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Faculty of Science

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Perspectives on the role of Social Impact Assessments in solving Acid Mine Drainage imposed socio-economic impacts in post-mining communities: A study of Carolina Catchment area X11B in Mpumalanga, South Africa.

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DECLARATION:

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ABSTRACT

Acid Mine Drainage (AMD) is the biggest problem mining communities in South Africa face. AMD has environmental, social and economic implications. In the context of Carolina in Mpumalanga, South Africa, the prevalence of AMD poses a threat to environmental, social and economic stability in the area. In view of this, extensive work has been done to address the physical elements overlooking the social and economic elements. This study was aimed at exploring the role of Social Impact Assessments as a tool in assessing and addressing the AMD imposed socio-economic impacts on mining communities. Data was gleaned from interviews, public dialogues, stakeholder consultative forums, community forums, questionnaires, focus group discussions, Integrated Development Plans (IDP), Stats SA Community Surveys, and Local Economic Development (LED). Cultural Historical Activity Theory (CHAT) was used as the main methodological approach in conjunction with an ethnographic approach and the aforementioned data collection tools, to unpack the problem. A myriad of stakeholders within the Carolina community ranging from; ordinary community members, farmers, business people, Inkomati Usuthu Catchment Management Agency (IUCMA) officials, mining officials, municipality and LED officials from local government within Mpumalanga. Mining community activists from within Africa were also engaged as participants.

The findings revealed that AMD has grossly impacted on the socio-economic wellbeing of the mining community. Notable is that, the affected communities have remained excluded from any planning and decision-making processes in mineral development. Public participation is still at its doldrums imbued with gender, racial disparities, coupled with human rights violations emanating from environmental injustices. The environmental injustices imposed by AMD pollution from mining activities have led to dire consequences on the community's health, food security, employment and poverty intensity. A major premise of the thesis untangles opportunities for SIAs in reducing socio-economic and environmental impacts of AMD and feeds into local and national socio-economic development with a view to establish possible entry points to the regulatory policy. Moreover, it gives room for further debates on SIA to be used as a stand-alone environmental management tool that is conducted by Social Scientists to afford the socio-economic impacts of mineral development more weight.

Key terms: Acid Mine Drainage (AMD), Social Impact Assessments (SIAs), and Socio-economic impacts.

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ABBREVIATIONS

AMD	Acid Mine Drainage
CALLM	Chief Albert Luthuli Local Municipality
CALS	Centre for Applied Legal Studies
CBD	Central Business District
CCPJ	Catholic Commission for Peace and Justice
CDA	Community Development Agreements
CHAT	Cultural Historical Activity Theory
COM	Chamber of Mines
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessments
EPWP	Expanded Public Works Programs
FET	Further Education and Training
FPIC	Free Prior and Informed Consent
FSE	Federation for a Sustainable Environment
GCRO	Gauteng City Region Observatory
GDP	Gross Domestic Product
GSDM	Gert Sibande District Municipality
IDP	Integrated Development Plan
IUCMA	Inkomati Usuthu Catchment Management Agency
LED	Local Economic Development
I&AP	Interested and Affected Parties (I&AP)
MCSA	Mineral Council of South Africa
MPRDA	Mineral Petroleum Resource Development Act
MMDS	Mining, Minerals and Sustainable Development
MWCB	Mine Water Coordinating Body

MWCUB	Mine Water Clean Up Bureau
NEMA	National Environmental Management Act
NPO	Non Profit Making Organisation
NRGI	Natural Resource Governing Institute
NWA	National Water Act
MTR	Mpumalanga Treasury Report
PAP	Poverty Alleviation Programmes
SERO	Socio-Economic Review and Outlook
SIA	Social Impact Assessment
SLP	Social Labour Plan
UNDRIP	United Nations and Education on the Rights of Indigenous People
UNEP	United Nations Environmental Program
USCEQ	United States Council on Environmental Quality
TDS	Total Dissolved Solid
WAMUA	Women Affected by Mining United in Action
WWF	World Wide Fund

CHAPTER ONE

FRAME OF REFERENCE

1.1 Background to the study

Perhaps no single industry has attracted so much environmental and socio-economic concerns over land use than coal mining. Historically coal mining played an important role in the economies of many countries creating employment and wealth (Azapagic, 2004). During the 1950s, coal was perceived to be paramount in the growth of the European economy (Wolkersdorfer *et al.*, 2005). However, five decades later the coal sector saw a downward trend characterised by defunct plants owing to coal's high pollution levels. Alongside the pollution scare, the United Nations Environmental Program [UNEP] (2017) pointed to; the decrease in the competitiveness of coal, stagnation of export demand, global coal plant closures and cancellation of projects in the pipeline, citing India and China who have cancelled more than fifty percent of their planned coal plants.

According to the Africa Progress Report (2013), mining in Africa has the potential to contribute significantly to economic growth and poverty alleviation. However, there have been concerns about the high levels of pollution from mining activities that negatively impact on the environment and the socio-economic well-being of communities. This, in turn, puts an upper limit to the generation of employment and poverty reduction (Africa Progress Report, 2013).

Nevertheless, the economic benefits of coal mining come at an environmental and social cost. This is substantiated by Morrice and Colagiuri (2012) who argue that the negative effects of coal are initially observed in environmental degradation and subsequently to health and well-being, for both mine workers and communities within the concession area. According to the study done by Ochieng *et al.*, (2010), Acid Mine Drainage (AMD) is argued to be the most serious environmental problem in the mining industry the world over. AMD: "is caused by pyrite (FeS_2) (also known as 'fool's gold'), found in underground rock formations coming in contact with oxygen and water" (Tempelhoff *et al.*, 2014, p.82). McCullough *et al.*, (2006) in their study cite the abandoned Bowen Coal Field of North Queensland pit lake, where the water chemistry is highly acidic with high concentrations of dissolved cations, with a pH of 2.4, and sulphate and iron concentrations of 2610 and 690 mg L^{-1} respectively. The 2.4 pH levels are far below the permissible standards for World Health Organisation (WHO) where the pH for drinking water

recommended levels are in the range of 6.5 to 8 and Total Dissolved Solids (TDS) are recommended at 1000 mg/L (Akale *et al.*, 2017).

In Zambia's Copper belt region, high levels of adverse impacts on farming settlements in close proximity to polluted groundwater from tailings dams have been observed (Von der Heyden *et al.*, 2004). A number of studies on the Zambian copper belt show that trace metal uptake in agricultural plants like cassava, sweet potatoes and maize is high in contaminated areas (SGAB *et al.*, 2005; Lindahl, 2014). In some cases water in streams is polluted by water coming from these polluted tailing dams and unsuspecting communities continue using the water for agriculture and fishing to support their livelihoods with detrimental effects (Boularbah *et al.*, 2006; Halder and Islam 2015). Mirroring these observations is the Centre for Natural Resource Governance, (2017) that expresses the view that if this mine water contamination is not addressed it can compromise the entire fabric of society.

In light of the above mentioned and existing literature, it has thus been recognised and appreciated that mining developments generate both positive and negative impacts for host communities (Morrice and Colagiuri, 2012). Therefore, within trying to understand the actual impacts of mining activities on the environment, Environmental Impact Assessments (EIAs) have been implemented. Saidi (2010, p.2) defines EIAs as: "policy and legislative framework which are used to integrate environmental with sustainability issues in development planning". Of great concern is that EIAs tend to be biased towards the biophysical environment, ignoring the socio-economic aspects of the environment. Alluding to this argument is Ridl and Couzens 2010 who express that the EIA regulations promulgated in 2006 excludes communities given that the EIA reports to the public do not require the consultants to provide them in a language of choice to the public. This out rightly compromises the tackling of the socio-economic impacts likely to be raised by communities. While Leonard (2017) articulates that this has remained unchanged even in the 2014 EIA regulations, he further mentions another hurdle posed by public notices during the EIA process that are placed in conspicuous places that are not easily accessible by members of the public to be able to voice their concerns on particular projects that may impact on their well-being. Consequently all this puts an upper limit for the public to bring the socio-economic aspects to the fore.

Within the South African context, research shows that coal plays an important role in contributing to economic growth and national development. According to the 2004 figures from the Chamber of Mines (COM), now Mineral Council of South Africa, coal was the second largest earner of foreign exchange in the country and contributed 4% of the Gross Domestic Product

[GDP] (Kirkman, 2006). In the period 1993-2015 coal accounted for approximately 12% of total merchandise exports from South Africa (Chamber of Mines, 2016). Despite these economic benefits that mining contributes to the economy, AMD and the degraded landscapes that it creates has become an *unpalatable* part of the lives of poor and vulnerable communities. The Gauteng City Region Observatory (GCRO) (cited in Bobbin and Tragos, 2018) identifies several communities in South Africa that continue to suffer from the legacy of AMD namely; Merafong city, Westonaria, Randfontein, Johannesburg and Ekurhuleni. Existing scholarly on AMD confirm these adverse impacts expressing that, the problem of AMD continues to impact on communities' wellbeing and health even post mining. This therefore shows that the positive impacts of mineral development tend to be short lived and temporary compared to the negative impacts that in most cases are not easily reversible. Ironically all this happens despite South Africa having the most advanced environmental legislation in the world (Mentis, 2010; Kotze and Paterson, 2009; Aucamp, 2015)

A significant component of South Africa's environmental legislation is its anthropocentric approach (Du Pisani and Sandham, 2006). This has seen South Africa implementing EIAs, in an effort to mitigate the actual impacts of mining. De Lange (2013) perceives EIAs as key tools in sustainable development, although parts of its implementation are still a barrier as they fail to address; social, economic and environmental aspects in a holistic manner. Hildebrandt and Sandham (2014, p.21) then argue that: "SIAs are conducted as a component of EIAs and ensure that social aspects of sustainability are recognised as an outcome of the EIA process". Therefore having SIA as a stand-alone management tool alongside EIAs can potentially give it equal weight to EIAs and this may put significant emphasis on the socio economic aspects of every assessment exercise. This is so because SIA are assessments which are commissioned by qualified Social Scientist, whereas EIAs are commissioned by Natural Scientists, who in most cases have limited knowledge on the human environment interactions (Sandham, *et al.*, 2005).

1.2. Thematic considerations

Natural resources play an important role in the South African economy and coal is among the top contributors to the economy (Chamber of Mines Report, 2016). A Study by Eberhard (2011) estimated that 93% of South Africa's electricity is produced by coal-powered stations. Most of the collieries are found in the Mpumalanga province where AMD from coal mining is a challenge. Naicker *et al.*, (2003) identifies the Highveld coalfield in Mpumalanga which experienced severe pollution which negatively affected the Loskop dam and the Olifants river

catchment, following AMD pollution from the mines. Alluding to the AMD menace in Mpumalanga is the study by McCarthy and Humphries (2013) who point to the case of Carolina town in Mpumalanga, where AMD has affected water quality in the Boesmanspruit dam. AMD has impacted on the community's well-being as reduced water quality puts restrictions to industrial and domestic activities. Munnik (2010) in his study identifies several adverse impacts of AMD on the community's wellbeing expressing that there is; the displacement of people, health issues, the destruction of their habitats and natural resources.

In response to the adverse environmental impacts, EIAs have been implemented as remediation tools. However, Hildebrandt and Sandham (2014) argue that EIAs have a tendency of focusing on the biophysical environment at the expense of the socio-economic implications. Little is therefore done to understand the socio-economic impacts of mining on communities. Joyce and Macfarlane (2001) argue that the potential exists for SIAs to facilitate information dissemination that can be used to achieve long-lasting benefits for people affected by mining projects and promote sustainable development.

