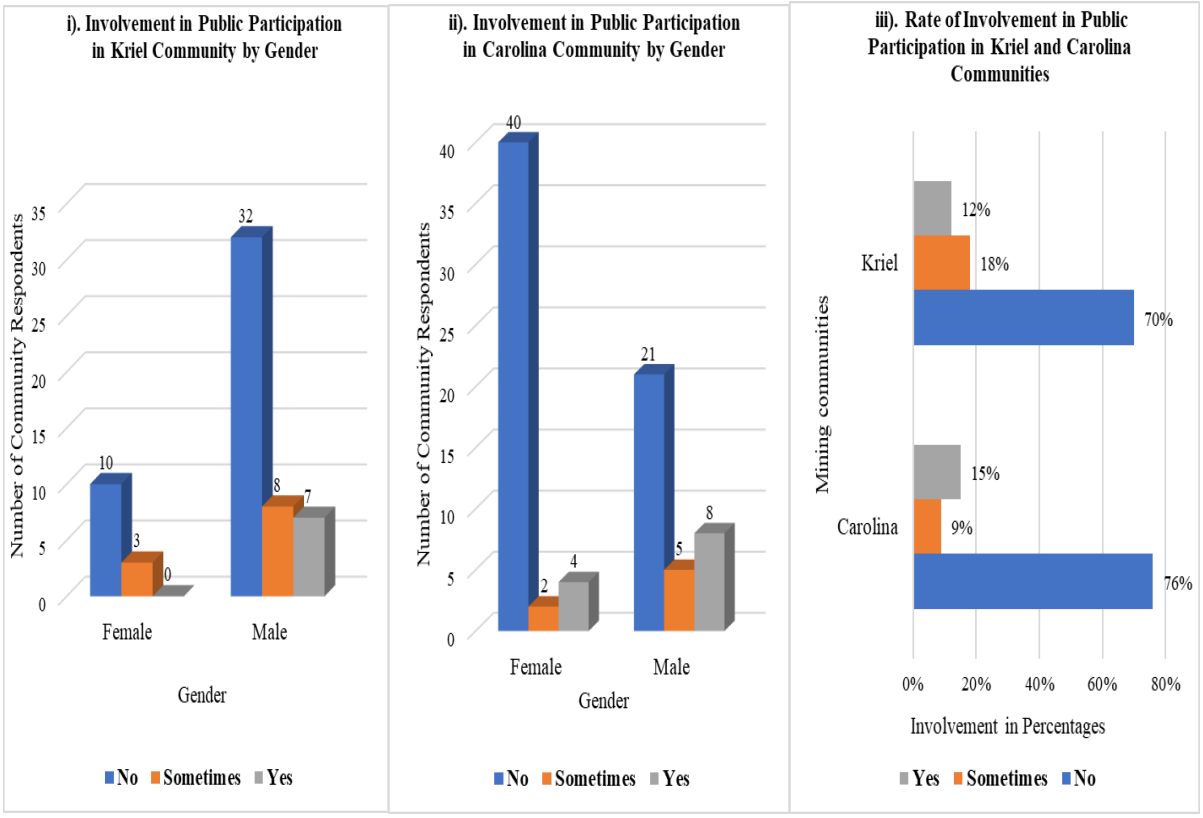


Source: (Based on Online Surveys, 2021)

Only 38 participants from the expert group responded to this question. 28 (73.68%) of the 38 respondents said public participation as part of the SIAs process is ***extremely important***, while 9 (23.68%) said it is ***very important***, and only 1 (2.63%) said it is ***not important*** at all.

Since public participation was deemed an important part of the SIA process, community groups were thus questioned about whether they were involved in this important process. See **Figure 22** overleaf.

Figure 22: Community involvement in public consultation during energy projects



Source: (Based on Fieldwork Surveys, 2021)

Of the 80 participants from Carolina who took part in the survey, 76% said ***no***; they are not involved in public participation, and of the 60 participants from Kriel, 70% also responded with a ***no***. 9% from Carolina and 18% from Kriel said ***maybe***. Only 15% of Carolina and 12% of Kriel said **yes**; they engage in public participation. Males have been more involved in public participation in both sectors than females. Participants expressed concern that their exclusion from energy transition planning would jeopardise the project's acceptance.

One participant argued that:

> *The SA mining industry does not take people along as it develops. People should be part of co-creation, and this may continue into the renewable energy sector* (Expert Interviewee 4, 2020).

The interviewees stressed that communities are unable to engage in effective public participation, while others stated that "community forums that represent the community in the mine have taken the place of public participation" (Community interviewee K4, 2021). Another one said: "*Public participation only exists on paper as a formality, and people cannot engage effectively in contributing to solutions unless they are empowered"* (Expert Interviewee C20, 2021).

> *Engaging with the public does not mean you can work with everything they bring up; however, the public needs to be aware of the consequences of this transition. You cannot expect a large conglomerate to deal with complex and contentious issues without first gaining a thorough understanding of them from communities and other impacted stakeholders (Expert Interviewee 11, 2021).*

One participant who expressed support for this viewpoint stated:

> *We should not be abused by opportunists when doing public consultation because it usually involves a lot of "politicking," but people should be taken along and be able to inform the decision-making process* (Expert Interviewee, 5, 2020).

Some female participants expressed that public participation is set aside for community leaders, and these are men who tend to push their agenda while women's needs are overlooked. They expressed the following:

> *We feel helpless as women to partake in public engagements with these mining companies because they do not employ us; public participation, to me, is a waste of time, and even if renewable energy comes, this will not change for us* (Community Interviewee C1, 2021).

> *I do not know anything about public participation. "Abadala" (meaning the father) is the one who attends the public participation* (Community Interviewee, 3C, 2021).

We are not involved in public participation; mines do their own thing after putting memoranda on notice boards along the roadside, and they say we were informed (Community Interviewee C17, 2021). See **Figure 23**.

Figure 23: Public participation notice board on the farms near Carolina belonging to the local municipality

Source: (Fieldwork material, 2021)

In the town of Carolina, memoranda inviting communities to comment in writing on mining developments are put on the notice board at the magistrate courts, while in the nearby farms they are just placed on noticeboards in open spaces. The local government already does this to inform nearby communities about mining developments, and JET might continue this practise.

One participant had this to say:

> *In a democratic state, it is crucial for the public to be engaged and given opportunities to participate in matters that affect them both directly and indirectly; therefore, public consultation is not only a legal requirement but an important part of any development by allowing communities to be part of the development from inception (Expert Interviewee 6, 2021).*

The recognition of a myriad of social costs of development in all its evaluations gives SIA its flair for improving public participation and being an effective strategy for the assessment and addressing of the social impacts of a JET from coal to a low-carbon economy on the affected communities. These attributes further afford the SIA tool the

ability to influence and feed into social-oriented policies within the JET context, and this is discussed in the next section.

4.5. Social Impact Assessment as an Entry Point to Government Policy in a Just Energy Transition

SIA as an entry point into the JET policy environment addresses Key Question 4: ***Can SIA provide an entry point into government policy in a Just Energy Transition from coal to the renewable energy sector in South Africa?***

This section is divided into two sections that comprise the perceptions participants have on the policy environment in the coal sector and the perceptions they have on policy in the JET context.

4.5.1. Perceptions of the Policy Environment in the Coal Sector and the Role of Social Impact Assessment

The role SIA could play as an entry point to JET policies was explained against the backdrop of the policy environment in the coal sector. The participants expressed the following about the policy environment in the coal sector:

> *Policy uncertainty remains a challenging factor in South Africa's mining industry; consequently, whichever policies are put in place, they must consider the economic sustainability of each affected community* (Expert Interviewee 6, 2020).

Other experts posited that:

> *I do not like policies because they are driven by those who enact them, and policies do not drive entrepreneurship; however, I am happy with policies and mechanisms whereby the government is always there to provide a level playing field, allow every player to play, and create an enabling environment to incentivise such opportunities* (Expert Interviewee 5, 2020).
>
> *In general, given that policies always create winners and losers, there can be an effort to have the winners compensate the losers. Many policies can*

encourage renewable energy while considering the equity and distributional impacts that a decline in coal may create; for example, the revenue from a carbon tax could be recycled to compensate coal workers who lost their jobs due to a related decline in the coal industry (Expert Interviewee, 13, 2021).

I am always disappointed that a coal mine like Kriel is paying tax to the government and that the money is used by the national government and invested in projects or communities elsewhere at the expense of the Kriel communities. Something is wrong with the policy (Expert Interviewee 5, 2020).

According to the old National Water Act, we are not allowed to irrigate with mine water or impacted water; however, 20 years' worth of research has shown that there are a lot of advantages to monitoring, reporting, and auditing. The Department of Water is looking at mine-impacted water to make sure it is fit for purpose and looking at legislation to make sure it is done properly (Expert Interviewee 2, 2020).

Incentivise industries such that they go beyond their core business; for example, if you are in the coal industry, you are not allowed to produce or generate our electricity; you can only apply and get 1 megawatt. A change in policy in this regard, as far as the renewable energy sector is concerned, is imperative (Expert Interviewee 4, 2020).

The coal value chain needs to be minimally phased out, while financing for fossil fuels globally must end (Expert Online Survey 4, 2021).

Thus, all these perceptions about policy speak directly to the socio-economic aspect of policy, which SIA can potentially leverage as a policy entry point.

4.5.2. The role of Social Impact Assessment in the Just Energy Transition policy environment

This section discussed the role of SIA as a policy entry point focused on skills development and community sustainability issues.

4.5.2.1. The role of Social Impact Assessment in a Just Energy Transition skills development policy context

Some participants focused on the labour skills development needs during policymaking in JET Planning, expressing that:

> *SIA can influence policy to enforce that RE projects absorb and reskill a certain percentage of labour from the coal sector, although this could be a challenge as coal mines in South Africa are restricted to the Mpumalanga Province, where there are minimal RE projects* (Expert Online Surveys 2, 2021).
>
> *Policy should ensure that industries have committed financial resources to continue with some of the projects at a lower scale and provide reskilling for employees in their management of mine downscaling* (Expert Interviewee 5, 2020).
>
> *SIA reports can influence the government to enact policies that increase local authorities' capacity to deliver services, identify other economic opportunities for investors outside of coal mining, and focus on skills development, especially portable skills in the renewable energy sector* (Expert Online Survey, 32).
>
> *As part of reskilling policy advocacy, SIA can recommend that the government mandate industry to incentivise communities and other workers within the coal value chain to explore or work in other sectors while they reskill and retrain workers involved in the coal sector value chain* (Expert Online Surveys 1, 2021).
>
> *SIA could advocate for a policy that considers cross-sectoral perspectives to identify other sectors that could benefit from renewable energy, like agriculture and tourism, and work towards job reskilling and job creation there as well* (Expert Online Surveys 3, 2021).
>
> *The government should enact smart coal mining policies, such as taxing the polluting companies and using the money to develop and reskill communities in different economic activities in the low-carbon economy (Expert Online Survey, 35, 2021).*

Considering the above views, SIA can identify potential opportunities in skill development and how they can be leveraged. Such input from SIA can inform policy

formulation within a JET skills development policy framework. Other participants discussed the role of SIA in policy from a community sustainability standpoint.

4.5.2.2. The Role of Social Impact Assessment in a Just Energy Transition Community Sustainability Policy Context

Other participants' views explained policy from a community sustainability perspective:

> *You can build a solar plant anywhere in Africa. In all those areas where there is coal, the building of solar plants could be part of the government's policy plans. Where there is coal mining, a substation to transmit electricity, and a labour force that can be absorbed, the community and the labour force therein will not die completely (Expert Interviewee 14, 2021).*

> *There should be a fine balance between putting up massive solar plants and food security, and the government should put in stringent regulations to manage where these solar plants are erected* (Expert Interviewee, 2, 2020).

Other participants had this to say:

> *Policy should mandate RE industries and potential investors to set up innovation hubs to start new businesses and train the youth in Mpumalanga, and the government should put in tax incentives for new industries set up in the affected areas* (Expert Online Surveys 34; 5; 2021).

> *The government should also make sure that packages are made available for those employees who were in coal mining, especially for those that are now at or are approaching retirement age, so they can get into entrepreneurship in the new economy and create more employment (Expert Online Survey 20, 2021).*

Evident in these findings are age considerations and tax incentives for both impacted communities and businesses that SIA can advocate for in its evaluations.

Other participants shared the following sentiments that policymakers should consider:

> *Clean water from power stations should be repurposed to support regional economic initiatives, and reforms should be initiated to scale agriculture, which should be supported by agriculture extension workers. Clean-up initiatives should be taken, and coal assets should be repurposed* (Expert Interviewee, 1, 2020).

Some participants argued that SIA engagements should recommend that employment recruitment processes be regulated to check if locals are given priority. Others advocated for the enactment of relocation policies and expressed the following:

> *Livelihoods will be jeopardised as previously displaced communities face a second round of relocations because of the energy transitions; thus, the government should prevent this through policy* (Community Interviewees 1, 2, 5, 7, and 9, 2021).

> *SIA can facilitate the enactment of community-centred policies that will compel the RE industry to involve communities in decision-making using a bottom-up approach and move away from government and industry-centred approaches (Expert Interviewee 7, 2020).*

> *SIAs teams can open platforms for industry to engage with communities and municipalities, study their LEDs and IDPs to know and understand their plans and SLPs, and align the energy transition projects within the LEDs and IDPs to use the input to influence government policy* (Expert Interviewee 5, 2020).