The South African circumstances as explained by the socioeconomic disparities that are a legacy of the Apartheid era also provide an opportunity to explore the future trajectory for SIAs. In view of the above observations, this study will explore the role of SIAs in assessing and addressing the socioeconomic effects of AMD on vulnerable mining communities in the Carolina catchment area X11B in Mpumalanga, South Africa. It is envisaged that the study will contribute to identifying policy intervention entry points aimed at building sustainable post-mining communities.

1.2.1 Research questions

In view of the above observations, the following questions guided the research process:

- i. What is the relationship between SIAs and public participation?
- ii. To what extent can SIAs contribute to the ability of communities to transition into a post-mining phase amid threats of AMD pollution?
- iii. In what ways does SIAs help in mediating between the conflicted interest of communities and mining companies in the Carolina mining community?

- iv. Can SIAs serve as a mechanism to provide real life, mainstream, and statistics based view for an effective assessment and addressing of the socio-economic impacts of Acid Mine Drainage (AMD) on the poor in the Carolina community?
- v. What are the policy implications of the findings of this study in a wider context, particularly in Sub Saharan Africa?

1.3 Research aim and objectives

The aim of this study was to explore the role of Social Impact Assessments as a tool in assessing and addressing the socio-economic impacts of Acid Mine Drainage on poor mining communities, taking Carolina mining community as a case study.

In view of the research aim above, the objectives of this study were to:

- i. Explore the relationship between SIAs and public participation in post-mining communities amid AMD threats.
- ii. Explore the potential of SIAs in promoting the ability of mining communities to transition into a post-mining phase.
- iii. Evaluate the ability of SIAs in mediating between the conflicted interests of impacted communities and mining companies.
- iv. Determine the socioeconomic impacts of Acid Mine Drainage on poor people in post-mining communities.
- v. Identify appropriate policy intervention entry points.

1.4 Theoretical considerations

The primary purpose of this section is to give a synopsis of the literature review covered in chapter two. The literature review is focused on unpacking the role of SIAs and its relationship with public participation in impact assessments. Moreover, the instrumentality of SIAs in transitioning to a post-mining phase as well as the role of SIAs in mediating between the conflicted interests of mining companies and affected communities. Furthermore, the ability of SIA to effectively assess and address socio-economic impacts of AMD on post-mining

communities is also dealt with. In addition, inferences are made on the potential SIAs have as an entry point into public environmental policy.

With regards to the relationship between public participation/consultation and SIAs, the former was proven to be of paramount importance in SIAs. Public participation is a participatory approach to development that has grown essentially to give a platform to active citizen participation into SIAs (Howitt, 1995). According to Wood (1995), public consultation is an integral accessory of the EIA/SIAs process because it plays a pivotal role in establishing social and economic sustainability. The NEMA/ EIA Policy Guideline under Section 2(4) f (as cited in Murombo, 2008, p.8) states that:

“The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills, and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured”.

If public participation is to fulfil the above-mentioned ideals, it should create room for educating the affected communities on resource protection. Furthermore, in South Africa public participation is hampered due to lack of mining companies sharing decision making on key management issues. Thompson (1997) alludes to the argument expressing that, public participation displays a bureaucratic tendency and verbal expectations exhibited in the unfairness to raise issues during public dialogues. In light of the above arguments Leonard (2017, p.3) suggests that: “it warrants the questioning of the effectiveness of the EIA participatory processes, quality of the EIA application process and the quality of the EIA procedure thereof”. In response to the afore mentioned argument, Lockie *et al.*, (2008) argues that for vibrant Social Impact Assessments to be carried out, the public should be well informed so as to influence the results of the process. Joyce and Macfarlane (2001) concur to the above argument adding that transitioning to a post-mining phase requires that communities be equipped with relevant skills required for participation in post-mining economies. A drawback that Lockie *et al.*, (2008, p.180) asserts saying: “once a community cannot genuinely influence decisions due to ignorance it runs the risk of ignoring positive change just as much as it does the risk of trivialising negative impacts, particularly among minority groups”. In their study, Joyce and Macfarlane (2001) express that the role of SIAs then becomes that of gathering information on the capacity of the key parties to participate in a development process. On the other hand, Lockie *et al.*, (2008) are of the view that promoting indigenous knowledge and science communication could provide a

platform for better comprehension of available information. This alleviates conflict of interests between mining companies and communities, given the new technologies that mines rob in during and post mining that may disrupt existing traditional practices. A role that SIA if given significant emphasis alongside the EIA process but perhaps in the form of a stand –alone assessment overseen by social scientists who have direct interaction with the communities may facilitate indigenous knowledge and science communication in mining. This may however seem costly at face value and on the onset but in the long run it is more economic as costly and irreversible socio economic impacts of development may be curbed.

The socio-economic impacts of AMD are the repercussions imposed by a developmental project on a communities' way of life (Vanclay, 2003). These adverse socio-economic impacts are associated with the greater political muscle of the mining industry that enables it to control knowledge and access to resources over native communities (Connor *et al.*, 2009). A litany of socio-economic impacts has thus been observed namely; human occupation deprivation, poverty, ill health, food insecurity, and unemployment. In this context, Blakeney and Marshall (2009) define occupation deprivation as an upper limit imposed on everyday activities following mine water pollution. Poverty is seen by Sen (1999) as penury of basic capability rather than a meagre income. These socioeconomic impacts tend to be peculiar from one place to the other as defined by local context. Thereby, making it imperative to do more studies of this nature, because findings from one study cannot really be used as a blueprint and become applicable to all mining areas.

The above observations on socio-economic impacts take us to issues around environmental public policy and SIAs being used as an entry point to such policy. At the core of SIAs are sustainable development and active citizen participation. This resonates well with governance that is at the centre of policymaking. Van Kersbergen and Van Waarden (2004) argue that governing processes eliminate the authoritative traditional process and brings in interactive dialogue, collaboration, and alliance formation. Thus it creates an enabling environment for active citizen participation in environmental policy making. South Africa is argued to be having one of the best environmental policies in the world although gaps still exist in legislation in so far as the socio-economic aspect of the environment is concerned. The EIAs according to Forrest and Loate (2017) are driven by economic and political imperatives, such that the need to hasten to license overrides social and environmental concerns. All this bias trivialises the importance of the socio-economic aspects of the environment. Furthermore, this is worsened by the lack of an

adequate formal set of guidelines for SIAs, which are at the core of the human environmental concerns (Hildebrandt, 2012).

1.5 Methodological considerations

This section focuses on the introduction of the role of SIAs in assessing and addressing the AMD imposed socio-economic impacts on the Carolina Community. Pragmatism was used to help in finding practical answers to the real-life problems the mining community faces amid AMD imposed socio-economic problems. The study took place in Carolina Quaternary catchment area X11B in Mpumalanga South Africa. The site proved to be relevant for this research as it lies on the Boesmanspruit dam which was affected by AMD in 2012. Moreover, Carolina is included in the Upper Komati Catchment Management Forum under the auspices of the IUCMA; hence historic information around the issue of AMD pollution is readily available.

Most notable is that the dam is the main supplier of domestic water for the Carolina community which has its socio-economic and biophysical environment greatly impacted by AMD pollution. The primary data was obtained from interviews, participant observations, questionnaires, community forums, and public dialogues. Community Survey 2016 from Stats SA and a range of literature was obtained from Newspaper articles, Journals, and Working papers. The Integrated Development Plan (IDP) for Gert Sibande (2018-2019), Chief Albert Luthuli Local District Municipality IDP (2017) and data from the local Non-Profit Organisation (NPO) 2018 database as well as the Local Economic Development (LED) also provided some socio-economic data. The research participants from the community were selected on a random basis while some key informants from the community were selected using purposive sampling based on that they are better informed around the AMD situation in Carolina. Community activist and community leaders were among the key informants as any envisaged sustainable developmental project post-mining are shaped by the interests and agendas of social groups. Other participants were selected based on their skills and knowledge with regards to AMD pollution, environmental policy, and mining communities. This afforded input from different perspectives and increased credibility of the findings. The section then goes further to describe the Data analysis, Scope, Limitations of the study and Ethical consideration.

1.6 Ethical consideration

The researcher complied with the ethical policy of the University of Witwatersrand when conducting the research as human participants were engaged in data collection. Such factors as confidentiality, anonymity and mutual consent were considered. Consent was one of the key considerations, potential participants were informed about what the study entailed and were allowed to be at liberty in so far as deciding whether to participate or not. They were also reassured that refusing to take part will not affect them in any way. The participants' identity was always protected during individual interviews however, it was not possible during community forums, and focus groups and this was pointed out to those who participated in these groups. Images were used with the verbal consent of the participants Pseudo names and terms like Interviewee 1, Participant 2, Regulator 1 or general titles were used to maintain participant anonymity. Tape recorders, laptops, and compact disks were kept safe away from easy access and had passwords so that no one could easily access the information it thus helped maintain confidentiality. The scholarly on AMD pollution, SIAs, environmental policies, and government documents were acknowledged through proper and recommended referencing.

1.7 Scope of the study and limitations

Social Impact Assessments have been brought in environmental management as an addendum to EIAs. SIAs are focused on socio-economic impacts of developmental projects, a missing element in EIAs that are biased towards the biophysical environment. The study was centered on untangling the role SIAs can play in assessing and addressing AMD imposed socio-economic impacts in post-mining communities. The Quaternary catchment area X11B, in Carolina Mpumalanga, was selected for this particular research as the study site, having considered that it was the centre of the AMD saga of 2012 as published in the media. According to the Mpumalanga LED section, coal mining activities are concentrated in Ward 21, in the Chief Albert Luthuli Local Municipality (CALLM), where Carolina the main study site is located. Carolina has many stakeholders who are better informed about AMD compared to other communities in Mpumalanga. The scope of the research was thus demarcated by this particular study site. The study gleaned information from empirical evidence collected from the Carolina community and relevant stakeholders. It is therefore envisaged that the findings of the study will

contribute to how SIAs can be used to reduce the AMD imposed socio-economic impacts of AMD and feed into local and national socio-economic development. Moreover, contributing to policy formulation, management, and planning of social and economic development.

1.8 Structure of the overall dissertation

This thesis has been divided into seven chapters; Chapter one comprises of the introduction to the study, with the definition of key concepts, the objectives, aims, guiding questions, a snippet of the literature review, methodology, scope, ethical consideration, and, the structure of the dissertation. In chapter two a detailed literature study which critically discusses the role, value, history, and importance of SIAs as an assessment tool in developmental projects and how it promotes public participation in mineral developments is interrogated. Moreover, the ability of SIAs in facilitating a transition to a post-mining phase as well as bringing together conflicting interests of communities and mining companies is unpacked. The role of SIA in assessing and addressing socio-economic impacts of AMD on post-mining communities is also narrated. Furthermore, the role of SIAs as an entry point in public policy is interrogated. Chapter three presents a detailed methodology used to explore the role SIAs can play in assessing and addressing the socio-economic problems mining communities face following AMD pollution post-mining. The research philosophy and positionality are explained. The research design, study site description, target and sample population are identified. Cultural Historical Activity Theory (CHAT) methodology in conjunction with an ethnographic approach, qualitative and quantitative data collecting tools are described. In chapter four a presentation of the empirical evidence is given. While in chapter five data analysis and discussions are done. Chapter six summarizes the concluding remarks of this dissertation, discusses the objectives and aim of the study in relation to the key findings of the study and includes a list of recommendations for the future of SIAs in post-mining communities. A list of reference is given in chapter seven and appendices attached at the end of the thesis.

CHAPTER TWO

THEORETICAL CONSIDERATION AND LITERATURE REVIEW

2.1. Introduction

The face of academia is so dynamic that knowledge is constantly being modified, updated and improved through further research. However, most of the new knowledge develops juxtaposed to existing literature hence the examination of existing bodies of knowledge from available credible scholarly is imperative when doing research. Riddley (2012, p.3) defines a literature review as: “the part of the research where there is an extensive reference to related research and theory in your field; it is where the connections are made between source texts that you draw on and where you position yourself and your research among the resources”.

The primary purpose of this literature review is to examine the existing scholarly debates on the role of SIAs in developmental projects, with special reference to post-mining communities. It is centred on introducing SIAs as an ideology, analytical framework and assessment tool in developmental projects and how it promotes public participation in mining developments. Moreover, the role of SIAs in transitioning to a post-mining phase as well as bringing together conflicting interests of communities and mining companies. The role of SIAs in assessing and addressing AMD imposed socio-economic impacts on post-mining communities is unpacked. Furthermore, the role of SIAs as an entry point in public policy will also be interrogated.

2.2 Social Impact Assessments (SIAs)

SIAs have been defined by Vanclay (2002) as not only an appurtenance to development but rather a dogma about self-governance that examines the challenges in development. Notable in this definition is a participatory approach, which Ross (1992) posit that it is an accessory to development that has gradually progressed from the imperative to integrate active citizenship into SIAs. An argument that Joyce and Macfarlane (2001, p.8) assert when they argue that: “the social reality is seen to be subjective, bounded and defined by social rules and meanings formed by the actors within in it”. Craig (1990) substantiates this assertion expressing that politics and significance plays a pivotal role in the decision-making process in SIAs. Given such a politicised

character, Esteves and Vanclay (2009) point out to criticisms against social impact assessments for mainly focusing on adverse impacts of developmental projects. Vanclay (2003, p.6) in his later works negates the criticism lodged against SIAs on being biased to negative impacts, where he gives a more comprehensive definition of SIAs as:

“including the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions with the primary purpose of bringing about a more sustainable and equitable biophysical and human environment”

Notable in these definitions is a sustainability component. This supports the idea of SIAs being grounded on sustainable development. This is best explained by the Sustainable Development Model for the mining sector proposed by the Department of Mineral Resources (DMR) shown below.

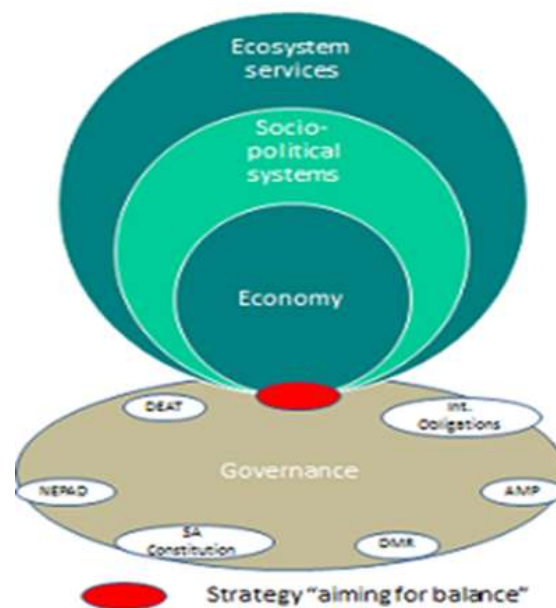


Figure 1: “The Sustainable Development Model- proposed for the mining industry

Source: (DMR, 2009)

The above model shows the environment as having three subsets, with the economy and the socio-economic systems being minor subsets of the ecosystem services. The trivet components

of the environment in sustainable development namely; the biophysical, human and the economic exhibit an indispensable interlink in an environmental system. Van Heerden (2016) in his study points to the fact that it is imperative to maintain a balance between economic and social components of the environment to ensure sustainability on a large scale, a quality that the model overlooks. The Mining Minerals and Sustainable Development MMSD (2002) posit that sustainability is thus realised when environmental and human well-being is maintained and improved on over the long term. Saunders and Retief (2012) confirm the above argument expressing that the role of good governance is to integrate the three components of the environment.

The realization of this interlink between the biophysical and socio-economic environment marked the genesis of SIAs. SIAs were formulated with the introduction of the National Environmental Policy Act (NEPA) Legislation in the US in 1969. The Term SIAs was initially used in Alaska in connection with the socio-cultural impacts of a constructed pipeline on the Indigenous Inuit culture. The first case where SIAs were considered was in Alberta under the Chief Berger Inquiry of 1974-8 into potential impacts of a proposed gas pipeline through the Mackenzie Valley. Existing studies point out that consultative approaches based on narratives from experts coupled with technocratic methods, were used in the Berger Inquiry (Dietz 1987; Craig, 1990).

The United Nations General Assembly (1987) expresses the closely knit relationship between SIAs and sustainable development that provides a set-up for the unification of environmental policies and development strategies. The United States Council on Environmental Quality [USCEQ] (1986) expresses that there has been recognition of the importance of SIAs in policy pertaining to environmental modification that ensures a holistic approach to the three components of the environment.

Considering the above arguments, it has been argued that it is imperative to have an integrated SIA approach where both community and professional judgment are used to justify the impact assessment process (Taylor *et al.*, 1995; Vanclay, 1999). This is reflected in the South African environmental legislation which has a human centred approach (Du Pisani and Sandham 2006). Cooke & Limpitlaw (2003)'s study points out to the enabling environment SIAs create for developmental projects to afford fair and non-discriminatory participation in post-mining economies by all members of the affected communities. In addition, Joyce and Macfarlane (2001) are of the view that moving to an integrative SIA process will address power disparities between the mining company and the community, subsequently avoid the sense of a *weaker muscle*

within communities when dealing with powerful mining companies. Be that as it may, Oakley *et al.*, (as cited by Joyce and Macfarlane, 2001) express that once impacts are not understood by the stakeholders at the grassroots level of the project the endeavour to assess development becomes pointless.

Most notable in SIA is that the type of public participation that is imbedded in the process empowers communities and improves decision making in resource development. This mirrors Ross (1990)'s arguments where she describes this type of participation as a community SIA where she recommends a cumulative view rather than a project based approach that involves high level of community control. This is best described in figure 2 below that is an attempt to illustrate how a matrix of process may be incorporated in public participation when conducting the community SIA.

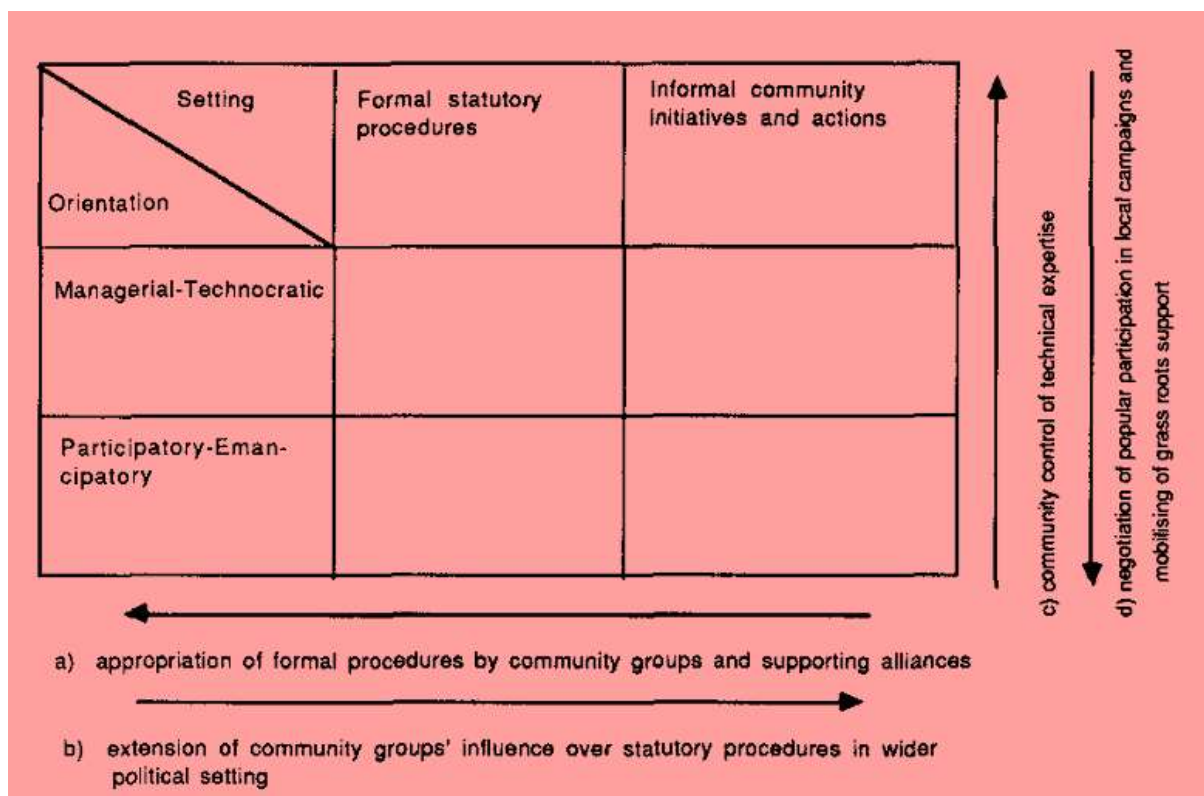


Figure 2: Showing the Community Empowerment SIA process

Source: (Adapted from Gagnon, Hirsch and Howitt 1993)

From the above illustration of a Community empowerment SIA, the formal SIA procedures are appropriated to community preferences promoting community influences and control over technical inputs into SIA inquiries thereby allowing for pro-community outcomes in the process.

In light of the arguments given in the above literature, a platform for untangling opportunities for SIAs in empowering communities that result in improved decision making in extractive industry resource management is realised.

2.3 The relationship between public participation/consultation and Social Impact Assessments

The term public consultation and public participation will be used interchangeably in this particular study. Aucamp (2015,p.84) posit that: “given that South Africa is a democracy and most of the legislation advocates for a participatory process and human rights intensely; it still does not allow Free Prior and Informed Consent (FPIC)”. Embedded in FPIC is public consultation. According to Wood (1995), public consultation is an innate retrofit of the EIA process because it is pivotal in establishing social and economic sustainability. Gibson 2001 Pers. comm (as cited by Joyce and Macfarlane, 2001) mirrors the same views expressing that the term consultation specifically refers to a process of collaborated management and shared decision making. However, shared decision making with communities in extractive industries is a *taboo*. This is mirrored by Joyce and Macfarlane (2001) who articulate that mining companies hardly share decision making on key management issues with communities or Non-Governmental Organizations (NGO). A view alluded to by Murombo (2008) who brings in a social class perspective articulating that in South Africa the framework and level of public participation are shaped by the social and economic status of the citizens or Interested and Affected Parties (I&AP).

The above arguments on public participation portray it as an unfair process. According to Brown (2015), the disjunction, in this case, lies in the fact that if public participation is meant to be a dual process then it should promote public environmental protection awareness. The NEMA/EIA Policy Guideline under Section 2(4) f as cited in Murombo (2008, p.8) states that:

“The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills, and capacity necessary for achieving equitable and effective participation and participation by vulnerable and disadvantaged persons must be ensured”.