4.6. Conclusion

In summary, this chapter presented the detailed results of the data collected from the Kriel and Carolina communities through in-depth, semi-structured face-to-face interviews and questionnaires that were given in person, as well as the data collected from experts through online semi-structured interviews and survey questionnaires. Demographic data came from the Mpumalanga Local and District Municipalities' IDPs, Community Surveys (2016), and Census (2011).

Sustainability Perspectives

The biophysical effects of fossil fuel combustion, which cause climate change and frequent droughts, floods, snowmelt, and other events that threaten environmental sustainability, have social and economic effects on food security, health, and economic productivity, which threaten community sustainability. Using renewable energy sources like wind and solar is expected to have more positive biophysical effects than negative ones, which will improve community and environmental sustainability.

Skill Development Needs

The results show that a low aptitude towards STEM subjects and low educational attainment among matriculating learners in the Mpumalanga local and district municipalities, the province, and the country influence the ability of students and young people entering or already in the job market to take on jobs that require technical skills in the RE sector. To reduce the effects, SIA could recommend that the government give tax incentives to the RE industry and training institutions that open training and innovation hubs to train the youth in STEM subjects for easy absorption in the low-carbon economy.

SIA as a Strategy for the Assessment and Addressing of the Social Impacts of the Just Energy Transition

Key to SIA's effectiveness as a strategy for assessing and dealing with the social impacts of JET is its ability to help people understand the structure of complex mining communities, correctly identify impacts and opportunities, and encourage open communication between project proponents and communities. As JET develops, it will affect people's farms, land, way of life, culture, and even economic activities. SIA is able to assess the magnitude and intensity of these social impacts and how they can be managed and addressed through its work with communities, regulatory bodies, the private sector, and project proponents.

SIA as a Policy Entry Point within a Just Energy Transition Context

Findings from the study demonstrate that SIA reports can advocate that government policy spearhead the creation and improvement of physical and social infrastructure that is responsive to social change and the changes in the means of energy production as the JET unfolds. Considerations on land reform, repurposing of coal infrastructure, protection of livelihoods, and pro-local recruitment policies that SIA could advocate for are highlighted. As part of policy advocacy, the study submits that SIA could recommend an in-depth interrogation of existing policies and the alignment of IDPs and LEDs with community needs in the context of a JET. SIA could also advocate for training policies that give locals priority and reduce racial and gender discrimination in skill development. SIA’s inclusive collaborations promote buy-in from local communities and other affected

stakeholders, including the government and the private sector, giving SIA the ability to influence socially oriented policies within the context of JET.

CHAPTER 5

Analysis and Discussions

5.0. Introduction

The chapter discusses the empirical findings of the study presented in **Chapter 4**. The perceptions that participants have of JET are discussed as a preamble to the discussion chapter. The findings for the four key questions are then discussed in depth using the four defined themes or categories presented in **Chapter 4**. Firstly, the findings on the sustainability perspectives of a JET are discussed. Secondly, the findings on the skills development needs of workers exiting the coal industry to a low-carbon economy as JET unfolds are discussed. Thirdly, a discussion of the findings on SIA as an effective tool for assessing and addressing the socio-economic impacts of a JET in the coal sector is presented. Lastly, the findings on the potential of SIA as an entry point to government policy in the JET are discussed.

5.1. Participants' Perceptions of the Just Energy Transition

In this section, the perceptions participants had of the JET are discussed to gauge the level of understanding and the prevailing attitudes towards this radical energy shift.

Some of the experts perceive JET as a potential climate mitigation strategy that is going to bring about an improvement in the biophysical environment. They stated that the JET would involve industry implementation of carbon capture and storage, and this would be the most effective move against the high carbon footprint from the burning and use of fossil fuels. They were, however, quick to point out that apart from these biophysical environmental improvements, JET comes with social costs that have been overlooked in climate mitigation policy, a gap that the scholarship on JET alluded to (Glynn *et al.,* 2020; Strambo, 2019; AREI, 2016).

Expert participants also argued that in JET, we are transitioning to a new economy that includes previously disadvantaged groups. Thus, it is assumed that it comes as a potential antidote to the racial and gender disparities of the legacies of apartheid in South Africa, which allowed only a minority (whites) and males to actively partake in the economy. ILO (2015) confirms these disparities with a focus on gender, documenting that in South Africa, the JET is part of efforts to correct existing structural problems that have led to the marginalisation of women, among myriad social injustices in the economy.

The community participants acknowledged the improvements in the biophysical environment that JET brings, although with some degree of scepticism. However, they perceive JET as a recipe for large-scale job losses, arguing that the renewable energy sector cannot create as many jobs as coal mining does and that this will have adverse impacts on coal workers and the surrounding coal-dependent communities. Munnik (2019) alludes to these perceptions of job losses, arguing that the worry of retrenchments drives the discourse about an energy transition away from coal, which includes concerns about splitting up Eskom into a grid operator and an independent power production unit.

Participants from both groups perceived JET as a potential climate mitigation tool; however, it will come with a lot of social costs, mostly borne as a result of social and environmental injustices within the coal sector. This takes us to the four categories or themes and their sub-themes that present a discussion on the findings that answer the four key questions and objectives in the succeeding sections.

5.2. Sustainability Perspectives in a Just Energy Transition

A binary approach to sustainability was applied. Firstly, environmental sustainability in the coal sector and in the renewable energy sector was discussed. Secondly, community sustainability, with a focus on communities and the coal workers who are part of these communities, was discussed.

5.2.1. Environmental Sustainability in the Coal Sector

From the findings gleaned from interviews and survey questionnaires, participants from both groups identified a plethora of environmental impacts from coal mining, ranging from air pollution to land scarification and water pollution (AMD contamination). As well as loss of grazing land and dust, see **Figures 9** and **13** in **Chapter 4.**

The findings on air pollution show subsequent social impacts on health, pointing to coughing among children and lung infections like silicosis among workers. Scorgie and Thomas point to a study done in 2006 in Mpumalanga's Highveld on Eskom's emissions and other sources where "550 deaths per year and around 117,200 respiratory hospital admissions per year were predicted" (Munnik, 2019, p. 10). Studies show that the air pollution standards specified in Eskom's licences are persistently surpassed, and Mpumalanga is one of the world's biggest sulphur dioxide hotspots (Sunday Times, 2019; Vlavinios, 2019; Myllyvirta, 2019). All of this has a negative impact on environmental sustainability and imposes social costs on community health.

Participants from Carolina identified genital infections among women linked to AMD pollution as it affects the pH levels of the water. Chidzungu (2019), in her study in Carolina, found that information on these genital infections was never documented in the local hospital statistics. The study, in line with Reidar (2018) and Vanclay *et al.* (2015), argues that SIA during assessments can bring gender aspects that relate to the environment to the fore and that, as part of local action plans, SIA could advocate for bringing statistics on such health issues to the public domain. Moreover, considering that SIA teams work with regulatory agencies, they could facilitate the enactment of local action plans like compensation for local health issues related to coal mining, for example, by providing free treatment for such ailments.

The impacts on water and air quality have a negative impact on the SDG 3 clause 3.9 goal of "substantially reducing the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination" (United Nations, 2015, p. 16). This affects both the sustainability of the ecosystem and the community.

Other participants pointed to the contribution of fossil fuels to climate change, which results in frequent floods and droughts, which in turn impact food security, nutrition, and disease outbreaks. Existing research supports the effects of climate change, pointing to the occurrence of heatwaves in some regions of Europe, Asia, and Australia as well as

snowmelt, heavy rains, floods, and drought in large portions of Africa, the Mediterranean region, North and South America, and south-eastern Asia (Koubi, 2018; Zemp et al., 2019). As stated in Chapter 2 (Allen et al., 2018; Perez-Escamilla, 2017), the effects of climate change will threaten environmental and social well-being, which will put SDGs 2, 3, 6, and 16 in danger.

Some of the study's interesting findings focused on the opportunities that the low-carbon economy can leverage in the coal sector to achieve much-needed environmental sustainability. Some participants expressed that AMD can be treated to make usable and portable water, pointing to scientific research that has identified crops that can survive in AMD-impacted soils. For example, harvesting invasive species like the black wattle for medicinal, domestic, and industrial use; sunflowers for biofuels; and mushrooms for farming further substantiates these findings, as do studies done in Mpumalanga on water and soil reclamation (Postma et al., 2017; Human and Truter, 2021).

The next section, therefore, discusses environmental sustainability within the renewable sector as the JET unfolds.

5.2.2. Environmental Sustainability in the Renewable Energy Sector

Interviews and surveys done with expert participants pointed to the possible improvements in environmental sustainability that the renewable energy sector will bring. Some experts argue that if wind energy is used, there will be a great improvement in air quality and water resources, and both the broader community's health and that of workers will be improved. Thus, the shift away from coal supports the National Environmental Management: Waste Act 59 of 2000, which implies that future interventions should protect the health, well-being, and environment of the affected communities (Government Gazette, 2009). The renewable energy sources will also be cheaper, safer, and more affordable.

The reviewed literature demonstrates wind turbine blades may kill birds, mostly migrating and resident birds, cause noise pollution, and disturb bird habitats (Apunda and Nyangoye, 2017). Research done at the Buffalo Ridge in Minnesota showed that the number of birds in the grasslands with turbines in the Conservation Reserve

Programme (CRP) was much lower than in the grasslands without turbines in the CRP (Leddy et al., 1999). Seasonality and daily weather conditions may have an impact on the viability of wind energy (Apunda and Nyangoye, 2017). Maia et al. (2011) posit that this seasonal or daily natural variation in wind may require some backup from coal to ensure stability of the power supply, which may compromise environmental sustainability.

As demonstrated by the reviewed literature, Solar photovoltaic panels will provide clean energy with no noise pollution from blasting, as is the case with coal, and they do not need water, so no impacts on water are anticipated (Vivint Solar, 2021; Durrenberger, 2015). The water-saving attributes of solar energy thus promote environmental sustainability, considering that South Africa is a water-scarce country (Munnik et al., 2018).

The study participants allude to the fact that Solar PV produces harmful emissions during processing, manufacturing, and shipping and has recycling challenges after some 25 years of its useful life. Maia et al. (2011) refer to the incorporation of toxic elements like mercury, lead, and cadmium in the production of some thin-film modules and the significant water requirements for large-scale installation, unless the plant is dry-cooled or, as in the case of concentrating dishes or Stirling engine systems, water is not used. Frisvold and Tatiana Marquez (2013) point to wet-cooled CSP technologies, which can generate electricity at a lower cost than traditional technologies while using more water per MWh.

Furthermore, existing literature shows that solar PV requires large stretches of land on which to install the panels (Maia et al., 2011). This poses a risk to ecosystems, takes away arable land, and disrupts ecological systems. See **Figure 14**, taken from Kriel in Mpumalanga, which can provide a source of inference on what a fully-fledged erection of solar panels may look like and the potential impacts on arable land and the land ecosystems that may arise therefrom. None the less, the Agri-voltaic or Dual Solar Project, which has been introduced in Komati, Mpumalanga, involves the dual usage of a solar PV plant to generate energy and to utilise the ground space under the panels for agricultural uses (Kamanzi, 2022), which has the positive effect of reducing the impact on arable land.

A survey of the communities and expert participants on the anticipated improvement in environmental sustainability during the JET supported the reviewed literature and study findings on the positive impacts of renewable energy sources. As seen in **Figure 7** in **Chapter 4**, the results showed that **53.85%** strongly agreed and **38.46%** agreed, showing the kind of perceptions participants have on the reduction of environmental impacts. Only **5.13%** are neutral, meaning they neither agree nor disagree, with only **2.56%** somewhat disagreeing and none strongly disagreeing that energy transitions away from coal will reduce environmental impacts.

Figure 8 in **Chapter 4** shows that the results of the polls with the community members show that **65%** of the people in Carolina and **16.7%** of the people in Kriel agree that the environmental effects will be lessened, while **21.25%** in Carolina and **48.30%** in Kriel disagree, and **13.75%** in Carolina and **35%** in Kriel say maybe it will be lessened.

The overall percentages from the two community groups and the expert group show the high perceptions that participants have about the reduction of adverse environmental impacts as the JET unfolds. This reflects the envisaged improvement in environmental sustainability as the JET unfolds (Munnik, 2019; Cardoso and Turhan, 2018).

Only 10 out of the 60 participants agreed with that idea, indicating that there are some strong reservations among participants from the Kriel community about the reduction of environmental impacts. This speaks to the differences in the lived experiences and understanding of the environmental problems caused by mining that are perceived from different standpoints among the communities. This emphasises the need to contextualise the nature, extent, and magnitude of impacts during assessments as they tend to be localised, and SIA considers the local context (Burdge and Vanclay 1996) and could promote an understanding of the depth and context of the social costs therein.

The findings show that identified environmental impacts could have social impacts and vice versa. Additionally, the biophysical and social mitigation strategies could have their own environmental and social impacts that might not be considered in impact statements because they typically only consider first-order impacts (Vanclay and Burdge, 1996). This interconnection justifies the importance of interrogating community sustainability issues within the JET, which are discussed in the next section.

5.2.3. Community Sustainability in the Just Energy Transition

Community sustainability was discussed using two lenses: from the perspectives of impacted communities and from the perspectives of affected workers who are part of the community. According to Kabir (2021), workers hired by a mine from other parts of the country move there with their families and eventually assimilate with the local population. The mining companies employ locals from the community as well. These two groups bring a complex situation to the JET, considering the consequences of the JET on their well-being.