If public participation does not observe this, it defeats the ideals of public participation echoed in participatory development by Gran (1983, p.32) as: “the self-sustaining process to engage free men and women in activities that meet their basic needs and beyond that, realise individually defined human potential within socially defined limits”. A view that Sumi and Thomsen (2001) allude to arguing that for native communities to respond significantly to mineral development they need to know the contextual imperative to examine and analyse the problem from an informed position. On the other hand, Cooke and Limpitlaw (2003) highlight the imperative to enhance leadership capacity, skills development within the community, and local government in public participation.

Joyce and Macfarlane (2001) then point to a paradigm shift where public consultation has become a social impact management tool in mining projects and is ingrained to all stages of a mine life cycle. Lockie *et al.*, (2008) concur with the view on the paradigm shift, expressing that there is a need for a transition towards the implementation of an iterative participation process as opposed to impromptu attempts to consult the public in response to short term needs. Murombo (2008, p.11) reiterates the above views articulating that:

“Effective public participation must not be a once-off event, but a sustained, iterative process, which commences with problem identification and goes on to project conception or formulation, and approval”.

Drawing from Del Furia and Wallace-Jones (2000) the primary goals of public participation in impact assessment include; comprehending the essence of the problem through the lens of affected communities, spanning the gap of conflict, and reaching a compromise regarding the problem. While Lockie and others, identify a number of ideal conditions for effective public participation expressing the need to:

“Firstly involve diverse a public as is possible, including those who do not belong to self-organized interest groups. Secondly, the ensuring of that the affected public has the opportunity and capacity for genuine influence over the outcomes of impact assessment and decision-making processes. Thirdly, public involvement from the genesis of the proposal that continues throughout its life cycle. Last but not least, they also point to going beyond legislative requirements to facilitate taking public feedback into account enabling a flexible and participatory approach” (Lockie *et al.*, 2008, p.178).

These are further supported by Hartley and Wood (2005) who advocate for accountability and honesty in decision making. Concerning, is that public participation is used to substitute a proper

SIAs process and once it is done at the permitting stage it undergoes a silent death. In view of the above observations, Vanclay and Esteves (2011) posit that public participation efforts should be informed by a SIA process that sets out the modus operandi on how the compensation for impacts and benefits from projects will be distributed in a sustainable manner. Furthermore, legislating SIAs will promote the supporting and expansion of Social Labour Plans (SLPs) in all developmental projects. According to The Centre for Applied Legal Studies [CALS] (2016), SLPs are binding documents that mines, after being granted mining rights have to adhere to. They thus provide a mechanism for monitoring and ensuring continued public participation.

2.4 The role of SIAs in transitioning into a post-mining economy

At the centre of SIAs is sustainable development. The United Nations General Assembly (1987) defined sustainable development as a type of development that caters for the present generation without putting an upper limit for future generations to meet their needs. Impediments to sustainability in a mining context is observed by Wolkersdorfer and Howell (2005) in their study where they argue that most active coal mines will inevitably face imminent closure due to coal's high pollution levels. This compromises any sustainability efforts post-mining. On a positive note, Emas (2015) observes that the robbing in of SIAs in mineral developmental projects aims at maintaining socio-economic advancement while protecting the long-term value of the environment. Hildebrandt and Sandham (2014, p.14) concur expressing that, "in South Africa SIAs form an integral part of the EIA milieu, however SIA is not legislated but is largely responsible for bringing to the fore the social aspect of sustainability as an outcome in the EIA process". Joyce and Macfarlane (2001) mirror the above arguments, stating that SIAs provides opportunities for capacity building of communities, promoting all possible benefits and mitigating known adverse impacts to affected communities

Joyce and Macfarlane (2001) are of the view that capacity building in post-mining landscapes could promote relevant skills development of communities for post-mining economies. However, Mpehle (2012) hastens to point out that this does not easily obtain reality given appointments of unqualified and technically unskilled officials linked to political engineered cadre deployment. Lockie *et al.*, (2008, p.180) concur with Mpehle's views articulating that: "it promotes critical debate around the knowledge claims of 'experts' and 'lay people' alike, provides opportunities to collate validate and improve understanding of a wider variety of data". Postma *et al.*, (2017) in support of Lockie's argument, observes that SIAs provide a platform for indigenous

and science communication that may boost capacity building. Joyce and Macfarlane (2001) reflect Postma and Lockie's views pointing out that the role of SIAs then becomes that of gathering information on the capacity of the key parties to participate in a development process.

One drawback with capacity building is pointed out by Joyce and Macfarlane (2001) who say there is a failure by the state to educate and train communities around resource development to participate in the process. According to Del Furia and Wallace-Jones (2000), it is imperative that affected communities are empowered to influence decision-making processes in impact assessments. A drawback that Lockie *et al.*, (2008) assert arguing that, communities tend to overlook positive change and trivialise adverse impacts if they are not well informed. This places an upper limit on their ability to influence decision making. It speaks to the need for transparency throughout the entirety of the mineral development project that may contribute to a sustainable developmental process (Joyce and Macfarlane, 2001). Australia's Ministerial Council on Mineral and Petroleum Resources (2004) points to the importance of transparency in the basic principles of engagement highlighting the need for integration, inclusivity, transparency and free communication in developmental projects (Lockie *et al.*, 2008).

In conclusion, the reviewed literature puts emphasis on the essence of SIAs that assist communities' transition to a post-mining phase through capacity building, transparency, and mitigating known negative impacts to affected communities. All in all this emphasizes the need for SIA to be given equal weight as a stand-alone assessment in environmental management efforts. This helps minimise the odds of the conflicting interests of impacted communities and mining companies during and post mining transitions in mineral developmental projects that are described in depth below.

2.5 Social Impact Assessments as a mechanism for mediating between the conflicting interests, of impacted communities and mining companies

“In this way, we tried to have the best of both worlds: at the community hearings, the world of the everyday, where most witnesses spend their lives; and, at the formal hearings, the world of professionals, the specialists and the academics” (Berger 1983, p.387).

Joyce and Macfarlane (2001) also cite the above quotation from the Berger inquiry of 1974-8 highlighting the importance of integrated SIAs, which saw the rejection of a proposed pipeline

project through the Mackenzie Valley. They argue that the project's likely impacts were assessed according to the vision of the affected communities not based on technical criteria. Reinforcing this course of action is Muntingh (2011) who argues that environmental impacts of the mining industry are peculiar and localised to the native community hence it is imperative that they are dealt with locally and with community involvement. With SIAs advocating for active citizen participation, an enabling environment for inclusive public participation is created allowing for mediation between the conflicting interests of stakeholders.

In light of the above arguments, SIAs then gives an audible voice to poor and impacted communities in mineral development. This brings to the fore the plight of affected communities' and their preferences of post-mining economic activities. A narrative of the mediation role SIAs are playing between the conflicted interests of affected parties in mineral development worldwide is given below.

Australia, the United States, and Canada have been among the front runners within the European countries to use SIAs. Gibson (2000) cites the case of Canada where he says, development is evaluated to fairly benefit all the members of the community and it goes beyond the expected minimal standards. Freudenburg (1986) points to a project in the Northern Cheyenne Tribe in 1985 where an EIA was rejected following its failure to consider social impacts on residents.

In Australia, as evidenced in Queensland's Bowen Basin coal industry, Lockie *et al.*, (2008) observed that mine operators provide on-going community consultation throughout the project's entire life and go beyond the standard legislative provisions for EIA when it comes to community consultations. This gives communities an audible voice as Burton *et al.*, (2012) substantiates this by pointing out to surveys by the bauxite mine Alcoa that found that the communities near the mining concession area in Western Australia opted for reforestation of indigenous Jarrah forests instead of recreational areas such as lakes and grassed picnic sites.

Within Africa, according to 'Africa Progress Report' (2013), macro scale mining investments exclude the indigenous communities from the socio-economic benefits of extractive industries. Goldman and Baum (2000) posit that SIAs have been robbed in focused on understanding the implications of large scale development projects on social elements. This is substantiated by Usher (1993) where he argues that the technical component within SIAs focuses on economic well-being as measured by income and employment while the political component is centred on social institutions, well-being, and cultural values.

In light of the above reviewed scholarly on SIAs, it is argued that it helps bring to the fore the socio-economic significance of the impacts of extractive industries. These socio-economic challenges and opportunities are thus identified and described in depth in the next section.

2.6 Acid Mine Drainage (AMD) and the socio-economic impacts it imposes on post-mining communities

According to McCarthy (2011, p.1), AMD is formed when: “the pyrite undergoes oxidation in a two-stage process, the first; producing sulphuric acid and ferrous sulphate and the second orange-red ferric hydroxide and more sulphuric acid”. Ochieng (2010) points to Pyrite (FeS_2) as being responsible for starting acid generation and metals dissolution in coal and hard rock sites. McCarthy (2011) expresses that AMD is very much dependent on existing conditions in the area and is influenced by the relief, the climatic conditions, and the size of AMD generating deposits.

Tiwary *et al.*, 1997 (cited by Tiwary 2001, p. 188) identify a myriad of AMD characteristics ranging from; “pH values as low as 2.0, high sulphate concentration and high metal loading typically including iron and manganese”. They also point to the formation of a yellow-orange precipitate, usually called *yellow-boy* that coats the bottom of the stream and obstructs the biological activities. While Younger (2001) observed that in some acid mine drainage systems temperatures reach 117° F (47° C) and the pH can be as low as 3.6.

The impacts of AMD on the biophysical environment and subsequently on the economic and social environments are observed mostly in the post-mining phase. The World Wide Fund [WWF] (2011) observes that the high-risk period for water pollution, resulting from coal mining occurs during the post-mining phase. Johnson and Hallberg (2005) make the same observation articulating that AMD is most prevalent after mine closure. Furthermore, McCarthy (2011) posits that many mines in Mpumalanga lie derelict; and most are discharging acidic water which pollutes the local river system, the Olifants and its tributaries.

A wide array of environmental, social and economic impacts emanating from AMD have been observed and alluded to in existing scholarly on mineral development. The Federation for a Sustainable Environment (2017) expresses that long-term exposure to AMD-polluted drinking water may lead to mental retardation, skin abnormalities, and cancer. Feris and Kotze (2014) argue that AMD will affect infrastructure, livelihoods, disrupt economic activities and affect South Africa's policies and actions. While Munnik (2010) talks about agriculture and mining

having an antagonistic relationship. The notable potential socio-economic impacts of AMD on mining communities are thus described in depth below.

According to Vanclay (2003) socio-economic impacts are the subsequent effects of forces of change imposed by a developmental project on communities' way of life. The adverse socio-economic impacts are closely associated with ignorance, as narrated by existing scholarly on mine water pollution. According to Moraba (2015) who quotes the 'Tunatazama—a Network of Southern African Communities Living near Mines, the EMalahleni mining informal settlement had its livestock and children drinking and paddling in acidic water. While Olalde (2015) further mirrors this ignorance citing the Tudor Shaft informal settlement in the Witwatersrand gold mining area where unplanned settlements are crowded on radioactive and toxic soil, with children swimming and religious activities taking place in the radioactive streams.

Connor *et al.*, (2009) in their study further mirror community ignorance in relation to the ability of the coal mining industry to control knowledge and access to resources over local communities which gives it greater political capital. This has resulted in numerous socio-economic impacts that are unpacked below.