5.2.3.1. Communities

Participants expressed that coal mines are large employers, and where these mines are built, whole towns are built. These are rooted in communities with a rich history. Undergoing a transition from coal to the renewable energy sector will lead to a large-scale loss of jobs, the closure of allied economic activities, and population migration. Studies done in the context of JET confirm the above social costs, pointing to a surge in unemployment, displacements, and losses of economic activities along the coal value chain (Burton et al., 2019; Haerer and Pratson, 2015; Munnik, 2019; Daniel, 2020; ILO, 2019).

Some participants posited that most small mining communities depend on the mine for their water supply. Once the mines are closed, local governments will have to deal with these impacts. Participants cited Emalahleni as one good example of a municipality where mines provide water for the local community. Munnik (2019), in his JET study in Mpumalanga, provides an illustration of how the transition away from coal will affect social structures in addition to physical infrastructure like rail, roads, and water canals.

If such services are lost as the energy transition is ushered in, this will conflict with the Water Services Act 108 of 1997, which implies that "the project should not affect access to basic water and sanitation" (Government Gazette, 1997). Vanclay and Esteves (2011) posit that one of the business advantages of evaluating and managing social impacts in a JET environment is that SIA can promote better planning for social amenities. Aucamp and Lombard (2018) observed that, while the provision of social amenities is the

responsibility of the government in South Africa, infrastructural development is part of SIA's mitigation measures.

Reduced investments in Social Labour Plan (SLP) projects are evidence that participants believe the JET would lead to a loss of socio-economic projects from coal mining initiatives. Studies indicate that the infrastructure under coal is currently in a poor state, and little is being done to fix this. See Chapter 4's Figure 11. This discovery is consistent with Munnik's research in Mpumalanga, where he recognises "the treatment of closure plans, the legacy of destroyed and unrehabilitated landscapes, and the river catchments that coal will leave behind at the expense of communities and refers to the social licence to mine and SLPs as impoverished figures for society" (2019, p. 13).

The study contends that SIA can support obligatory infrastructure development as a condition of contracts for new business actors in the renewable energy sector if considered during mainstream JET decision-making. By implementing effective social programmes and administrative procedures, SIA practitioners may ensure that economic development leads to real, positive improvements in the quality of life in deprived areas (Gray, 2006).

The study further found that the relocation of coal mining communities from their traditional homes and gravesites has impacted their cultural practises; see **Figure 12** in **Chapter 4**. Skosana (2019), in her study on ‘dispossession and the desecration of ancestral graves by mining corporations in South Africa’, points to grave relocations that affect the traditional and spiritual sacred realms. Similar impacts will be observed in the inevitable renewable energy-related relocations, as alluded to in Section 5.2.2, that will disrupt cultural heritage, raising social justice issues around spirituality.

The SIA for a mining project in Australia (Coronation Hill), where sacred ground was disturbed and it was believed that the spirit of Bula would rise and destroy the world, resulted in the state rejecting the opening of a mine (Lane et al. 1990). Community sustainability is upheld once cultural practises and spirituality are preserved, and these are key elements in deciding the adoption of a project (Burdge and Vanclay, 1996).

SIA practitioners have a legitimate mandate that incorporates socio-cultural considerations into the developmental project (Esteves et al., 2012). This mandate makes SIA better placed as a tool to advocate for the importance of spirituality if it is

included as part of mainstream JET mitigation tools. This is consistent with SDG 11, clause 11.4, which calls for "intensifying efforts to protect and safeguard the world's cultural and natural heritage" (United Nations, 2015, p. 22). Unfortunately, most EIA-SIA statements hint at the importance of culture but never explicitly admit that cultural history is a key factor in the decision-making process (Burdge and Vanclay, 1996).

The study found that in Carolina, at some sites where mines have relocated mining communities, there is no running water and no grazing land for their cattle, and this may continue in JET-related relocations. Burdge and Vanclay (1996) contend that, since these effects cannot be reversed, compensating may not always be the best course of action. Once people are resettled into such dry areas that offer negative utility in terms of water supply and pasture for their livestock, these aspects of their well-being are affected for good, and this demonstrates nuanced human rights violations.

The study findings and reviewed literature posit that SIA could work to stop these kinds of abuses by industry because SIA and Human Rights Impact Assessment (HRIA) coexist. According to Ruggie (2008), the focus of HRIA is on "Due diligence," which entails the actions that a business must take to learn about, avoid, and address problematic human rights issues. The second is respecting rights, which is tied to corporate responsibility impacts, and the third is sphere of influence, where the company's activities or relationships violate human rights (Ruggie, 2008). As part of impact mitigation advocacy, SIA could, for example, recommend giving displaced rural peasants replacement land of equal or better quality, unless it is unavailable and that is formally documented (Reidar, 2018), during JET relocations in affected communities to uphold human rights considerations.

The study further argues that SIA could propose support mechanisms such as the use of Unconditional Cash Transfers (UCTs) to ensure community sustainability for relocated people who have lost their traditional livelihoods. UCTs do not have any active conditionality and include social pensions, child support grants, family relief grants, and grants for qualifying people (Samson et al., 2006). This becomes an inclusive solution for even those members of the impacted communities who cannot work. The study submits that the ideology behind social protection fits perfectly into SIA's principles, supporting Aucamp and Lombard's (2018) findings on the interlink between SIA and social protection.

Moreover, SIA, as part of impact mitigation, could also recommend psychosocial support given the radical change that the JET involves, which affects not only their livelihoods but also their way of life and sense of identity. However, for these proposed social protection mechanisms to be effective, they must be coordinated with and integrated into existing social welfare systems (Bastagli, 2009; Samson et al., 2006).

The study found that there is poor public participation in developmental projects and no platform to air their concerns, given the political support these large-scale energy projects get. See **Figure 22** in **Chapter 4**. Existing research on JET demonstrates the governments' alignment with industrial interests rather than those of their citizens and the lack of public participation (Munnik, 2019; NPC, 2019; Polity, 2019). In the USA, community activists are threatened with "legal action over public statements" made by project proponents using SLAPP (Strategic Lawsuits Against Public Participation), which have the effect of muting opposition to a project and discouraging affected communities from public participation (Vanclay, 2002). Aucamp and Lombard (2018) contend, however, that SIA might be used as a tool to empower communities by giving civil society the chance to voice their concerns and offer their opinions on development projects.

Nevertheless, the issue with SIA is the once-off involvement of SIA teams during licencing, which compromises the public engagement process considering that the JET is an ongoing programme. According to Stacey et al. (2010), mine closure requires long-term involvement as well as cooperation and understanding between people who are directly and indirectly impacted by the decommissioning of the mine. Considering SIA as an iterative process in the energy transition process can improve public engagement and prevent communities from being excluded from mainstream JET decision-making.

On the other hand, women, the most excluded group in public participation, raised concerns about resettlements, which have deep roots in South Africa's land reform process. The land reform programme consists of three subprograms, namely land redistribution, land restitution, and land tenure (Saunders, 2003). The participants expressed that there is a separation of land and water rights in the land reform process. People are given land on which they have neither land nor water rights. This points to the need for land restitution within the JET context, as this may affect traditional livelihoods like subsistence agriculture, thereby compromising community sustainability.

Findings show that women are the most affected by these dysfunctional land reform policies, as they still do not have land rights to date (3rd Inkomati Basin Women in Water Conference, 2021). The literature review demonstrates that SIAs take gender into account in all their assessments and can therefore be a useful tool for leveraging the Extension of Security of Tenure Act, which grants women the same rights to land as men (Saunders, 2003; Vanclay, 2002; Vanclay et al., 2015). Also, SIA's strong connections with experts in fields like law, resettlement, and economic development may make it easier for action plans to be put into place as part of rectification justice on land restitution issues at the local level as the JET moves forward (Vanclay, 2003).

The study suggests that using information from SIA reports can hasten the process by which women are given priority when applying for agricultural land in the green economy. Women can be assisted via start-ups, leadership, mentoring, internships, and expedited training in agricultural sciences, and this should come before land transfer in accordance with Vision 2030 and the National Development Plan (Saunders, 2003).

SIA teams work with regulatory agencies and have collaborative platforms with multistakeholder and grassroots engagements, which affords inclusive decision-making. SIA advocates for the inclusion of gender and cultural considerations in evaluations, which can therefore facilitate understanding and address community sustainability issues in JET. Nevertheless, at the centre of community sustainability are coal miners, who support a substantial portion of these communities and are equally important.

5.2.3.2. Coal Workers

This is the group that will be most deeply impacted. Considering the impacts on their livelihoods and the need to adapt to new job designs, given the repertoire of skills they have built over the years, they will have to upgrade or completely revamp to meet the skill demand in the new RE sector. The workers may experience difficulties adjusting due to unforeseen job losses, employee age and location, the lack of close alternatives, and the shortcomings of political programmes (Garcia-Garcia et al., 2020).

Findings from the study confirm García-García et al.'s (2020) findings on the different age groups that will be affected differently. The participants in this study described the impact on coal workers using an age-cohort lens. A three-tiered division of coal workers emerged: the younger ones, under 40, who have portable skills can find work anywhere and may need reskilling. Portable skills are job skills that can be used in a variety of

situations and are based on networking, entrepreneurship, and other aspects (Milazzo, 2012). Settled workers over 40 who have sent their children to university and purchased homes are established and will be the most impacted, as by the time most mines are decommissioned around 2040, they will be reaching retirement age. The study supports findings by COBENEFITS (2019), which show that by 2040, when most of the coal plants will be nearing the end of their valuable lives, a percentage of the current workforce in Mpumalanga will be approaching retirement age.

Older workers over 60 will require pensions. These workers will not be reskilled for RE jobs but will require some entrepreneurial portable skills development and some form of compensation to sustain them. As part of social investment by the RE industry, funding for social projects like poultry and small-scale crop farming, to name a few, can be made available to absorb the redundant older workers. In addition to these age cohorts, there were general workers who will be affected and may not easily get absorbed in the new economies, as competition for semi-skilled and unskilled labourers is common in South Africa.

Considering the above findings on the reskilling and job placement of older and unskilled workers, social investment projects could help absorb these groups. As demonstrated by the reviewed literature, SIA reports could feed into policy decision-making and the prioritisation of Corporate Social Responsibility (CSR) projects to assist impacted workers (Vanclay and Esteves, 2011). Aucamp and Lombard (2018) found that the focus of SIA should not be project-specific but should consider alternative economic opportunities, which allow SIA to be used as a planning tool for income loss mitigating programmes, for example for older workers who can find it difficult to be reskilled and absorbed in the skills-intensive roles in the RE sector.

Participants identified a large network of formal and informal businesses that form part of the coal value chain during the study. See **Figures 15** and **16** in **Chapter 4**. All these economic activities will be impacted, compromising community sustainability.

Others expressed concern that people would lose their jobs and never be able to work again. Other participants point out that, socially, it will mean coal workers, who are also the main breadwinners, are not employed, which will call for the government to start issuing social grants that can help these people. Social grants have been showing an

upward trend since COVID-19. During the 2020–21 period, social grants amounting to R1 555 838 ($91.049.80 US dollars) were issued in Mpumalanga (SASSA, 2020– 21). This figure increased to R1 591184 ($93.118.29 US dollars) during the 2021–22 reporting period (SASSA, 2021/22). The JET will put extra pressure on an already overwhelmed social welfare system; however, social protection is necessary in this case, and SIA has its philosophy anchored on social welfare as part of its mitigation strategies (Aucamp and Lombard, 2018).

On a positive note, a study by COBENEFITS (2022, p. 4) demonstrates that in Mpumalanga, the introduction of wind and solar will contribute to job creation, with up to 43,000 jobs in solar PV and 28,900 jobs in wind energy by 2030. According to the World Bank (2022), considering the most low-carbon transition-affected industries like the chemical, Petroleum, and coal industries, South Africa may lose about 302,000 direct jobs and gain as many as 815,000 direct jobs over the 2022– 2050 period. It further posits that the high carbon-emitting sectors, including petroleum and coal, will employ almost no workers by 2050.

There is minimal opportunity to replace employment lost in conventional high-carbon sectors on a one-to-one basis with opportunities in clean energy, even while overall energy transitions result in significant job creation (IEA, 2021). Additionally, current research is increasingly concentrating on net employment, which is a highly encouraged practise, as opposed to just volume, which is not ideal because it ignores the nature of employment, such as low-quality jobs that harm the environment and do not improve social conditions (Garcia-Garcia et al., 2020; ILO, 2018).

On the other hand, participants and existing studies on the JET identify the temporary nature of construction jobs as a disadvantage for community sustainability as the JET unfolds (Semelane et al., 2018). The World Bank (2022) points to energy transition-related dislocations, where new jobs are created elsewhere and not necessarily in the same places where jobs are lost.

The study's findings on job losses can be attributed to the challenges of transition brought on by unanticipated job losses, employee age and location, the lack of local alternatives, and the flaws of political programmes. All these issues will impact the workers, thereby impacting community sustainability. Overy (2018) argues that to ensure

that employees who lose their employment due to JET are recompensed or retrained, unions should push for enabling state laws. To lessen the effects on impacted individuals and communities, SIA could promote social protection for those who lose their jobs in deteriorating industries and encourage ongoing engagement by governments, trade unions, and financial institutions.

The different age cohorts will require different mitigation measures against the social costs of JET. Support for business incubators to foster entrepreneurial development may be required to address workers' varying sustainability needs. Through the social profiling of communities and collaboration with industry, academia, and regulatory bodies, SIA can help with informed adaptive project and plan management; therefore, it must be used to inform the planning, development, and implementation of the intended intervention (Vanclay, 2003). Moreover, SIA could facilitate skill needs assessments in line with labour market demands. This will cater for the absorption of workers in different alternative economic activities to ensure community sustainability. However, this should be supported by robust skill development programmes.

5.3. Skill Development Needs in a Just Energy Transition

Skill development needs were discussed at three levels: within communities, in educational institutions, and lastly, at the industry and government levels. Studies show that there are skill shortages in most economic sectors in South Africa, placing a compromise on skill transfer to the renewable energy sector (Jain and Jain, 2017; Semelane et al., 2018). This is also worsened by the fact that South Africa is rather slow in implementing programmes that will promote new green skill development going into the future (World Bank, 2022).

5.3.1. Skill Development at the Community Level

This section discusses skill development at the community level, which reveals gender disparities, different age group needs, the temporary nature of contract work, and the hiring of migrant workers as major impacts on skill development.

Some participants that were interviewed expressed that women have a difficult time finding work in mines because they can only work under certain conditions in terms of the machinery that is compatible with them, and this will reduce their chances of getting upskilled in the new sector. See **Figure 19** in **Chapter 4**. This finding supports a study by the World Bank conducted in South Africa in 2022 that claims that the mining industry's conservative stance as a field unsuitable for women is to blame for the low representation of women there. Additionally, it notes that women usually work in indirect occupations, such as those in companies with a coal-related supply chain or small businesses that provide services to workers, and as a result, they might not have access to skill upgrades offered by employers.

COBENEFITS (2022) found that Eskom employs only 31% females, compared with 21% in coal mining, and this will encroach into the RE sector. It is argued that a lack of technical knowledge and a lack of time deter women from the RE sector, and mostly men are getting new jobs, hence skills in the low-carbon economy (Clancy and Feenstra, 2019; Lieu, 2019).

The COBENEFITS (2022) argue that educating and empowering women through the establishment of programmes at TVET colleges and the provision of childcare facilities near vocational colleges may reduce the time constraints that prevent women from advancing themselves. Maseko (2021) argues that strengthening and enforcing antidiscrimination legislation such as the Employment Equity Act, No. 55 of 1998, which promotes equal opportunity and fair treatment in employment, can be a viable measure as the JET unfolds in South Africa. In line with the reviewed literature, the study argues that SIA, through its grassroots engagements where women are concentrated, could advocate for gender consideration if used as part of mitigation strategies in JET reskilling programmes.

The study also found that participants had strong reservations about the idea of reskilling 50-year-olds and advocated for the reskilling of unemployed youths instead. This pro-youth advocacy contributes positively to SDG 8, clause 8.6, which advocates for "significantly reducing the proportion of youth not in employment, education, or training by 2020" (United Nations 2015, p. 19).

However, Vanclay (2002, 2003) argues that SIA should consider impacts on all impacted age groups because the older workers' future aspirations and the future of their children are left hanging. All-encompassing age group consideration can be an excellent strategy for pushing for the portable skills training of the older age cohort through small-scale business incubators. This is in line with the terms of Section 52 (1) of the MPRDA, the National Social Plan guidelines of the Department of Labour (DoL), and Section 189 of the Labour Regulation Act (LRA), "which include a comprehensive self-employment training programme, re-employment programmes, and portable skill development plans" (Revised Social Labour Plan Guidelines, 2010, p. 24), and could feed into the JET skill development planning.

The participants also identified subcontracting in the mines as a major challenge that will prevent the reskilling of deserving workers, arguing that once the contract ends, the chances of being considered for reskilling for absorption in the renewable energy sector fall away. The participants also discovered that migrant workers, primarily from other parts of South Africa (Limpopo and KwaZulu Natal), are taking up technical positions in the coal mines at the expense of the affected communities. Therefore, the shift to renewable energy will see skills upgrades given to these migrant workers, who have the aptitude for the skill-intensive nature of RE jobs. Muntingh (2011) discusses the global issue of migrant workers, stating that multinational corporations provide and control knowledge and experience in new technologies post-mining in developing countries, limiting indigenous skill development.

Participants argued that given the new skill needs, people's attitudes need to change towards the coal energy system. It is important not to create new externalities. The study participants argued that there is a need to train people on climate change and the impacts of chemicals in the physical environment on people, vegetation, and animals. SIA's multi-stakeholder teams can promote social learning among communities to facilitate educational awareness of the changing skill needs or career paths in new low-carbon economies (Esteves et al., 2012).

Moreover, SIA conducts thorough stakeholder and skill profiling to understand the different skill needs of the communities affected by a developmental project (Esteves et al., 2012; Vanclay and Esteves, 2011). In support of the role that SIA could play in skills assessment in line with labour market demands, Kaluba (2018) argues that, once skills

needs are accurately defined to meet sustainable development objectives, accessing funds and even producing long-term visions and national development educational plans to guide JET skill development become easier.

The gender disparities in skill development in favour of males, the differences in age group skill development needs, the dependence on migrant expertise, and the temporary nature of contractual work impact skill transfer, creating a gap in skill development. In this context, the existing skill development needs in educational institutions had to be explored, and the role of academia in bridging the skills gap within the JET context was questioned.

5.3.2. Skill Development within Educational Institutions

The development of skills in the education sector was discussed against the backdrop of the current status quo in the education system in the two study sites' local municipalities, the province, and the country.

Findings on matriculation attainment were low right across the municipalities, provinces, and country, with an average of 36%. See **Figure 17** in **Chapter 4.**

Participants contend that the fact that the youth in the study areas are not pro-school, some drop out before matriculation level to work menial jobs in the mines, and they have a general low aptitude for STEM subjects makes this situation worse. On average, the Mpumalanga population has even lower educational attainment, with only 11% holding a post-matric qualification and 30% holding a matric qualification (COBENEFITS, 2022). On the other hand, South Africa’s education system and vocational training institutions are not yet providing the skills needed by individuals for absorption in the low-carbon economy (World Bank, 2022).

This general low level of matric performance coupled with a low aptitude for STEM subjects in South Africa has made it difficult for companies like SARETEC to find candidates who could complete the wind turbine technician training since its inception in 2016 due to the high technical standards required by Original Equipment Manufacturers [OEMs] (Hancock, 2020).

The study argues that SIA could recommend such measures as the use of Conditional Cash Transfers (CCTs) to promote the teaching of science subjects. Samson et al. (2006) state that CCT will directly support households through monetary compensation, contingent upon pre-determined criteria intended to improve outcomes, including schooling. CCTs can be viable mechanisms to promote continued school attendance, adult literacy classes, and STEM subjects among learners and college students. In Mexico, the Progresa-Oportunidades CCTs partly focused on education and led to a surge in enrolment since 1997, from 101,000 students to 4.4 million students in 2002 (SEDESOL, 2003).

From existing Kriel SLP reports 2014–2018 (in Anglo-American, n.d.), the desktop study found that the Kriel Colliery implemented some learnership programmes; see **Table 5** in **Chapter 4**. However, some of the skills will not be relevant to the renewable energy sector, while others may need to be upgraded as they are transferable. The Friends of the Earth (FOE) Scotland's 2020 report suggests that most workers in oil and gas are prepared to take up jobs in industries along the energy value chain as some of these skills are transferable to the RE sector (Ferris, 2021). Semelane et al. (2018) point to this transferability of skills from the fossil fuel industry to the RE sector with reference to the wind industry in South Africa, where skills from workers in the coal industry were being used in the wind industry.

Semelane et al. (2018) further argue that Technical Vocational Education and Training (TVET) colleges and universities could be a way to facilitate skills upgrades and skills transfer to unemployed youths for absorption in the RE sector. According to the study, there are only a few vocational colleges with limited courses available to students in the two study areas. Aucamp and Lombard (2018) express that it is crucial to invest money in reshaping education to consider the emerging low-carbon sectors that combine climate-based education and learning.

This study, in line with Vanclay (2002), argues that the work of SIA teams with regulatory agents, investors, industry, grassroots-level organisations, and the education sector can pave the way for the financing and enactment of programmes for post-primary and secondary education, adult literacy for dropouts, and skills acquisition through learnerships fit for industry's skills needs. However, due to a lack of reliable information and an ongoing discussion that is concentrated on job losses in the coal sector, there

hasn't been enough knowledge of career routes within the renewables sector (IASS/RENAC/UfU/IET/CSIR, 2020).

Participants argued that a serious rethink of the curriculum in institutions of higher learning is needed. Most participants supported the idea of revamping the education curriculum in South Africa to meet the demands of the RE sector. See **Figure 18** in **Chapter 4**. The WindAc Academic Conference (2021) discussions condemned the university curriculum for a theory-based education system, for failing to prepare students for the workforce, and for failing to collaborate with large turbine companies, such as those in wind energy. Substantiating the slow pace of green technology development is the World Bank (2022), which reports that South Africa was ranked 49th out of 138 countries by the World Economic Forum for technology readiness in 2017/18 and only spent 0.6 percent of its GDP on research, far from its targeted 1.5 percent of the GDP. This shows the existing barriers to skill development in green technologies across educational institutions and industry.

JET policies must address technology skill requirements but also consider social implications (Sanz-Hernandez, 2020). SIA could bring social justice considerations to the forefront alongside data from feasibility studies on possible economic opportunities and skill requirements post-mining (Lockie et al., 2012; Usher, 2000).

Educational institutions can help bridge the skill gap as they deal with some of the drawbacks in the curriculum and consider social justice issues that contribute to low school attendance, a high dropout rate before matriculation, and gender disparities in STEM subjects. With all the challenges of the South African education system, the question that arises is what kind of role industry and government are playing to support the educational institutions in bridging this skill development gap within the JET?

5.3.3. The Role of Industry and Government in Skill Development for a Just Energy Transition in South Africa

The section on skill development was discussed, considering industry and government initiatives to reskill coal workers.

Findings from the study point out that Eskom has begun reskilling some of its employees to assume roles in the renewable energy sector. According to recent data on Eskom, employees receive on-the-job training and higher skill levels through education (55% have post-grade 12 qualifications; 36% are technicians and associated professionals) (COBENEFITS, 2022). As a result, depending on their skill sets, Eskom employees could migrate to the renewable energy industry by undergoing training in the technologies required.

However, challenges were highlighted, as it points to the unemployed but educated youths and contract workers with relevant skills who may find it difficult to be incorporated into the reskilling programmes without any contracts with Eskom. The study argues that these reskilling programmes should not only be confined to coal workers but should be left open to qualified unemployed youths and workers in industries along the coal value chain. Ferris (2021) posits that skills in the high-carbon industry are transferable to the low-carbon economy; hence, reskilling should be open to any qualified potential worker along the coal value chain. In South Africa, workers from other sectors of the country are being employed to take up jobs in the RE sector in either solar PV or wind technology projects (Semelane et al., 2018).

The study also found that several organisations are involved in skills development initiatives, including BRICS, which is focused on getting grant funding to conduct an energy skills baseline for South Africa. The MCWB and its members are looking at reskilling the labour force in green jobs, focusing on mine water, mine land, and mine infrastructure as enablers of the new green economy (E. interviewee, 2, 2020; E. interviewee, 11, 2021). This is necessary, as it incorporates even low-skill-intensive jobs like reclamation and forestry that can accommodate even those who have a low aptitude for technical skills.

For JET's skill development activities to be successful, such collaborative efforts are required. They support the development of entrepreneurial potential as well as the exchange of ideas and resources between major and small business owners. Large and small business owners in India collaborate with one another to develop infrastructure and skill sets (ILO, 2019).

Part of SIA's core value is to ensure that all planned developmental projects and their assessments contribute to the social and human resources of native people (IAIA, 2003; Aucamp and Lombard, 2018). Hence, it can facilitate such initiatives if it is included in the mainstream JET skills development initiatives.

The study's findings indicate that trade unions and the energy sector are working together to address vulnerable industries that the transition from coal to renewable energy is likely to affect. A good example is the South African Renewable Energy Master Plan. Other sector organisations like the Mineral Council, NUMSA, and TESSA have had dialogues about what is necessary and what is to be done for skills development in a JET from coal to the low carbon economy (E. interviewee 11, 2021).

In its 2019 report, the ILO posits that the South African trade unions need to organise robustly and recruit more members in the workplace to be the key voice in the system to afford collective bargaining (ILO, 2020). The ILO 2019 report further advocates for collective bargaining on issues such as analysing individual training needs and obtaining advice and counselling on relevant skills, as well as considering whether paid time off is available for learning purposes given that the impacted workers have dependents (ILO, 2020). This calls for strong networking, and the SIA process's community engagement helps create the networks that make up social capital, which is described as the norms and networks that enable action (Aucamp and Lombard, 2018; Woolcock, 2001).

Social capital also affords subsequent contact, leverages resources that can help with development initiatives, and gives the less privileged or less economically powerful members of the community access to resources that might otherwise be out of their reach (Aucamp and Lombard, 2018; Adler and Kwon, 2000; Evans and Syrett, 2007; Woolcock, 2001).

According to the study, the local government will implement the government's JET reskilling programmes in Mpumalanga on behalf of the national government and will guarantee the projects' viability (E. interviewee 2, 2020). According to Ferris (2021), the lack of widely recognised accreditation, insufficient financing for adult retraining, and insufficient national policy planning for future skills all have an impact on skill development. He further argues that one of the difficulties in skill development that governments face globally is the restricted power provided to local governments that are

best able to comprehend skill demands and tailor solutions to local communities (Ferris, 2021).