Human occupations top the list of these socio-economic impacts. According to Blakeney and Marshall (2009), occupation in this particular context refers to all human activities, not just employment. One key theme they identify is occupational injustice or deprivation, where an upper limit is imposed on everyday activities following mine water pollution. Blakeney and Marshall (2009) identify a number of socio-economic impacts emanating from occupational injustices namely; garden crops being unsafe for human consumption due to irrigating with contaminated water, and reduced ability to gain income by growing and selling local produce. The imperative to use water filters, buy bottled water including loss of recreational activities such as swimming is identified, as well as the unpleasant odour and the grimy appearance of clothes washed in the local water supply.

Embedded in Blakeney and Marshall's arguments on occupational deprivation is poverty. This is declared by Sen (1999, p.87) who describes poverty as, "penury of basic capabilities rather than just as a low income". In addition, Ross (2001) observes that mineral-dependent countries are characterized by economic disparities between the wealthy and the less privileged. Morris *et al.*, (2012) further articulates that the mining industry is in control over natural and financial resources at the expense of local communities. To support this, the Natural Resource Governing Institute (2015) observes that the point-source nature of extractive industries often poses some

hurdles when an attempt to balance the needs of the mining communities and environment is made. This is further posited by Krause and Snyman (2014) who expressed that communities affected by mining largely comprise impoverished communities, who face impediments in accessing justice and whose socio-economic rights are violated. The Human Rights Clinic (as cited in Moeng, 2018) brings in another aspect that includes race, expressing that those residents within mining concession areas or derelict and defunct mine sites are usually poor and constitute black communities.

Another socio-economic impact that Morris *et al.*, (2012) highlight is ill health that they argue has always been recognised from an occupational standpoint. Existing scholarly suggest that communities living near mines are also exposed to mining externalities that put a compromise on their health (Moeng, 2018). Yapici *et al.*, (2006) identify a myriad of pollution-related illness ranging from birth defects, miscarriages and high levels of heavy metals in children living near coal mines. Morris *et al.*, (2012) observe a weakness in identifying these ailments and linked it to the fact that it is based on numerical pathological states which are mostly of a physical nature overlooking possible emotional ill health.

According to Forest and Loate (2017), the effect of mine water pollution is further exacerbated by the fact that in South Africa the mining industry as a driver of economic development more often than not supersedes the protection of a clean water supply. Inferring on studies done in Papua New Guinea and the Philippines, Holmes *et al.*, (2003) identify the relationship that exists between mining and other economic activities that are ecologically sensitive. He observes that in Papua New Guinea, fragile forests occur partly within mining concessions while in the Philippines, more than half (56 percent) of all exploration areas and mining leases encroach to ecological sensitive areas (Holmes *et al.*, 2003). This puts an upper limit to the viability of these economic activities.

In Sub Saharan Africa one most notable socio-economic challenge in mining communities is food insecurity. Munnik (2010) asserts this when he says both agriculture and mining core exists in rural communities but are seen as “uncomfortable neighbours” when sharing the same land. Nonetheless, Kitula (2006) points to a research conducted in the Geita District of Tanzania that negates Munnik `s view showing a complementary relationship between mining and agriculture. Kitula (2006, p.409) argues that: “community perceives in order of importance; employment, improved infrastructure, the selling of food crops and other businesses as the main benefits from mining activities in their community”.

It should also be noted that opportunities can be made in the midst of the AMD turmoil in post-mining landscapes. Postma *et al.*, (2017) argues that SIAs through the social construction of technology may bring to the limelight; the potential for treated AMD polluted water's valuable use in a bio-economy. The bio-economy has been defined by the European Commission (2012b) cited in Schmidt *et al.*, (2012, p.50) as: "an economy using biological resources from the land and sea as well as waste, including food wastes as inputs to industry and energy production". According to Power (2002), he argues that the only drawback of the new technologies post-mining in poor countries is that knowledge and experience are provided and controlled by transnational companies thereby limiting indigenous skills development.

Muntingh (2011) is also cognisant of the positive socio-economic impacts of mining. He points to socio-economic infrastructural development such as; roads, clinics, schools and employment creation that mines brings to communities. Moreover, there is a transfer of skills and exports that lead to technological advancement that may benefit the local communities. Burton *et al.*, (2018) refute its universality citing the case of Eskom in Mpumalanga South Africa, which has no plans for decommissioning plants, reskilling and supporting workers to migrate to other stations or into new industries.

In summary, the reviewed literature on socio-economic impacts depict that mining despite the anticipated and assumed economic gains has adverse impacts on people's socio-economic well-being. Moreover, the literature also points to the uniqueness of some socio-economic impacts as defined by local context. This particular study has thus been influenced by the above observations that are consistent with Carolina's water crisis and subsequent socio-economic impacts. This makes it imperative to do more studies of this nature because findings from one study cannot really be used as a blueprint and become applicable to all mining areas. Perhaps from the above literature inferences possible policy entry points can be made and these are unpacked in section 2.7 overleaf.

2.7 Identifying appropriate policy intervention entry points through Social Impact Assessments

Notable is that at the core of SIA is sustainable development and active citizen participation. This resonates well with governance that is at the centre of policy making. Van Kersbergen and Van Waarden (2004) argue that governing processes eliminates the authoritative traditional process and brings in an interactive dialogue, collaboration, and alliance formation. Thus it creates an enabling environment for active citizen participation in environmental policymaking.

Kooiman argues that interaction is a central process in governance and defines interaction as: “a mutually influencing relationship between two or more actors or entities” (Kooiman, 2003, p.13). A platform that Moeng (2018) argues as being provided by environmental justice organisations, where affected stakeholders are empowered to be vocal about the impact of mining on local communities and their exclusion from decisions pertaining to their environment. Nevertheless, Moeng (2018) further argues that the government and mining companies are not empowering communities to be able to influence issues and decisions relating to the environment. All these loopholes depict gaps in policy that need to be spanned.

Oelofse (2008) argues that in South Africa, existing studies show good progress in policy shift to redress mine closure and mine water pollution although, gaps still exist in the current system. In response to this drawback, Hildebrandt and Sandham (2014) argue that EIAs have been enacted but are biased towards the biophysical environment at the expense of the socio-economic environment. The EIAs according to Forrest and Loate (2017) are driven by economic and political imperatives, such that the need to hasten to license overrides social and environmental concerns. Notable, is the National Environmental Management Act (NEMA)’s standpoint on the all-encompassing definition of the environment and in the South African Constitution. This does not give enough weight to the socio-economic aspects of the environment as it does to the biophysical component. Hildebrandt (2012) in addition expresses that there is also a lack of an adequate formal set of guidelines for SIAs.

Lockie *et al.*, (2008) point to a positive shift in SIAs where impact mitigation is a significant part of legislation and Social scientist are part of the impact assessment teams. While, the Mineral Council of South Africa (MCSA) (n.d) identifies up skilling of local communities, job retention and legislative long term investments as sustainability policy enablers. The United Nations General Assembly, (1987) expresses the closely knit relationship between SIAs and sustainable development that provides a ‘platform’ for the unification of environmental policies

and development strategies. Mirroring these positives shifts in SIAs is, The United States Council on Environmental Quality [USCEQ] (1986) which expresses that there has been recognition of the importance of SIAs in policy pertaining to environmental modification that ensures a holistic approach to the three components of the environment.

2.8 Gaps in knowledge

In light of the arguments expressed above, a relevant platform on which to infer entry points to public policy is established. The subservient role of SIAs, under EIAs that overlook the socio-economic impacts of mining, needs to be revised. The need to hasten licensing in EIAs which overrides social and environmental concerns depicts a weakness in impact assessments. This is mirrored in the practice of SIAs and EIAs that has been at the project level although they were intended to be at the policy level (Vanclay, 2004).

The absence of adequate working guiding principles for SIAs, within the South African regulatory environment, as well as the standpoint of NEMA regarding the definition of the environment are existing gaps that need to be bridged. Moreover, the lack of capacity in terms of skills to review SIAs reports and reactive nature of SIAs instead of a proactive approach needs to be reviewed. This is expressed by Sandham *et al.*, (2005) who argues that the majority of EIA practitioners who compile reports have a natural science rather than a social science background and therefore not well conversant with socio-economic aspect of development.

In conclusion, the above literature review highlights SIAs as taking cognisance of local communities promoting a social learning-oriented approach to mine development. The interaction between communities and mineral developers facilitates the understanding and acceptance of biotechnologies by communities. It is also argued that SIAs can give weight to the socio-economic plight of communities amid effects of AMD, much to the recognition of policymakers. A concerning drawback in SIAs is that companies tend to only use it during inception stages of mining, once the license is granted its role goes into 'hibernation'. The socio-economic impacts thereafter are not seriously considered thereby impacting on the post-mining phase. Making it difficult for these mining companies to be held accountable and address any impacts. The above review of the literature therefore, sets the stage for further debate on the role of SIAs amid socio-economic impacts of AMD on mining communities in post-mining landscapes.

CHAPTER THREE

METHODOLOGICAL CONSIDERATION

3.1 Introduction

The research methodology is an organised way to tackle a research problem, essentially involving identification, description, explanation, prediction and making inferences on the problem under study. It helps identify the best and relevant data collection methods and materials for the problem under study. It is argued that there is an entangled link between the methodology and the nature of data hence the data directs the methodology (Leedy and Ormrod, 2001). For this particular study, The Cultural Historical Activity Theory (CHAT) has been used as the main research methodology in conjunction with an ethnographic approach and these are explained in depth in section 3.2.

The first section 3.1 commences with the introduction, then section 3.2 deals with the description of the Methodology and Theoretical framework used in this study. Section 3.3 describes the Research philosophy, followed by section 3.4 where there is a recap on the Research aims and objectives. Section 3.5 describes Research design, which is divided into the Research site, Sampling methods, Study population, Data collection procedure, and Data analysis. The last section 3.6 looks at Methodological reflections which entail the Scope of the study, Limitations of the study and Ethical considerations. A myriad of data sets were used in this thesis. The Gert Sibande Integrated Development Plan (IDP) 2018-2019, Chief Albert Luthuli IDP 2017 and Community Survey 2016 from Stats SA, were used. However, the study area, which is Carolina Quaternary catchment area X11B, will be the most important source in informing the arguments put forward and conclusions thereof. Furthermore, a range of literature was obtained from Dissertations, Journals and Working papers. The local NPO 2018 database, as well as the Local Economic Development (LED), also provided some socio-economic data.

Some of the data is also drawn from Public Dialogue on Mining and Extractive Industries attended by the researcher in Johannesburg in November 2018. As well as the Mining Water Coordinating Body (MWCB) stakeholder consultative meeting held in Sandton, Johannesburg in February 2019. Mining community activist within Africa from The Catholic Commission for Justice and Peace (CCJP) and ActionAid South Africa, Zambia, Zimbabwe, and Uganda were

also interviewed. These were chosen for their experience working with mining-affected communities across Africa. This afforded a brief comparative analysis to be made between the Mpumalanga, Carolina study in South Africa and other AMD affected mining communities in Africa.

In cases where official documents have been used names of companies and official stamps have been painted over in black for confidentiality purposes. Images used in the research were taken and used with the verbal consent of the participants, where participants did not want their faces to be shown only the lower parts of their bodies and back-views were taken.