As part of industry initiatives in dealing with skills development beyond coal power generation, "the sites could also be used as research centres for future fuel sources, and these sites could benefit from co-location, co-creation, and sharing assets among private and public companies and academia" (Glossop and Johnsson, 2021). These initiatives could be supported through the Section 121 Tax Allowance Incentive (12I), which is an incentive through DTI funding that provides both capital investment and training opportunities to support greenfield and brownfield investments (SME-South Africa, 2022).

From discussions about sustainability to the development of skills, many social effects can be seen. For example, the biophysical effects of coal burning, and climate change can lead to poor community health, low food security, and cultural disruptions. However, the use of renewable energy (RE) technologies can improve the environment and community health. On the other hand, poor citizen participation, an increase in the burden on social protection, gender disparities in recruitment and skill development, differing age cohort needs in skill development, poor aptitude in STEM subjects, and a poor education system that will impact JET were identified. Considering the above findings, an in-depth narrative on the role of SIA in assessing and addressing the socio-economic impacts of the JET from coal to the renewable energy sector is discussed in the next section.

5.4. Social Impact Assessment as an Effective Strategy for Assessing and Addressing the Social Impacts of the Just Energy Transition

According to the study's findings, most participants supported the concept of SIA as a long-term strategy for assessing and addressing the social impacts of JET. See **Figure 20** in **Chapter 4**. This was further verified through interviews and survey questionnaires.

Participants during interviews expressed that SIA is important to understand the area and population dynamics, considering that South African mining communities are overly complex institutions. Comprised of native communities and mine-created communities of immigrants who were lured by opportunities in the mine, such as work and entrepreneurship opportunities. According to Vanclay and Esteves (2011), SIA fosters knowledge about the local area and the communities that the development project is likely to affect, as well as offers a thorough stakeholder analysis to comprehend the varied needs and interests of the impacted groups.

Participants further argued that the SIA teams can encourage industry, government, and all the other technocrats to openly engage with communities and be truthful and pragmatic, especially when it comes to the inevitability of job losses and the fact that not everyone will be absorbed into the new economy. To ensure objectivity and pragmatism in SIA engagements, SIA teams must be part of long-term project planning tools rather than a one-time procedure (Aucamp and Lombard, 2018).

According to Burdge and Vanclay (1996), governments should take adequate steps to ensure that the SIA and EIA that are done are of a satisfactory standard. The effectiveness of SIA hinges on the integrity of the SIA practitioner.

Reidar (2018) states that a non-sector-literate SIA expert will give general advice about the importance of social issues, compromising practicability from an implementation perspective. Lockie et al. (2012) argue that social scientists with knowledge of local settings are now included in SIA, and this affords an informed assessment process and the addressing of impacts.

One participant expressed that the "world of command and control is gone; you must take people along with you; they need to understand the decisions you are making, especially if they impact them; you get more educated employees and more informed communities; and they help you improve your value offering in terms of what you are doing" (E. interviewee 5, 2020). The success of SIA in facilitating the addressing of impacts even within mine closure in a JET context can be seen in the BAC mine in Queensland, Australia, where SIA provided a platform where all parties could come together and create a plan that was acceptable to the local community, workers, and the company during mine closure (Kabir, 2021).

Burdge and Vanclay (1996) point to the 1983 inquiry by Chief Berger into the proposed Mackenzie Valley pipeline from the Beaufort Sea in the Yukon Territory to Edmonton (Alberta). Here, SIA was able to influence decision-making by getting local communities involved and helping them get funding to attend public hearings. This allowed social impacts on the local communities to be fully considered, and the proposed project was stopped. The study argues that once all impacted stakeholders can engage on a level playing field, procedural justice may be realised, and an effective assessment and addressing of social impacts can be guaranteed during the SIA process.

Evident in the above discussions is the pivotal role of community engagement in the SIA process. Findings from the poll conducted with experts deemed public participation a vital component of the SIA process. A further investigation of the two community groups on the extent which impacted communities participated in public participation during these large-scale energy development projects showed low public participation figures among the two communities under study. See **Figure 21** in **Chapter 4.**

Given the low public participation figures, interviews had to be conducted to gather the reasons for such a low level of participation in a fundamental part of the SIA process. The study found that the South African extractive industry does not take people along as it develops, and the communities are incapacitated to effectively engage in public participation. This will not be different in the renewable energy sector.

The study also found that community forums are used to bridge this capacity gap among communities. However, it was found that these community forums are male-dominated and corrupt, and they collude with mining companies at the expense of community

interests in return for favours on job placements for their relatives and social contacts. Participants confirmed this weakness, which they partly attributed to gender roles and patriarchy, in which males dominate the space as they are the ones who make up the greater population of the community forum leadership. This leads to women being excluded from decision-making, even on issues that affect their health, skill development, and employment prospects. Burdge and Robertson (1990), in their study, found that community forums suffer from the limitations of maintaining the existing bureaucratic structures in the community.

Existing studies show that SIA applies gender considerations in all assessments, enhances the position of women as well as the empowerment of other disadvantaged members of society, and contributes to the capacity building of these groups (Vanclay, 2002; Vanclay et al., 2015). This attribute affords SIA the ability to advocate for rectificatory justice, which is a branch of special justice that aims to put an end to situations in which one party has treated another in an unfair or unjust manner (Roberts, 2011). Thereby, it affords SIA the opportunity to effectively assess and address social issues that impact women when women's voices are not recognised in decision-making during public participation, which may feed into policy change where women are discriminated against, be it in skill development, employment opportunities, or land rights as the JET unfolds.

On the other hand, one of the disadvantages of the public engagement process was also mentioned as being a lot of political squabbling. Decisions regarding developmental problems have always been and will always be political, according to Burdge and Vanclay (1996). Munnik's (2019, p. 4) analytical framework for analysing JET criticises the isolation of communities and activists from decision-making by promoting participation in "debates, public opinion, and policy-making."

The study argues that SIA could fuel procedural justice, which deals with decision-making processes to ensure equitable engagement of all stakeholders. The concept of procedural justice emphasises fairness in the procedures used to settle conflicts and shows how people's judgements of fairness are influenced by more than just their experiences (Longley, 2022). Sovacool & Dworkin (2015) state that the normative approaches to procedural justice suggest that communities should be involved in making decisions about projects that will affect them, that they should be given fair and informed

consent, and that there should be genuine public participation in the environmental and social impact assessments. See **Figure 24** on SIA and procedural justice in fueling an effective public participation process.

Figure 24: SIA and procedural justice fuel effective public participation

Source: (Based on Research Material, 2022)

Barragan-Contreras (2022) asserts that the procedural justice pillar of the energy justice framework requires governments and project developers to consult with communities when making decisions regarding projects that will have an impact on them. She goes on to claim that one of the key injustices she saw throughout her research was who gets to pick which communities get to participate in making decisions and on what grounds. According to Kabir (2021), an empirical study was conducted to close the BAC mine in Queensland, Australia. The pertinent parties were located and invited to participate in public engagements, and this was made possible through SIA. As a result, the corporation was able to establish trust with the community and avert potential conflict and controversy. In a similar vein, Barragan-Contreras (2022) asserts that the Social

Impact Assessment is used to determine the "area of influence," or the area in which adjacent communities may be impacted (Barragan-Contreras, 2022).

According to Lockie et al. (2012), social scientists carry out SIA and conduct in-depth evaluations of impacts with the support of a vibrant scientific community and Indigenous communities. These organisations provide information that will aid and neutralise the politically fraught process of public participation and decision-making. Once the politicking in public participation is minimised, the assessment and addressing of issues within the SIA process might be more effective.

According to Vanclay and Esteves (2011), SIA, through the Free Prior Informed Consent (FPIC), can facilitate an Impact Benefit Agreement (IBA) between the developer and impacted stakeholders. This is in line with Kabir's (2021) findings, according to which the Queensland-based BAC Company was able to understand its social obligations to the impacted members of the local community through SIA and took several actions to resolve their concerns before coming to an IBA. However, Muuch' Xiinbal contends in his 2018 study on energy justice that while such legal tools as the FPIC enhance justice on the procedural side, communities disregard them as tools to only legitimise project implementation in contexts with high levels of inequality and marginalisation (Barragan-Contreras, 2022).

Esteves et al. (2012) contend that SIA exhibits some flaws in terms of the IBA because it is unclear who represents the impacted communities and, thus, has a claim to compensation. Furthermore, it might be difficult to decide who is legitimate as an information provider when it comes to FPIC and to ensure informed consent in situations where traditional understandings diverge from Western scientific understandings.

Reidar (2018), however, contends that the necessity for FPIC places more of an emphasis on communal affects and rights than individual impacts. The study argues that SIA, with its focus on communities that are not comfortable with the JET, does not do FPIC based on an individual's concern but on the whole community. This supports Barragan-Contreras's (2022) study in Mexico on procedural injustice, where he argues that individuals conceive themselves as one whole community, and if only a few sections of their lands are impacted, everyone is affected. She further argues that these collective

injustices are overlooked in the just energy transition policies due to their strong bias towards the Global North-Western individualist justice frames.

This relates to distributive justice as well, which focuses on the economic, political, and social frameworks within which each society has its own laws, institutions, and policies that lead to various distributions of advantages and costs among society's members (Stanford Encyclopaedia, 2017). Munoz Cabré and Vega Araújo (2022), who support the idea of distributive justice within the JET context, argue that any developmental undertaking needs to ensure an equitable distribution of public benefits rather than exacerbate them.

The relationships, power dynamics, and vested interests between the project proponents and the affected communities can be understood using SIA. Additionally, it supports procedural justice by ensuring that the community is well informed and prepared to participate in the public participation process. Vanclay and Burdge (1996) contend that widespread support for a project does not imply that it should proceed or that there won't be any substantial social repercussions. Because of this weakness, Vanclay and Burdge (1996) recommend that SIA be used to conduct an independent, unbiased expert assessment of the project's likely impacts. All these characteristics give SIA the opportunity to evaluate and efficiently handle the social impacts of the JET. Although SIA still has significant issues with FPIC and IBA that affect its ability to influence distributive justice, these issues must be resolved for SIA to offer a workable impact assessment procedure. SIA is a preferable option as an entry point for policy because of the emphasis it places on the social cost of development for communities.

5.5. Social Impact Assessment as an Entry Point to Government Policy in a Just Energy Transition

Following an exploration of the current policy environment in the South African coal sector as a prelude to this discussion, this section discusses the participants' prior opinions on it as well as the anticipated policy environment within JET skills development and community sustainability issues.

5.5.1. Perceptions of the policy environment in the coal sector and the role of Social Impact Assessments

The study's findings demonstrate that policy uncertainty continues to be a challenge for South Africa's coal mining industry and that technocrats oversee policy making. This supports Munnik's (2019) conclusion that academic research and activist organisations both play important roles in the policy cycle. However, significant community voices are absent from the policy-making process and decision-making in the coal industry.

This technocratic bias in policy results in “winners and losers” (Expert interviewees 2 and 5, 2020). The study contends that grassroots engagement and multistakeholder collaboration through SIA can promote procedural justice by ensuring a level playing field for both technocrats and civil society, thereby avoiding the “winners and losers” scenario in policy decision-making. Studies that have been reviewed indicate that SIA makes it easier for communities to understand the challenges surrounding development projects and their impact on them, giving them the chance to facilitate capacitated individual and group decisions and public policy plans (Aucamp and Lombard, 2018; Buchan, 2003; Kabir, 2021).

Furthermore, Burdge and Vanclay (1996) assert that SIA can identify stakeholders, winners, and losers by focusing on how social costs and opportunities among social classes and marginalised groups affected by the development project are distributed. This establishes SIA as a tool that, if used in JET action plans, can promote distributive justice by promoting legislation that demands an equal distribution of costs and benefits across impacted communities. One participant argued that revenue from the carbon tax could be recycled to compensate workers who are retrenched due to the closure of coal mines as the RE sector is ushered in (E. interviewee, 13, 2021). Another participant argued that taxes paid by companies should be used in the areas where the company is located and not elsewhere, and policy should be amended in this regard (E. interviewee 5, 2020).

Some participants claimed that when it comes to resource use and user rights, policy is characterised by a lot of red tape. One participant said that "according to the old National Water Act, irrigation with mine water or other impacted water was prohibited.” However, the Department of Water is currently examining mine-impacted water to ensure that it is

suitable for use and examining policy to ensure that it is implemented correctly (E. interviewee 2, 2020). Another example of red tape was the stipulation that approval be sought from the Department of Mineral Resources [DMR] before the black wattle could be harvested as part of a rehabilitation effort and economic activity post-coal mining (Chidzungu, 2019).

Participants in the study assert that SIA reports can inform regulators of the negative impacts that these red tapes have on disadvantaged communities through input from grassroots engagements and collaboration with regulatory organisations. This is in line with Vanclay and Esteves (2011), who posit that SIA teams work closely with regulatory bodies and grassroots communities and can influence community-oriented policies. Aucamp and Lombard (2018) argue that the SIA process assists with establishing connections for further engagements, which may assist, for example, with providing the right platforms or regulatory agents to help with community concerns on issues such as the red tape attached to development efforts. Findings also argue that SIA's grassroots engagements can advocate for policy that allows for a gradual cessation of coal use to avoid the devastating effects on livelihoods. The findings demonstrate that the current coal industry policy environment will have a bearing on JET policies.

5.5.2. The Role of Social Impact Assessment in the Just Energy Transition Policy Environment

Some participants focused on labour and reskilling needs during policymaking in response to the question that fed into this theme, while others highlighted community sustainability issues. Hence, it was imperative to discuss these separately.

5.5.2.1. The Role of Social Impact Assessment in a Just Energy Transition-Skill Development Policy Context

Participants argue that SIA can advocate for policies that encourage industries to commit financial resources to continue with some of the projects at a lower scale while reskilling some of the workers. Moreover, they can advocate for policies that compel RE industries, as part of their contract conditions, to absorb and reskill a certain percentage of labour from the coal sector. According to the study, in this case, SIA reports can bring to light contextual issues about pre-existing skills and educational dynamics that policymakers

should be aware of as reskilling policy guidelines are enacted and imposed on new companies. According to Vanclay (2003), SIA takes the affected community's life history into account. Making policy decisions in this case should consider the level of educational achievement and aptitude for STEM skills among coal employees and young people, as well as the skill requirements of the RE project and any measures to be put in place.

Given the input from multi-skilled experts, SIA reports can influence governments to enact policies that increase local authorities' capacity to identify other economic opportunities for investors outside of coal mining, like agriculture, eco-tourism, and a focus on skill development. Participants also stated that, as part of policy considerations, SIA may recommend to the government that it consider offering tax incentives to renewable energy firms and international investors that construct training and innovation hubs in the affected areas (Expert Online Survey 34; 5, 2021). Asserting the use of tax incentives is Kaluba (2018), who argues that, to attract money from investors, governments should create an enabling environment by implementing attractive taxation and feed-in tariff policies. The fact that SIA pushes for tax incentives for companies that offer training and innovation hubs also supports Aucamp and Lombard's (2018) findings that SIA's recommendations for mitigating impacts include funding for infrastructure development and related skills development initiatives, which make funding for affected workers more stable.

Findings posit that SIA, as part of reskilling policy advocacy, can recommend that the government mandate industry to incentivise communities and other workers within the coal value chain to explore or work in other sectors while they reskill and retrain workers involved in the coal sector value chain. Moreover, SIA could also advocate for the RE industry to consider women in skills development policy decisions given that they are overlooked in reskilling programmes as non-coal employees. Studies show that SIA applies gender considerations in all assessments, enhances the position of females as well as other less privileged members of society, and contributes to the capacity building of these groups (Vanclay, 2002; Vanclay et al., 2015).

Considering the above-mentioned perspectives, SIA can identify inherent and external challenges on a micro-scale, assess potential opportunities and challenges, and

recommend reskilling measures to aid in policy formulation within a JET framework. Other participants' views explained policy from a community sustainability perspective.

5.5.2.2. The Role of Social Impact Assessment in a Just Energy Transition Community Sustainability Policy Context

The study, alongside existing studies, points out that current JET and climate change policies, such as the Carbon Tax, REIPPPP, NCCRWP, and IRP, have a strong bias towards reducing carbon emissions, overlooking the social costs of JET (Burton et al., 2019; Glynn et al., 2020). This will impact the community sustainability of the impacted workers and communities that require socially oriented policies that SIA could facilitate.

Participants argue that SIA, with its community-centred approach and advocacy for job preservation, can influence policies that will ensure continuity of life in JET-impacted areas. They argued that solar plants can be built anywhere if there is coal, a transmission substation, and a labour force that can be absorbed (E. interviewee 14, 2021). This has the potential to prevent a lack of in-situ economic activities as the energy transition unfolds, as was the case in the United States (Haerer and Pratson, 2015), where jobs in the renewable sector were increasing but not in the same places as jobs in the fossil fuel sector. Participants argue that policy should assist in managing such risks, arguing that policies enacted should govern where the solar infrastructure is put, as it should not interfere with agricultural land or food security. According to Aucamp and Lombard (2018), SIA could offer these risk management mitigation strategies since they help businesses understand the context in which their operations will take place and the dynamics of local populations.

Another intriguing and more technical finding on SIA and policy was tax. Some participants suggested that the proceeds from the carbon taxes be used to pay coal miners who are retrenched because of the coal industry's related decline and that the national government should invest the taxes paid in the same communities that pay them instead of investing elsewhere in the country. The study suggests that SIA may be better positioned to identify such secondary impacts imposed through unfairly allocated taxes, which may affect service delivery and the provision of related basic infrastructure, thereby affecting community sustainability.

ILO (2011) contends that having inexpensive, universal access to basic social services in the areas of housing, education, food security, water and sanitation, and health is a

national goal. This forms part of the social protection floor that SIA advocates for (Aucamp and Lombard, 2018). SIA as part of social protection advocacy in a JET context could feed into local action plans in JET-impacted areas, such as the use of clean water from power stations to support regional economic initiatives, such as initiatives on land reform to scale agriculture.

In relation to land reform, findings point to the absence of land and water rights that need to be rectified. This highlights problems with distributive and rectificatory justice that previous policy on coal has not addressed and will affect the RE industry. According to Reidar (2018), SIA considers contextual issues or risks in the project environment that a project did not cause but to which it is related. These risks are frequently disregarded during policy formulation.

There is a connection between Frank Baumgartner and Brian Jones' Large Leaps Theory of Change and SIA's impact identification, assessment, and mitigation that arises from contextual issues outside of or unrelated to JET that call for a review or modification of current policies (Stachowiak, 2013). It asserts that when new aspects of an issue become known, current policies are often fundamentally questioned, which opens the door for policy reform (Stachowiak, 2013). Land reform is returning to policy, in this case as a contextual issue, necessitating new actors and a re-evaluation of policies as the energy transition progresses.

Some participants raised issues about employment recruitment processes that favour migrants at the expense of locals. According to Aucamp and Lombard (2018), supporting small and microbusinesses and creating jobs are two high-potential focus areas that are frequently addressed in SIA mitigation. The study also contends that SIA reports can highlight the importance of giving locals priority in JET recruitment policies.

Participants suggested that SIA should influence the government to implement community-centred policies that will push the RE sector to involve communities in decision-making using a bottom-up approach to decision-making. According to Reidar (2018), SIA is anchored on informed stakeholder engagement and stakeholder analysis, which are essential elements of good governance based on the values of accountability, transparency, and non-discrimination. The United Nations Framework Convention on Climate Change [UNFCCC] (2021) cites the Just Transition Commission in Scotland,

where young people's views are actively sought after by the commission, which consults with the public through open forums, seminars, and social research to develop climate policies in the JET context. Similarly, the Canadian Transition engaged in direct consultations with citizens and communities, reinforced procedural justice, and gave weight to policy decisions. It also placed a high priority on outreach (European Commission, 2019).

Participants argued that SIA teams should advocate for the alignment of the JET projects with LEDs, IDPs, and SLPs and integrate them with community needs to influence government policy. According to Armour (1990), as SIA is an iterative process and permits continual review of plans as the JET develops, this type of integration in planning demands data gathering throughout time and constant plan amendment to guarantee that planning goals are being accomplished, allowing for community-centred policies.

5.6. Conclusion

The first objective focused on the sustainability perspective as it points to environmental sustainability and community sustainability in JET-impacted communities. The findings and reviewed literature show that the biophysical impacts from the burning of fossil fuels and climate change result in frequent droughts, floods, snowmelt, etcetera, and they affect environmental sustainability. In turn, these have subsequent socio-economic impacts on food security, health, and economic productivity. The study findings add to existing knowledge on climate change, its impacts on water resources, and the need for shifting away from fossil fuels (Koubi, 2019; Zemp et al., 2019; Olivier and Peters, 2018). The findings from the study confirm that renewable energy sources such as wind and solar have low environmental impacts and hence improve environmental sustainability. These findings highlight JET as an effective climate change strategy that promotes environmental sustainability.

With regards to community sustainability, the findings point to job losses affecting mostly the 65+ age cohort, who cannot be easily reskilled for absorption in the technologically intensive job designs in the RE sector. Gender disparities in recruitment in the RE sector were identified, with women being marginalised. Non-existent land and water rights that emerge as contextual issues impacting agriculture, which is a potential alternative

economy within the JET context, are also highlighted. Furthermore, a lack of public participation was observed, which inhibits community voices in decision-making. Relocations of communities to make way for RE infrastructure result in cultural disruptions. These findings on sustainability perspectives add to the growing concerns about the social costs that are overlooked in the policy that the JET comes with and that require a social mitigation strategy (Strambo, 2019; Glynn et al., 2020) that SIA can provide.

The second objective focused on skills development needs in the JET context. The findings show a general lack of establishment in STEM subjects as well as a pro-male gender bias in their pursuit. A general low aptitude for technical subjects among coal workers and the youth in the study areas of the province and country is said to impact skill development. Furthermore, poor education in South Africa, combined with an outdated curriculum design that is theory-based, limits the development of technical skills in the RE sector. The study findings show that SIA, through its collaborations with industry, academia, and communities, can be effective tools for advocating for curriculum redesign and the establishment of a skills needs assessment that is aligned with labour market demands.

The third objective focused on using SIA as an effective tool for assessing and addressing the social impacts of the JET on local communities. Findings of the study demonstrate that SIA provides an understanding of the structure of these complex mining communities, their social and educational histories, their interrelationships with mining companies, their power struggles, and the social change process. Moreover, it facilitates human rights protection, FPIC, public participation, age, and gender considerations in their assessments, positioning it to effectively assess and address the socio-economic impacts of JET. One weakness that was identified is that the FPIC that SIA advocates for improves justice on the procedural side, but in context with the inequalities in these mining-impacted communities, SIA is seen as a compliance instrument. The fourth objective focused on SIA as an entry point into JET policy decision-making. Findings and reviewed literature state that SIA advocates for integration in planning, data collection over time, and continual plan amendment as they recognise that policy is in flux. Additionally, the study asserts that the collaboration of SIA teams with regulatory bodies, impacted communities, and multistakeholder groups

gives SIA the opportunity to shape socially responsible policies. However, SIA can only make recommendations; it cannot change policy.

CHAPTER 6

Conclusion, Recommendations and Future Research

6.0. Introduction

This thesis was based on a qualitative investigation that incorporated quantitative techniques and used the Theory of Change as a theoretical framework. It employed semi-structured interviews and survey questionnaires administered online with experts and physically with the Kriel and Carolina coal mining communities. The study brings to light the role of SIA in mitigating the social costs of skill development and community sustainability perspectives within the JET context. The JET is perceived as a key climate change strategy, a technological shift, and an attempt to manage the social impacts of the energy shift, which illuminates the pivotal role of SIA in mitigating the social costs of development efforts.

6.1. Sustainability Perspectives in a Just Energy Transition

The study shows that fossil fuel burning which is a major contribution to climate change contributes to air, land, and water pollution and these adversely impact environmental and community sustainability. They have subsequent impacts on food security, health, economic productivity, and jobs. The use of wind and solar energy sources is envisaged to improve environmental sustainability through the reduction of air, land, and water pollution. As a subset of EIA, SIA can help ensure that environmental and social impacts are considered concurrently during energy transition planning, allowing social costs to be accounted for in JET mitigation plans and policy considerations.

With regards to the community sustainability aspect, the study found that there are issues in land and water rights that have not been addressed in the land reform process that will encroach on the low-carbon economy. These will affect livelihoods in agriculture, which is an alternative economic activity in the low-carbon economy. This will in turn impact food security by promoting malnutrition, job losses, and increasing poverty rates, thereby adversely impacting community sustainability. SIA assists with the understanding of the communities in which JET will take place and the complex issues therein; they are therefore pivotal in assisting project proponents with risk

management—an unmanaged land reform process in this case. The failure to actively involve communities in JET decision-making processes was identified as one aspect that would affect community sustainability as it has a bearing on cultural practises, relocation, and decision-making about the community's future. The reviewed literature and the study findings demonstrate that, as part of the SIA methodology, a two-way communication method is established between affected communities and project proponents, who are then capacitated to voice their concerns and make informed personal and shared decisions. Gender disparities in employment, common in coal mining, will and have already encroached on the energy transition space, affecting women's recruitment in the new low-carbon economy. According to the literature reviewed, the SIA process includes gender consideration in its evaluations, which could bring such issues to light and mitigate their costs. Job losses across the coal value chain and differing impacts based on age groupings were identified as affecting community sustainability as they will increase dependence rates, increase poverty, and increase stress levels among the impacted communities, thereby affecting community sustainability. The ideology that supports the social welfare system and the SDGs both align with the principles of SIA; hence, SIA could advocate for such local action plans as the use of CCTs, green funding, business incubators, innovation hubs, and non-cash support in the form of psychosocial services to cater for the different needs, mitigate the social costs of income loss, and preserve community sustainability.

6.2. Skill Development in a Just Energy Transition

The study shows a poor establishment of STEM subjects in the educational system. In addition, a lack of aptitude for technical subjects among coal workers and youth, as well as a general pro-male gender bias in the STEM field, impact skill development within the JET context. The findings of the study, as well as assessments done in the field of SIA, show that SIA, through its skill profiling and collaborative engagements with academia, industry, and communities, could facilitate a rethink of curriculum design. Furthermore, through SIA's skill profiling, the establishment of a skill needs assessment that is aligned with the vocational system and labour market demand could be realised. A high pre-matriculation dropout rate as well as poor school attendance that further impacts their

aptitude to take up basic vocational training that can bridge the skills gap to do skills-intensive training in the RE sector were identified. As part of impact reduction, SIA could advocate for the use of measures such as CCTs to promote school attendance and STEM subjects, particularly among female students who are hesitant to pursue technical subjects. Moreover, they can help advocate for reskilling compensation guidelines based on fair and appropriate distribution focused on age cohorts, minority groups, and gender considerations to mitigate against the costs of skills development posed by these factors.