3.2 Research methodology and theoretical framework

The research methodology is used to extract meaning from the data. According to Leedy and Ormrod (2001), there is a correlative link between the methodology and the nature of data hence, the data dictates the methodology. In this particular study, the research problem is centred around socio-economic impacts of AMD on mining communities. Slootweg *et al.*, (2003) describes such a problem as context-specific, thereby warrants that research carried out in the SIAs field consider the; historical, political, social, and, surrounding conditions within the study area. To ensure this, the Cultural Historical Activity theory (CHAT) has thus been used as the main methodology in the study. According to Roth (2007), CHAT is essentially a dual unit of analysis with continuities across social and biophysical environments.

Given the context of the research problem occurring within the human and biophysical environment, it is befitting that CHAT is complemented by a sustained presence of the researcher through an ethnographic approach. According to Fetterman (2010, p. 1), ethnography “is about telling a credible, rigorous and authentic story”. Whitehead (2005, p.5) further describes ethnography as “a holistic approach to the study of cultural systems, where culture is seen as a holistic, flexible and non-constant system with continuities between its interrelated components”. This is to say it involves a study of the community and extends to other social settings such as public meetings, community forums, organisations where humans engage with each other. Whitehead (2005) in his study identifies a number of data collection tools in ethnography namely; focus groups, semi-structured interviews, Geographical Information Systems (GIS) to enable mapping of the site and even use of secondary data which is used to analyse already existing data on the problem. Fieldwork is also deemed an essential appurtenance

of ethnography. Pole and Hillyard (2015, p.1) define fieldwork as: “doing research in a practical, applied, ‘hand on’ sense”.

In light of these above-mentioned attributes, ethnography and CHAT seem compatible. This is substantiated by Van Manen (1977) when he says, CHAT emphasises people’s lived experiences, which is the essence of ethnography. Both the methodology and the theoretical framework, in this study give us a platform to access the Carolina community and look at the problem in retrospect. In addition, they afford the use of SIAs to assess and address the socio-economic challenges within the community context.

CHAT provides a set of apparatus that recognises that a dichotomy cannot be drawn between human activity, the influence of the setting and the intrinsic power relations in the setting. Grestchel *et al.*, (2005) alludes to this saying, CHAT logically links the individual and the social structures in which they exist in a historical, economic, cultural, and, political context. Lampert-Sheppel (2008) expresses that CHAT methodology provides research tools that can aggregate the qualitative research methodology.

Human activity is seen in CHAT as the collaborative, tool-determined outcomes of a group as influenced by tradition (Foot, 2014). Engestrom (1987) diagrammatically explained the intersectionality of human activity as depicted below.

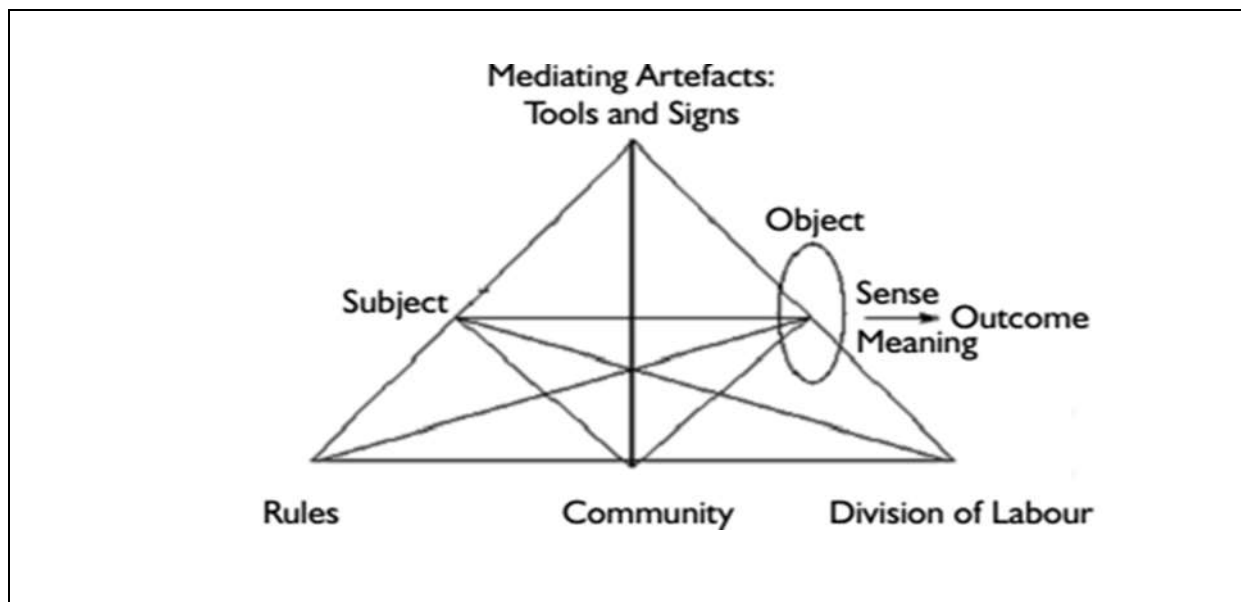


Figure 3 The structure of a human activity

Source: (Engestrom 1987, p 78).

Engestrom describes a six-fold part in a human activity based on Leontiev's work on the collective nature of human activity, in which the intersectionality of the triangles depicts a mutual interaction between the parts of an activity system. In the uppermost triangle collective activity is depicted as the action/s undertaken by people (subjects). The Upper Komati Community Forums, IUCMA and other environmental and community activists who are fighting against the impacts on AMD on the biophysical and human environment can be the subjects also forming part of the community. The Community refers to people who share the same problem space as the subjects denoting intersectionality in the subject's activity system (Gretschel *et al.*, 2015). The community is the Carolina community in this study, who are facing the AMD imposed socio-economic problem within the Quaternary X11B catchment area. The problem space is the Quaternary X11B catchment area, consisting of the Boesmanspruit dam which was grossly affected by AMD in 2012. Tools in this study can be the environmental legislation on water, that is used to achieve the goal or outcome which is solving the AMD problem. The objects can be the National Water Act (NWA), Mineral Petroleum Resource Development Act (MPRDA), SIAs, EIAs that regulate mine water treatment and reuse within closure. The rules can be formal or informal. Formal as defined by such tools as water use licenses, closure requirements or environmental systems. The informal are not written down but commonly known, such as community activism when expressed verbally through protest action (Munnik 2018, oral presentation, DWS Workshop Presentation, Pretoria October 2018).

Thus the Human Activity structure in the case of AMD imposed socio-economic activities in the Carolina Community is imbued with a lot of complexity. Considering that the affected communities, all have particular areas of interest to safeguard. Munnik *et al.*, (2019 p.21) in press points to the fact that: "mining industry balances the agendas and interests of shareholders in Carolina with those of mining managers, environmental managers, and regulators, making decisions that are influenced by economic competition and commitments to sustainability". While in this study, communities can be segmented into local Silobela Township and the Caro Park Suburb, farms, local economic-political interests, community forums and mining community activists whose interests are shaped by the need to transition to a post-mining sustainable economy in the face of Acid Mine Drainage threat and mine closures.

Engestrom further introduces three lower triangles and highlights how human activity is influenced by socio-cultural and historical norms. Gretschel *et al.*, (2015) elaborates on the argument saying, social organisations and prevailing rules are contextually framed within the broader community's cultural and socio-historical framework. Elsewhere, Postholm (2015)

argues that research using the activity system can establish knowledge about the situation before and after-intervention. This resonates well with SIAs which endeavour to show the impacts of an activity pre and post-developmental phases (Vanclay, 2003). On the argument on knowledge, it should be noted that knowledge acquisition and development is a dual process between the external world and the human being. Leontjèv (1981) mirrors this argument claiming that activity removes the dichotomy between the outside world and the world of internal phenomena. This is further posited by Vanclay (2003) when he argues that, SIAs acknowledge that there should be a holistic approach to the environment as the human and biophysical aspects are intrinsically and inseparably interlinked. By virtue of CHAT being based in the “expanded social learning approach” Engestrom (2001), it gives a platform for collaboration amongst different actors with different agendas and interests in terms of the six aspects of the human activity structure.

In conclusion CHAT and ethnography as the main methodological and theoretical approach respectively, seem to be compatible with SIAs. This resonates well with the study which focuses on exploring the role SIAs play in the assessment and addressing of AMD imposed socio-economic impacts on mining communities. Moreover, CHAT provides a platform to understand the manner in which human activities, needs and knowledge helps forge communication between indigenous knowledge and new biotechnologies.

3.3 Research philosophy

Pragmatism was used as the main research philosophy in this study. Saunders *et al.*, (2012) define pragmatism as a philosophy that recognise reality as diversified and exhibits a four-fold component namely; ‘consequences of actions, problem-centered, real-world practice-oriented and pluralistic’. Considering the component on consequences of action, it has been argued that researchers examine the *how* and *what* questions on a problem understudy as determined by the anticipated consequences (Cresswell and Garrett, 2008). Regarding the problem-centred component, it thus examines the problem under study and looks at all methods available to comprehend the particular problem (Rossman & Wilson, 1985). The real world practice pragmatism component recognises that research takes place within social, historical, political settings that obtain reality relevant to the study (Cresswell and Garrett, 2008). While they also elaborate on the pluralistic view component pointing to that pragmatism freely draws from both quantitative and qualitative research during the research process.

Curry *et al.*, (2009, p.1443) defines qualitative research as: “occurring in natural (rather than experimental) settings and produces text-based data through open-ended discussions and observations”. They further define quantitative research as: “performed in randomized or nonrandomized experimental and natural settings and generates numeric data through standardized processes and instruments with predetermined response categories” (Curry *et al.*, 2009, p.1443).

The above views are linked to the fact that pragmatism views the research problem and questions as more significant than the embedded theoretical assumptions of the techniques that are employed (Giacobbi *et al.*, 2005). Cresswell (2014) argues that pragmatism also allows for flexibility allowing other research philosophies to be used in the study. For example, the Carolina community is a social entity; an ontological approach to the study was also used, which Bryman (2001) describes as focused on the nature of social entities. Carolina in Mpumalanga is characterised by severe socio-economic challenges emanating from AMD from mining activities that needed practical solutions.

Existing scholarly in philosophy argues that the use of mixed methods in pragmatism comes embedded with a lot of benefits. According to Gorard and Taylor (2004), the use of figures in quantitative methods tends to be very persuasive to policy makers while the narratives in qualitative research are easily remembered for illustrative purpose during social investigations, allowing for integration. Pragmatism also allows such philosophical positions as methodological positivism to be brought on board. Methodological positivism is defined by Steinmetz (2005) as, a concept of knowledge, social reality, science and he describes a three-fold perspective of the philosophical concept; firstly: “it is an epistemology that identifies scientific knowledge with over-arching laws for example if ‘1 occurs then 2 will follow’. Secondly, it is an ontology that qualifies existence with objects that are observable. Thirdly it is associated with a self-grasping of scientific activity in which social science is independent of the reality it describes” (Steinmetz 2005a, p.32; 2005b, p.281–83). In this study, positivism is used in conjunction with data gleaned from questionnaires and socio-economic surveys.

In summary, pragmatism allows that research questions are used to determine the research framework, allowing for the determination of how best the problem under study can be assessed and addressed. The researcher comes in as a catalyst to change through the provision of relevant and useful information that may bring awareness and inform policy from the data garnered in the field. This creates an effective platform for the study to determine the role of SIAs in assessing

and addressing AMD imposed socio-economic impacts on mining communities in the Carolina context.