6.3. Social Impact Assessment as a Strategy for Assessing and Addressing the Social Impacts of the Just Energy Transition

The study found that SIA could be an effective strategy for assessing and addressing social impacts associated with the energy transition due to their community-led participation, coupled with grassroots impact profiling and a deep understanding of complex mining communities. Assessments based on a community-rich understanding of issues raised by SIA are consistent with the Grassroots Theory of Change, which advocates for community-wide action to address a problem or problems affecting their lives. Also, the study's results show that SIA's process for addressing problems involves all the key players to ensure a fair outcome and the right way to frame impacts. This makes it easier to assess and address the social costs of JET. According to the reviewed literature, SIA makes it easier to observe FPIC and respect for human rights, two qualities that JET mitigation policies lack but are ideal for impact assessment and management. However, one weakness of SIA is that the FPIC in the SIA process is seen as a compliance mechanism by affected communities and is disregarded. SIA’s focus on social costs, however, gives it the flair to assess and address social impacts within the JET context and further feed into JET policies.

6.4. Social Impact Assessment as an Entry Point to Government Policy in a Just Energy Transition

The study demonstrates that SIA's collaborative stakeholder engagement can facilitate an alignment between IDPs and LEDs with community needs and proposed RE projects. This increases private sector and civil society involvement, which neutralises politics during policymaking and legitimises policies henceforth. The study, in line with other assessments carried out in the SIA field, found that SIA acknowledges that policy is in flux; hence, they promote integration in transition planning and advocate for an iterative process in planning to ensure that the goals are met. This also positions SIA as a policy strategy that can facilitate the establishment of a skills needs assessment that functions in coherence with the vocational system and labour market demand. The study found that SIA, in line with the "Large Leaps Theory of Change," through its impact identification, assessment, and mitigation that arise from contextual issues outside of or unrelated to JET, can call for a review of current policies, as is the case with land reform, which emerged as a contextual issue within JET impacting community sustainability. The study findings show that SIA teams collaborate with regulatory agencies, impacted communities, and multi-stakeholders, giving them the ability to fuel distributive, procedural, and rectificatory justice, which can influence socially oriented policies, which are overlooked in JET and climate change policies given their biophysical bias. The drawback that SIA, however, has is that it can only make recommendations but cannot change the policy as the onus lies with the government.

6.5. Recommendations

Based on the above conclusions, the researcher recommends that:

- Findings from SIA should be given equal value with findings from EIA and integrated and analysed as a collective, considering the complex interlink between the biophysical and social environmental impacts of climate change and the multiplier impacts of JET as a climate change mitigation strategy that brings on board secondary impacts on the social environment.

- As part of SIA's impact management and mitigation, it can recommend that the state provide financial aid through such measures as UCTs that may include social pensions, child support grants for children of ex-coal miners, and other qualifying individuals within the affected community to ensure community sustainability. Public employment programmes that foster self-employment among UCT beneficiaries and offer income assistance for impacted workers and communities are crucial for ensuring self-reliance.
- SIA, if included as part of mainstream JET mitigation action plans, could help advocate for the need for recognised accreditation of courses in the STEM field and enable local governments, industry, and vocational institutions, who are best positioned to understand skill needs, to tailor solutions to local populations. In addition, it should make it easier to conduct a thorough evaluation of how well the current primary through postsecondary education system is able to meet the demand for skills in the low-carbon sector.
- SIA should consider the use of CCT to encourage school attendance and attract students at vocational colleges to take STEM subjects to bridge the gap in JET skill development.
- SIA should advocate for training programmes for women in agriculture and help facilitate collaborative platforms between emerging women farmers, large commercial farmers, agriculture extension workers, financial investors, and the government. It should also push for the expediting of emerging women farmers' access to secure land tenure through the enhancement of land transfer procedures.
- SIA should be able to intensify public participation through its grassroot engagements with communities, which are still lacking in JET. Exclusion of affected communities could impact cultural heritage and even lead to human rights violations, and SIA recommendations should have legislative clout to facilitate criminalisation of some of their findings that involve human rights violations if they are integrated into mainstream policy decision-making.
- SIA gender analysis, risk identification, monitoring, and mitigation must advocate for career guidance on job opportunities and gender equality and a gender-sensitive way of promoting the education trajectory in the RE sector, considering that women are still under-represented in the energy sector.

- SIA should be used as a mechanism in policy that catalyses social and environmental restitution for past social injustices in the high-carbon economy and those that may encroach on or arise in the low-carbon economy. The necessity to grant SIA legislative authority through policy and designate it as a legally binding activity that goes beyond environmental permitting should gain traction.

6.6 Future Research

As social scientists, we need to constantly update quantitative databases rather than rely on existing government databases for quantitative data, such as the national census, which in most cases is 10 years behind. This was one limitation during the research, considering that it was not funded, and the researcher depended on desktop resources. Furthermore, we must continue to develop methods for selling qualitative findings from SIA to non-social scientists for use in decision-making and policy formulation. SIA consultants frequently lack expertise in relevant social and economic theory and may not have obtained SIA or social science methodology training. Further debate is needed on establishing fully qualified SIA practitioners who can effectively assess social impacts. More debate is also needed to establish the applicability of the micro-scale SIA findings to macro-scale projects. Alongside other assessments conducted in the SIA field, the study suggests that SIA has a weakness in that it can only focus on identifying and recommending amendments to existing policy but does not have the legal muscle to effect the actual change to policy. This is due to the monopoly the government has on decision-making, and a rethink of how SIA can overcome this weakness is necessary. More research is needed on issues of social inclusivity, values, and social and environmental justice and their link with SIA as a mitigation strategy within the climate change and JET contexts.

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APPENDICES

Appendix 1: Interview Schedule for Experts

INTERVIEW SCHEDULE FOR EXPERTS

Title: ***The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A Study of Kriel and Carolina Mining Communities in Mpumalanga***

Thank you for agreeing to participate in the study, I appreciate the opportunity you have afforded me to listen and interact with you as you share your expert knowledge on Just Energy Transitions from Coal to the renewable energy sector. The interview will be 20-30 minutes long and audio recorded as aforementioned in the consent form you signed; however, you are also at liberty to withdraw from the interview session at any time if you feel uncomfortable.

Section A: Demographic Questions

1. (i). What is the name of the organisation?

(ii) What are your duties in the organisation?

2). When did you join/start the organisation?

3). Which age category of these three do you fall under?

20-35	36-50	51-65	66+

4.) Under which race do you belong?

Africans	Whites	Coloured	Indian	Other

5. What is your highest level of education?

Grade 9 or below	Grade 10 or above	Matric	Occupational Certificate	Higher Certificate	Diploma	Degree	Other Specify

Section B: Focal questions for the study

1). What is your understanding of a JET from coal to the renewable energy sector?

2). What are your perceptions about this shift?

i) As part of the industry leaders?

3) Identify the prevailing environmental and socio-economic impacts on workers and mining communities under fossil fuels?

4). Can the above-identified impacts be lessened under the renewable energy sector? Explain?

5). Are there any JET from coal plans in terms of reskilling of the labour force exiting the coal industry that you are aware of that have been put in place by:

i). Industry ii). The local government iii) educational institutions?

6). How will coal workers and communities be affected by the JET from coal to the renewable energy sector?

7) Briefly explain the importance of Social Impact Assessments and public consultation in a JET from coal to the renewable energy sector?

8). How can a sustainable community be ensured under JET from coal to the renewable energy sector?

9). What kind of policy mechanisms can government enact on the mining industry to ensure the sustainability of communities during the transitions from coal to the renewable energy sector?

Appendix 2: Online Survey for Experts

Online Survey for Experts

Title: ***The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A Study of Kriel and Carolina Mining Communities in Mpumalanga***

Thank you for agreeing to participate in the study. Filling in the survey is a sign of consent. However, you are free not to respond to questions you do not feel comfortable responding to.

Q1. Which age range do you belong to?

18-24	25-34	35-44	45-54	55-64

Q2. What is your gender?

Male	Female	Non-Binary	Prefer not to say

Q3. Which sector do you belong to?

Mining Sector	Renewable Energy	Government	Private	Other

Q4. Identify the environmental impacts imposed by coal mining

Q5. Do you think Transitioning from Coal to the Renewable energy sector (wind, solar, hydro, biomass, geothermal...) will reduce the environmental impacts you identified in Q4 above

Q6. Identify the socio-economic impacts that are likely to be imposed on communities and other stakeholders within the coal value chain by the energy transition from coal to the renewable energy sector?

Q7. Do you think Social Impact Assessments can be a sustainable strategy for the effective assessments and addressing of socio-economic impacts in the Energy Transition from coal to the renewable energy sector?

Q8. In your opinion do you think there is a need for educational institutions in conjunction with the renewable energy and coal mining sectors to consider a rethink of the curriculum as far as skills development needs for the Just Energy Transition from coal to the renewable energy sector is concerned.

Q 9. How important is Public Consultation/Participation in a Just Energy Transition from coal to the renewable energy Sector

Q.10.What kind of policy mechanism can the government enact to ensure the sustainability of livelihoods for the impacted communities and the economic activities of stakeholders within the coal value chain?

Appendix 3: Kriel and Carolina Community Survey Questionnaire

Kriel and Carolina Community Survey Questionnaire

Title: ***The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A Study of Kriel and Carolina Mining Communities in Mpumalanga***

Thank you for agreeing to participate in the study. Filling in the survey is a sign of consent. However, you are free not to respond to questions you do not feel comfortable responding

1.Which age range do you belong to

18-40	**41-60**	**65+**

2. What is your gender

Male	**Female**	**Other**

3.Which sector do you belong to

Coal mining	**Agriculture**	**Government**	**Work closely with mines**	**Informal sector**	**Other**

Section B

1. What are the problems coal mining has caused to the environment?

2. Do you think if coal mines are closed the problems it has caused in the environment will be reduced?

Agree	Disagree	May be

3. Are you ever involved in public participation when a big mining project or energy project is done?

Yes	No	Sometimes

4. Do you think public participation is important during planning for this energy shift from coal to renewable energy like solar?

Very Important	May be	Not at all important

5. Do you think more jobs will be created if coal mines are closed and the renewable energy sector is introduced?

Yes	No

6. Give a reason for your answer in question 8 above

7. What kind of laws or policies should the government put to protect the livelihoods of coal mining communities if coal mines are closed to open the way for the renewable energy sector?

Appendix 4: Interview Schedule for Kriel and Carolina Mining Communities

INTERVIEW SCHEDULE FOR KRIEL AND CAROLINA MINING COMMUNITIES

Title: ***The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A Study of Kriel and Carolina Mining Communities in Mpumalanga***

Thank you for agreeing to participate in the study, I appreciate the opportunity you have afforded me to listen and interact with you as you share your expert knowledge on Just Energy Transitions from Coal to the renewable energy sector. The interview will be 20-30 minutes long and audio recorded as aforementioned in the consent form you signed; however, you are also free to withdraw from the interview session at any time if you feel uncomfortable. Section A

1). Which sector do you belong to

Mining	Agriculture	Government	Work closely with the mine	Informal sector	Other

2). Where were you born? _____

3). Which age group do you fall under?

18-40	41-60	65+

4). What is your Gender

Male	Female	Other

5). What are your educational Qualifications

Below Grade 9	Below Grade 12	Matric	Diploma	Degree	Postgraduate

Q1. What do you understand by the Just Energy transition from Coal to the renewable Energy Sector?

Q2. What are the problems you face with coal mining?

Q3. Do you think shifting from coal to renewable energy like solar and wind energy may reduce the impacts we have?

Q4 Are you ever involved in public participation? If yes or if no explain why

Q5 What do you think about learning new skills to work in new industries apart from coal mining?

Q6. What kind of policy should the government put to protect people who work and live in the coal mining areas before it shifts from coal to renewable energy?

Appendix 5: Ethics Clearance

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Chidzungu

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H20/06/04**
PROJECT TITLE	The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A study of Carolina and Kriel Mining Communities in Mpumalanga
INVESTIGATOR(S)	Ms T Chidzungu
SCHOOL/DEPARTMENT	Geography Archaeology and Environmental Studies/
DATE CONSIDERED	19 June 2020
DECISION OF THE COMMITTEE	Approved Permission letters required before data collection can commence Risk level: Low
EXPIRY DATE	13 July 2023

DATE 14 July 2020 **CHAIRPERSON** J. Knight
(Professor J Knight)

cc: Supervisor: Prof M Simatele and Dr F Postma

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature Date 15 July 2020

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix 6: Participant Information Sheet

School of Geography, Archaeology and Environmental Studies

Private Bag 3, Wits 2050, South Africa Enquiries: **GEOGRAPHY:** TEL: +27 11 717-6503 •
ARCHAEOLOGY: TEL: +27 11 717-6045 •
http://www.wits.ac.za/geography/

PARTICIPANT INFORMATION SHEET

My name is Thandiwe Chidzungu. I am a PhD student in the Department of Geography, Archaeology and Environmental Studies at the University of Witwatersrand. As part of my studies, I am doing research entitled: ***The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A Study of Kriel and Carolina Mining Communities in Mpumalanga***

The aim of the study is threefold: Firstly, to investigate ways through which the mining sector in Mpumalanga is transitioning from coal to renewable energy sources, but more specifically on how it is reskilling its labour force for absorption into new energy systems. Secondly, to explore how communities can undergo a sustainable Just Energy Transition from coaldependent livelihoods. Thirdly, to interrogate the potential Social Impact Assessments (SIAs) have in influencing the development of a comprehensive policy framework, within a Just Energy Transition context.