3.4 Recapping aims and objectives

The aim of the study sought to investigate the role of SIAs in addressing and assessing AMD imposed socio-economic problems in the Carolina mining community. The methodology therefore selected is compatible with this aim. Apart from this overarching aim, the objectives comprised of exploring the relationship of SIAs and public participation in post-mining communities amid AMD threats; determining the potential of SIAs in promoting the ability of mining communities to transition into a post-mining phase; evaluating the ability of SIAs in mediating between conflicting interests of impacted communities and mining companies; assessing and addressing the socio-economic impacts of Acid Mine Drainage on poor people in post-mining communities and identifying appropriate policy intervention entry points.

3.5 Research design

3.5.1 Description of research site

The section attempts to give the geographic location and historical description of the study site in relation to land use over space and time. The study site is the Carolina Quaternary catchment area X11B in, Mpumalanga, South Africa. The town of Carolina was founded in 1883 as a '*central place*' providing services to the local farming community and travellers destined for Barberton. It is located in the Chief Albert Luthuli Local Municipality (CALLM), under the Gert Sibande District Municipality in Mpumalanga, South Africa. The area according to the figures provided by Statistics South Africa 2016 (as cited in the Gert Sibande IDP, 2018-2019), Chief Albert Luthuli Local Municipality had a projected population in 2016 of 187 630 and in 2030 the projected population is estimated at 192 952 while the Gert Sibande District Municipality had an estimated population of 1 135 409.

Topography, vegetation, and climate

Carolina is located in the Grass and Wetlands region of Mpumalanga in South Africa, on the verge of the Komati Gorge. The province exhibits different topography namely; the Highveld standing at an elevation of between 1,200 to 1,800 metres in the west; the forested Drakensberg Mountains towering to more than 2,300 metres in the east; and the Low-veld a bush-clad plain

that slopes gently upward toward the Lebombo Mountains on the Mozambique boundary to the northeast. The area is also characterised by eastward-flowing tributaries of the Limpopo River. Mpumalanga's weather is influenced by its relief, with temperatures ranging from a mean of 16 °C in the Highveld to a mean of 23 °C in the subtropical Low-veld. The precipitation generally averages (510 to 760 mm) yearly in the Highveld and Drakensberg to more than (1,000 mm) in parts of the Low-veld. The Quaternary catchment area X11B lies on the Boesmanspruit, Which originates less than 10km west from Carolina at an altitude of 1,760m above sea level (Das *et al.*, 2013, Encyclopaedia Britannica).

Land use

There is mining, livestock grazing, crop irrigation, smallholder dams and streams draining from the Carolina town. The following are some of the collieries operating within the Carolina study area; Msobo Coal which operates a coal siding named Witrand and based on 2 collieries namely; Tselentis and Verkeerdepán. Tselentis Colliery occupying a significant portion of the Quaternary catchment area X11B. Much closer to Carolina is Verkeerdepán, with an anticipated life span of 12 years and was given a water use license much to the outcry of local farmers, who unsuccessfully opposed it (Munnik, 2010).

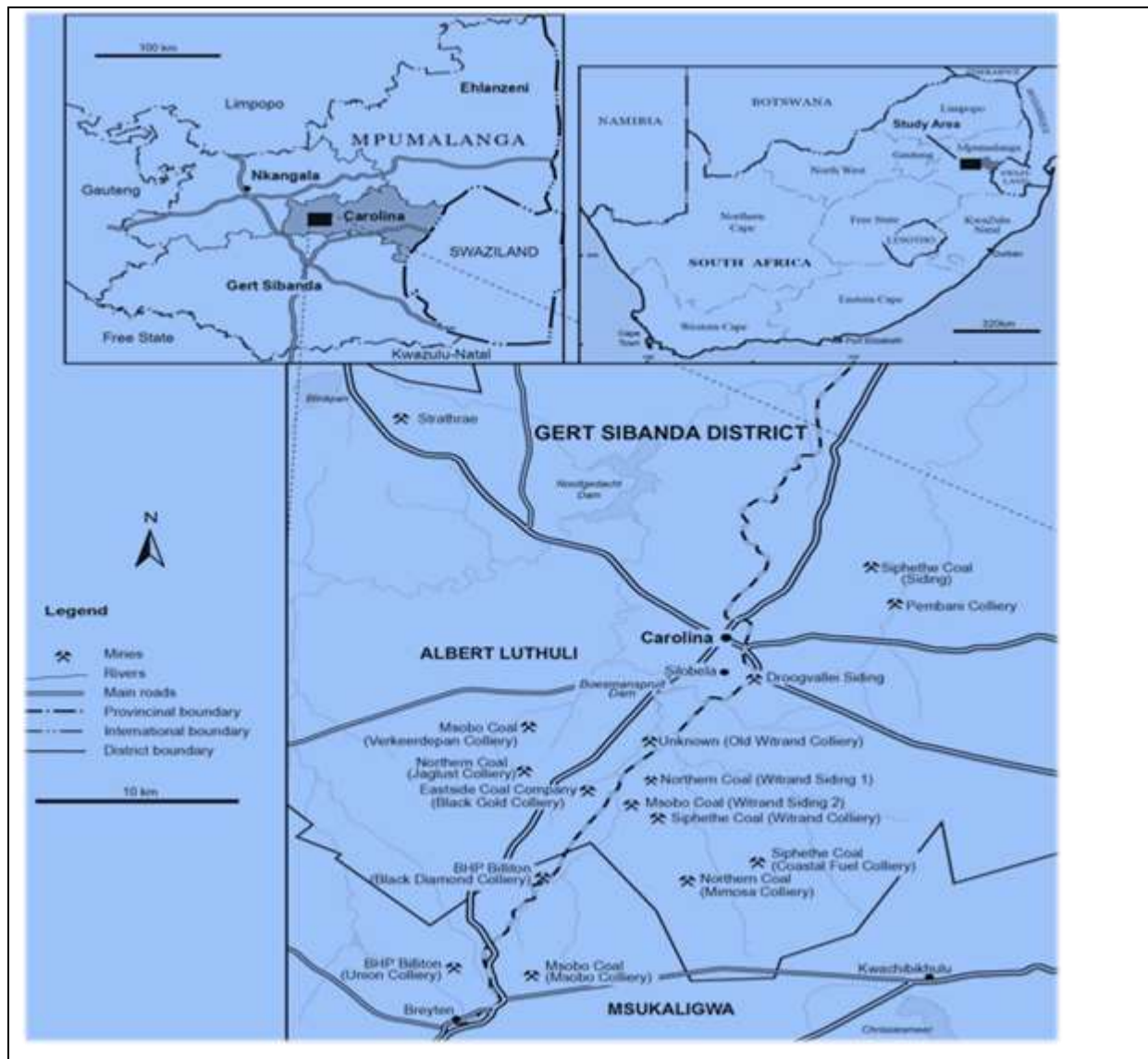


Figure 4: Map of the Carolina Quaternary Catchment area X11B, in Mpumalanga, South Africa

Source: Cartographic Unit, Department of Geography and Environmental Studies, Wits University (2019)

Figure 5 below shows a locality map showing the different coal sidings in Carolina. The catchment of the Boesmanspruit Dam comprising of the Boesmanspruit, Witrandspruit, Droogvaleispruit and the acid mine drainage observation points and water treatment works are also indicated.

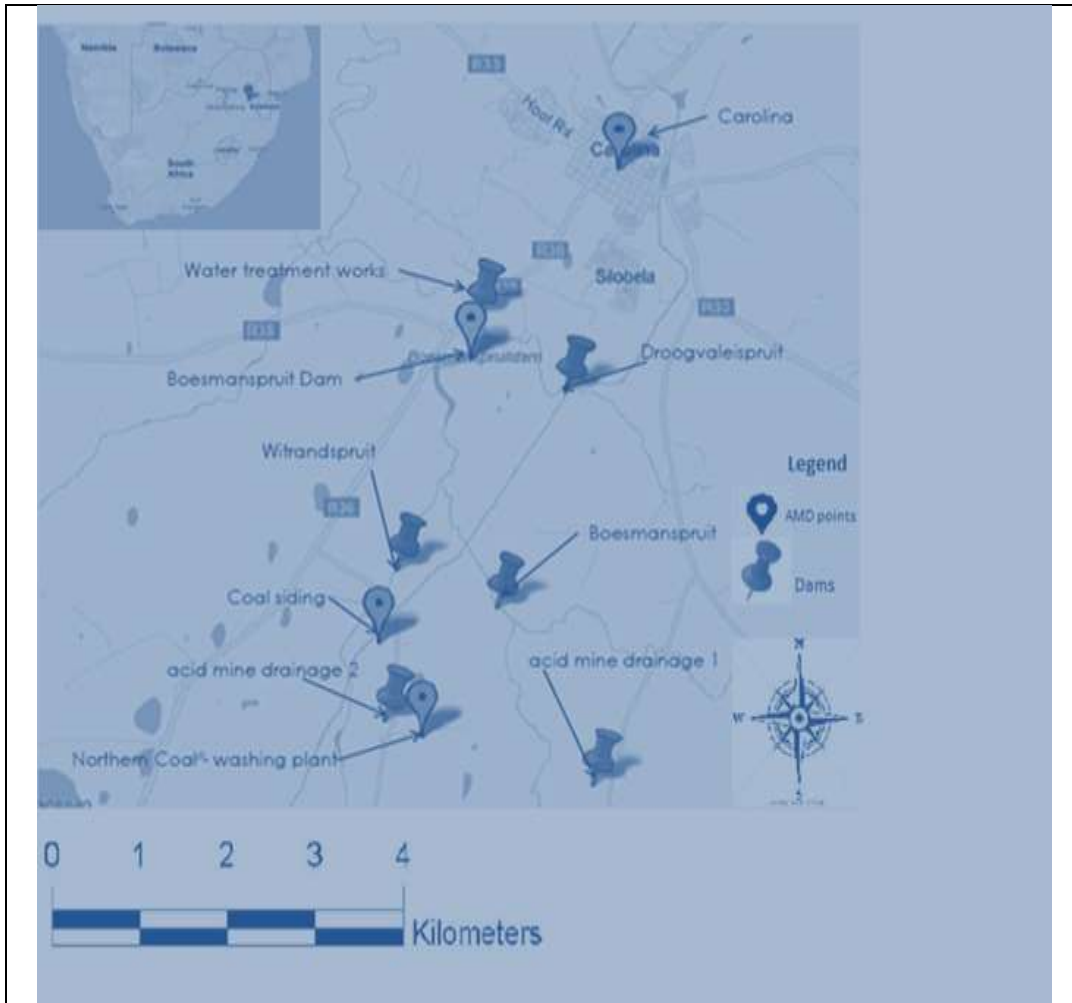


Figure 5: Locality Map of Carolina

Source: (Adapted from Ginster 2012 in Tempelhoff *et al.*, 2014)

This study site was the small town of Carolina in the Gert Sibande District Municipality in Mpumalanga province, South Africa. The site proved relevant for this particular research as its main potable water supply, the Boesmanspruit Dam was polluted with AMD in 2012. The source of the AMD was the numerous operational and abandoned mines as well as associated transport hubs dotted across the upper Komati Quaternary catchment area X11B. Moreover, Carolina is included in the Upper Komati Catchment Management Forum under the auspices of the IUCMA, which plays the role of convener on most of the stakeholder meetings around mineral development and its impacts on communities. A litany of archival material relating to this AMD catastrophe is therefore available, including administrative-legal records, such as IUCMA records and a biophysical analysis (McCarthy and Humphries, 2013) and social analysis on impacts on the town (Tempelhoff *et al.*, 2012). The different viewpoints of the Boesmanspruit Dam taken during fieldwork are shown overleaf.

i



ii



iii



iv



Figure 6 (i-iv): Image showing different views of the Boesmanspruit dam

Source: Fieldwork materials (2018)

3.5.2 Study population and sampling procedure

The study population according to Day (2010) is defined prior stating eligibility criteria, its impact on study design and ability to generalize and selection of prospective participants. There was also a need to take into account feasibility, risk and subject characteristics when selecting the study population. The study population for the study comprised of the Carolina community, the IUCMA officials dealing with communities, farmers, and business people, mining officials working with communities, mining activist and biotechnologists. Snowball sampling was used to

get to the target population. It involved sampling a limited number of participants in a defined group and then gaining access to more participants affording a series of referrals (Berg, 1988). This kick-started purposive sampling which (Bernard, 2002) expresses that it allows the researcher to find people with relevant knowledge and experience to inform her study. This assisted the researcher to reach out to the accessible population.