As part of my PhD thesis, different stakeholders who range from; academics, coal researchers and those working with mining communities, mining officials and those working in the renewable energy sector will be interviewed. I would therefore like to interview you and your colleagues as you have been selected as one of the experts to participate in the study. Your contributions will go a long way in making the findings of the research credible.

I would like to recognise the experts and people who contribute to this research and acknowledge them in my thesis. By agreeing to participate I recognise you as part of the contributing experts. However, if you do not agree with this, I will not compel you. Your participation in this interview is voluntary, confidential and will be treated with anonymity. The interview will be done either face to face or telephonically depending on the situation around the Covid-19 pandemic.

I would, therefore, appreciate your written consent if you are willing to participate in the study. There are no benefits, financially or otherwise, to be gained from participation. The only benefits will be policy makers recognising the potential of SIAs in dealing with the socio-economic impacts of Just Transitions from coal to renewable energy sources. Moreover, building sustainable post mining communities, and allowing them to transition into a post coal phase with the hope of a green economy driven industry.

If you have any questions during or afterwards about this research, feel free to contact me on the details listed below. This study will be written up as a research report which will be available online through the university library website, if you wish to receive a summary of this report. The data collected from this research project will be stored in the Witwatersrand University archives. With your permission the data collected from this research project may be used by other researchers (optional). If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecmedical.researchoffice@wits.ac.za.

Thank you for taking the time to read this letter.

Yours Faithfully

Thandiwe Chidzungu

If you agree to do this study, please, tick where applicable and sign below.

I do agree to participate in the survey. YES NO (mark with an X

I do agree to be audio-recorded. YES NO
(mark with an X)

PARTICIPANT'S

Signature ----------Date----------

I, Thandiwe Chidzungu, confirm that the above participant has been fully informed about the nature of the research.

Researcher: Thandiwe Chidzungu

Signature: …… Date:25/04/2020

Cell Number: 074 4351520

Email: 1312738@students.wits.ac.za

Dr Alex Wafer: 084 528 2978 (Supervisor)

Appendix 7: Consent Form for Interviews

School of Geography, Archaeology and Environmental Studies

Private Bag 3, Wits 2050, South Africa Enquiries: **GEOGRAPHY:** TEL: +27 11 717-6503 •
ARCHAEOLOGY: TEL: +27 11 717-6045 •
http://www.wits.ac.za/geography/

Title: ***The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A Study of Kriel and Carolina Mining Communities in Mpumalanga*** **Name**

of Researcher: Thandiwe Chidzungu

I, …… agree to participate in this interview. The research was explained too, and I understand what my participation will involve. I agree to the following:

I agree that my participation will remain anonymous YES NO
(please circle)

I agree that the researcher may use anonymous quotes
in his research report

YES NO

I agree that the interview may be audio recorded YES NO

I agree that the information I provide can be used YES NO

anonymously by other researchers following this study, subject

to their own ethics clearance being granted.

Participant:

Name of Participant…….

Signature…….
Date…….

_____ _____ _____

Researcher's Name Signature Date

Appendix 8: Consent Form for Survey Questionnaires

School of Geography, Archaeology and Environmental Studies

Private Bag 3, Wits 2050, South Africa Enquiries: **GEOGRAPHY:** TEL: +27 11 717-6503 •
ARCHAEOLOGY: TEL: +27 11 717-6045 •
http://www.wits.ac.za/geography/

Title: ***The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A Study of Kriel and Carolina Mining Communities in Mpumalanga.***

Name of Researcher: Thandiwe Chidzungu

I, ……agree to participate in this survey. It has been explained to me and I understand what my participation will involve. I agree to the following:

I agree that my participation will remain anonymous YES NO

(Please circle)

I agree that the researcher may use anonymous quotes in

his research report

YES NO

I agree that the information I provide can be used YES NO

anonymously by other researchers following this study, subject to their own Ethics

clearance being granted.

Participant:

_____	_____	_____
Name of Participant	Signature	Date
_____	_____	_____
Name of Researcher	Signature	Date

Appendix 9: Iphathisiphenti Sheet

School of Geography, Archaeology and Environmental Studies

Private Bag 3, Wits 2050, South Africa Enquiries: **GEOGRAPHY:** TEL: +27 11 717-6503 •
ARCHAEOLOGY: TEL: +27 11 717-6045 •
http://www.wits.ac.za/geography/

26 June 2020

Iphathisiphenti fomu: Yomphakathi wase Carolina le Kriel

Igama lami ngingu Thandiwe Chidzungu, ngingumfundi osebangeni le PhD kudiphatimenti le Geography eNyuvesi yase Witwatersrand. Ngenza ucwaningo olulesihloko esithi: ***The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A Study of Kriel and Carolina Mining Communities in Mpumalanga***

Okusemqoka kulocwaningo yikubhekisisa kabanzi indima engadlalwa yithuluzi le SIAs ekusizenu ukuthuthukisa amakonono kubasebenzi abazophoqeka ukuthatha umhlalaphansi lapho amamayini amalahle evalwa, kuvulelwa amashishini amasha lokusentshiziswa kwerenewable energy le mpila kahle yabantu abahlala kulezendawo z

Kulolucwaningo ngizathanda ukuxoxisana lawe ngaloludaba, kumbe ufilishe iquestionnaire ku email engingakuthumela yona, njengoba ulokunengi ohlangenwe nakho njengomhlali wendawo. Ma ungasaphathekanga uyakhona ukwenqaba ukuphendula imibuzo kumbe ukumisa lingoxoxo. Ngizokwazisa njengengxenye yabantu abahileleke kulolucwaningo ngokuvuma ukuxoxisana lami. Kodwa nxa ungazimisele ukhululekile ukwenqaba ukubayingxenye yocwaningo. Esizokuxoxa loba ozokubhala kuzozitshwa, ngisho legama lakho imbala ngeke livezwe. Lokhu kuxoxisana kumbe ukufilisha iquestionnare kungathatha imizuzu engamashumi amabili kusiya kwamane. Ngizacela ukurecoda lokhukuxoxisana ngemvumo yakho, nxa ungakujabuleli ulelungelo lokwenqaba. Loku kuxoxisana ngenxa ye COVID_19 sizokwenza ecingweni, nokho ma isimo sesingcono kungenzelwa emzini wakho. Ayikho inzuzo engokwemali ozoyithola kodwa ulwazi lwakho luzosiza libe nethonya emthethweni uhulumeni angayibeka enakho ukusiza umphakathi. Lolucwaningo lozobhalwa njenge 'research thesis' lukhiqizwe online kuwebsite yaseNyuvesi yase Witwatersrand. Nxa unombuzo ukhululekile ukuthinta abakhulu benyuvesi abangiholayo kulolucwaningo kunombolo ezingenhla. Kumbe uthinte umnyango we University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrec-medical.researchoffice@wits.ac.za. Ngiyabonga inkathi oyithetheyo ngokuzikhandla ufunda lincwajana. Yimi Othembekileyo uThandiwe Chidzungu Umcwaningi: Thandiwe Chidzungu Cell: 0744351520 Email: 1312738@students.wits.ac.za

Nxa ukhululekile ukuba yingxenye yocwaningo khombisa ngokuthwebula okulandelayo.

YEBO CHA (Khombisa ngo X)

Ngiyavuma ukurekhodwa YEBO CHA (Khombisa ngo X)

PARTICIPANT'S

Signature ----------Usuku----------

Mina, Thandiwe Chidzungu ngiyafunga ukuthi iphatisiphenti ichazelwe ucwaningo ngokugcwele

Umcwaningi: Thandiwe Chidzungu

Signature: …… Date:25/04/2020 Cell Number: 074 4351520

Supervisor: Dr Alex Wafer: 084 528 2978 Email: Alex.wafer@wits.ac.za

Appendix 10: Incwadi Yesivumelwano Somlomo Se Interview Yomphakathi Wase Carolina leKriel

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Private Bag 3, Wits 2050, South Africa Enquiries: GEOGRAPHY: TEL: +27 11 717-6503 •
ARCHAEOLOGY: TEL: +27 11 717-6045 •
http://www.wits.ac.za/geography/

26 June 2020

Incwadi yesivumelwano somlomo se interview: Yomphakathi Wase Carolina leKriel

Igama: Thandiwe Chidzungu

Isihloko Socwaningo: ***The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A Study of Kriel and Carolina Mining Communities in Mpumalanga***

Mina u..... ngiyavuma ukuhlanganyela kulokhu kuxoxisana. kuchaziwe kimi njalo ngiyaqonda ukuthi ukuhlanganyela kwami kushoni.

Ngiyavuma ukuthi ukuhlanganyela kwami kuzozitshwa. (Khombisa ngo X) Yebo Cha

Ngiyavuma ukuthi umcwaningi uzoziba amaphuzu ami. Yebo Cha

Ngiyavuma ukurekhodwa. Yebo Cha

Ngiyavuma ukuthi amaphuzu ami angasetshenziswa ezitshiwe ngabanye abacwaningi ngemva kwalolu cwaningo,

Kuphela ma bethole imvumo ye Ethics Clearance yabo Yebo Cha **Umhlanganyeli:**

_____ _____ _____

Igama lomhlanganyeli isiginesha Usuku

Umcwaningi odinga imvumo

Thandiwe Chidzungu _____ _____

Igama lomcwaningi: Isiginesha Usuku

Appendix: 11 Incwadi Yesivumelwano Esilotshiwe Somphakathi Wase Carolina Le Kriel

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26 June 2020

Incwadi yesivumelwano esilotshiwe se interview: Yomphakathi Wase Carolina Le Kriel

Igama: Thandiwe Chidzungu

Isihloko Socwaningo: ***The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A Study of Kriel and Carolina Mining Communities in Mpumalanga***

Mina u..... ngiyavuma ukuhlanganyela kulokhu kuxoxisana. kuchaziwe kimi njalo ngiyaqonda ukuthi ukuhlanganyela kwami kutshoni.

Ngiyavuma ukuthi ukuhlanganyela kwami kuzozitshwa. (zungeza) Yebo Cha

Ngiyavuma ukuthi umcwaningi uzoziba amaphuzu ami. Yebo Cha

Ngiyavuma ukurekhodwa. Yebo Cha

Ngiyavuma ukuthi amaphuzu ami angasetshenziswa ezitshiwe ngabanye abacwaningi ngemva kwalolu cwaningo,

Kuphela ma bethole imvumo ye Ethics Clearance yabo. Yebo Cha **Umhlanganyeli:**

_____ _____ _____

Igama lomhlanganyell Isiginesha Usuku

Umcwaningi odinga Imvumo

_____ _____ _____

Igama lomcwaningi: Isiginesha Usuku

Appendix 12: Imibuzo Ku interview Schedule Ku Bahlali Bomphakathi Wase Carolina lase Kriel

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ARCHAEOLOGY: TEL: +27 11 717-6045 •
http://www.wits.ac.za/geography/

Imibuzo Ku interview Schedule ku Bahlali Bomphakathi wase Carolina lase Kriel

Isihloko Socwaningo ***The Role of Social Impact Assessments in Skills Development and Sustainable Communities in South Africa's Just Energy Transition from Coal: A Study of Kriel and Carolina Mining Communities in Mpumalanga***

Ngibonge ukuvuma kwakho ukuhileleka kulolucwaningo, sixoxa kabanzi ngaloludaba lwe Just Transitions from Coal to irenewable energy sector. Ngibonga njalo ulwazi ozosabela lona njengengxenye yomphakathi, uchaza indlela elizizwa ngayo ngalolutshintsho oluza ngomsele. Ukuxoxisana kwethu kuzothatha imizuzo engaba phakathi kwe 20 kusiya ku 40 minutes ubude njalo sizo recorder njengoba sivumelene ku consent form. Njengoba ngishilo kusivumelwano sethu ku consent form oyisayinile, qaphela ukuthi ukhululekile ukungahlanganyeli kulolu cwaningo uma ungakujabuleli.

Isiqendu A: Imibuzo yokwakha ubudlelwano

1). Wenza msebenzi bani wokuziphilisa? _____

2). Uzalelwe kuphi? _____

3). Ukuliphi izinga ngokwemnyaka yokuzalwa?

25-30	36-50	51-64	65+

4). Ulaliphi izinga lemfundo

Ibanga 9 kusiyaphansi	Ibanga 10 kukhuphuka	Matric	Icertificate sezandla	Ihigher Certificate	IDiploma	Ezinye iziqu zemfundo

Section B: Imibuzo emqoka

1. Yini oyiqondayo ngokuguquka kwe-Just Energy kusuka ku-Coal kuya ku-Energy Sector evuselelekayo?

2. Yiziphi izinkinga obhekene nazo ngokumbiwa kwamalahle?

3. Ucabanga ukuthi ukushintsha kusuka kumalahle kuya kugesi ovuselelekayo njengamandla elanga nomoya kunganciphisa imithelela esinayo?

4 Ingabe wake wabandakanyeka ekuhlanganyeleni komphakathi? Uma yebo noma uma kungekho chaza ukuthi kungani

5 Ucabangani ngokufunda amakhono amasha okusebenza ezimbonini ezintsha ngaphandle kwezimayini zamalahle?

6. Uhlobo luni lwenqubomgomo okufanele uhulumeni ayibeke ukuvikela abantu abasebenza futhi abahlala ezindaweni zokumbiwa kwamalahle ngaphambi kokuba ishintshe kusuka kumalahle kuya kugesi ovuselelekayo