The accessible population comprised of thirty-seven community members and two community focus groups. Two officials from the Inkomati Usuthu Catchment Management Agency (IUCMA) and one IUCMA focus group as well as five community forums organised by the IUCMA. Four representatives dealing with mining communities in Africa also formed part of the participants as the researcher grabbed the opportunity to interview them during a public dialogue for extractive industries she attended. Four community activists from Mpumalanga were interviewed. One farmer was interviewed and an Agricultural Engineer working with farmers in Carolina took part in the survey. One mining official was interviewed, as well as one questionnaire was filled in by a mining official. Two local government officials from Carolina Chief Albert Luthuli Municipality were also interviewed. Ten regulators from the Department of Water and Sanitation (DWS) participated in the survey questions and two regulators forums and one focus group were done. One biotechnologist participated in the survey. While one mine Water Coordinating Body dialogue was also attended and one interview was done. This sample was selected using snowball sampling and purposive sampling respectively. Refer to appendix number 15 in the appendices' section at the end for the tabulated figures of the different participants, dates and venues where the different interactions took place during the study.

In this study, the key informants were selected from the community leaders during community forums organised by the IUCMA in Mpumalanga, which the researcher attended. The researcher was given an opportunity to explain her research during the community forums and they verbally consented to participate in the research. The community leaders were interviewed to get some insight into their opinions on the impacts of AMD and its effects on the socio-economic well-being of the community. Information from the IUCMA Officials dealing with mining communities within Carolina was gleaned from questionnaires that were distributed and filled in during community forums attended. Questions around how the impacts of AMD on communities are dealt with by mining companies and regulations that are in place to curb the severity of AMD and the engagement of SIAs in impact assessments were asked. Business people, who the researcher visited on foot at their places of work, also filled in questionnaires as

time did not allow them to do interviews. The research was explained to a number of ordinary community members as the researcher visited them at their homes, workplaces and met some in public places during fieldwork. About 22 questionnaires were filled in by members of the community.

The aforementioned mining community activists from Africa included; Women Affected by Mining United in Action (WAMUA), ActionAid, Catholic Commission for Justice and Peace (CCJP) representing South Africa, Zambia, Zimbabwe, and Uganda and they were also interviewed. Their professional expertise, skills, knowledge and experiences working with AMD affected communities was drawn into the study. Their incorporation into the study meant that a basic comparative analysis could be made. These interviews were done during a public dialogue attended by the researcher in Johannesburg. The research was explained; consent from participants sought either verbally or in writing. About ten questionnaires were filled in by officials from DWS during a workshop on mine water pollution in Pretoria organised by DWS. These officials were incorporated into the study so that their expertise on mine water regulation could be brought to the fore. Questions, regarding issues around AMD, SIAs and how they are dealing with them as a department were asked.

The incorporation of people apart from Carolina community members, with different expertise, skills, and experience around the experiences of mining communities in the advent of AMD pollution, contributed to ensuring some credibility within the research and different points of view around the problem on hand.

3.5.3 Data collection process

In this study, two types of data were collected namely primary and secondary data. The primary data were derived from interviews, focus groups, public dialogue, and questionnaires. It should be noted that the collection of the primary data only commenced after obtaining an ethics clearance by Wits Human Research Ethics Committee (Appendix 1). While secondary data was obtained from a review of existing literature on mine closure and impact assessments. Data on SIAs and EIAs were mainly gathered from journals, books, and dissertations. The Gert Sibande Integrated Development Plan (IDP) 2018-2019, Chief Albert Luthuli (Carolina) 's IDP 2017, and data on educational qualifications from the local NPO 2018 database as well as the Local Economic Development (LED) were also used to inform the study.

Qualitative and quantitative data were used to enhance the outcomes of this study, as the two research methods complement each other. Below is a brief description of the qualitative data methods used in this study.

3.5.3.1 Semi-structured interviews

According to Patton and Cochran (2002), semi-structured interviews are conducted on the basis of an adaptable structure consisting of open-ended questions demarcating the area to be studied. An interview schedule was used to guide the one on one semi-structured interviews. In some instances, the semi-structured one on one interviews were changed to 'peer paired-interviews' or the 'dyadic interview' methodology postulated by Doctor. David Morgan (Morgan *et al.*, 2013). In this instance, the research sample is a bit small to be considered a focus group methodology. This was done to save time and the participants found comfort in being interviewed in pairs and share experiences about the problem under study from different perspectives and experiences. This type of interview is commended by Morgan *et al.*, (2015) who argued that the dyadic interview process minimises the problems encountered in focus groups where one needs to bring together many participants in the same place which is difficult.

The semi-structured interviews were done haphazardly within the research site where and when a chance presented itself. Nevertheless, the key informants were visited at their workplaces, homes and anywhere they felt comfortable to be interviewed. One particular interview with a farmer was done telephonically due to the busy schedule of the interviewee. It was imperative that notes be written during this particular interview.

It should be noted that participant anonymity was stated prior to arranging the interviews and maintained throughout the process. Pseudo names and random numbers were given to the interviewees without a chronological pattern on the numbering in some instances. The entire one on one interviews were recorded using voice recorders, with the consent of the interviewee. No note writing was done during interviews as it was not practicable to do so. It should be noted that certain behaviours observed during interviews, like the attitudes as expressed by their gestures, responses and facial expressions were noted down soon after the interviews. This afforded the researcher to draw meaning from latent attitudes participants exhibited towards the study around AMD pollution. Below is an image captured during fieldwork of a dyadic interview session in the community gardens of Silobela in Carolina.



Figure 7: Image showing the researcher doing a dyadic interview session in Carolina's Silobela Gardens

Source: (Fieldwork materials, 2018)

3.5.3.2 Focus groups

This method was used mainly to get the views of the different stakeholders have on AMD pollution and the socio-economic impacts it has on the community. A focus group is defined as, interviews that engage several people who exhibit a number of similarities (Hennick, 2007). In this case, the different stakeholders in the Carolina mining community exhibited common characteristics that of being affected by AMD on water resources subsequently affecting their social, economic, and general day to day activities. A maximum of seven people on average was involved in each focus group.

The focus groups done during community forums convened by the IUCMA were divided into communities and regulators. Regulators were chosen to partake in the study due to their expertise around mine water pollution, legislation and their role as custodians of the water resources in South Africa. The Carolina community was chosen because they are within the study area and have had the first-hand experience of the AMD impacts on their wellbeing compared to any other community in Mpumalanga.

The questions asked in these different groups were similar in some cases to verify the credibility of responses and differed slightly in approach when it came to legislative questions. The

advantage of this method is highlighted by Stewart *et al.*, (2009) who argued that the focus group method is an adaptable technique as it exposes the researcher to different daily forms of communication. Moreover, the people within the focus group help each other to recapture past events. It also assisted to validate some comments or responses by participants from the community and regulators. The focus group discussions were recorded using a voice recorder. Note writing was also used to capture the different contributions and pictures of the session taken with consent from the groups.



Figure 8: (i and ii) Image showing the researcher doing focus group discussion during a community forum in Carolina.

Source: (Fieldwork Materials, 2018)



Figure 9: Image showing regulators focus group discussions in Pretoria 24th of October 2018

Source: (Fieldwork Material, 2018)

3.5.3.3 Participant observation

According to Schensul *et al.*, (1999, p.91), participant observation is: “the process of learning through exposure or involvement in the day-to-day or routine activities of participants in the research setting”. According to Demunck and Sobo (1998), this method gives a leeway to the hidden tradition and it gives room for active and silent participation in impromptu events. It is also ideal when doing socio-economic assessments of vulnerable groups. A larger part of participant observation was done within the Carolina community during a number of visits that lasted between 2-4 days long over the six month period between September 2018 and February 2019 of intense data collection.

Public places in Carolina such as restaurants, clinics, market places, schools, shops, and homes were visited where the researcher sat and mingled with the local people and listened to topical issues. In most cases, the topical issues alluded to the issue around the poor quality of the water in Carolina. These conversations on water quality were substantiated by the Jojo tanks that are a common feature in Carolina's lodges, shops, and horticulture gardens. The buckets of 'safe' boiled water in most households that were observed during interviews, questionnaire distribution and administering in some households in Carolina testified to the concerning quality of water in the area.

Thus participant observation helped in comprehending their way of life, accessed the sentiments they have about the topical issue which is AMD pollution. While on the other hand, those who work in the municipality, were not at ease with discussing the state of water citing ethical concerns during public conversations.

3.5.3.4. Community forums

A community forum is a necessary action group in promoting active citizen participation in development projects that affect communities. These were organised through the auspices of the IUCMA which also facilitated the granting of permission to do research in Carolina. The community forums were attended by community leaders, Upper Komati Community forum members, environmental consultants, mining community activist, IUCMA officials, researchers, mining officials, farmers' representatives and ordinary community members from Carolina. The forums took place in five workshops of which two were reported back sessions. The first workshop was organised by the IUCMA and held on the 26th of September in Carolina

Mpumalanga. However, the stakeholder meeting shown as Appendix 6 on the 12 of November was not attended due to the researcher's ill health but fieldwork was done the following two days respectively. Two of the workshops were organised by the Volkswagen Foundation-WRC funded research team under the auspices of the Global Change Institute and done in Carolina at Featherbed Lodge in Mpumalanga. These were held on 28 November 2018 and 22nd of January 2019 respectively. Two regulator forums with DWS officials from the Pretoria head office for mine water and resource planning were done on the 24th of October 2018 and on the 17th of January 2019 respectively.

The IUCMA partly plays the role of a convener of these community forums and it creates a collaborative platform for the mining companies, affected communities, local municipalities, non-Governmental Organisations, and Department of Water and Sanitation. The community forums facilitated the focus group discussions for this study. Thus the IUCMA with its rich archival and administrative records on the history of AMD in Carolina, together with rich indigenous knowledge from the community and expert knowledge provides a platform for spreading awareness on the AMD threat in Carolina.

The advantage of these community forums is that they are a very effective way to get various stakeholders' engagement on the issue under study. Most of the input was written down in the research diary, some contributions especially presentations were recorded and pictures were taken with the participants' consent.



Figure 10: Image showing a report back session at a community forum in Carolina

Source: (Fieldwork Material, 2019)



Figure 11: Image showing a report back at a regulators forum in Pretoria DWS 17 January 2019

Source: (Fieldwork material, 2019)

It should also be noted that the public dialogue and Mine Water Coordinating Board (MWCB) stakeholder consultative meetings the researcher attended also represented a collaborative form of these forums but largely at professional level and activism level. A drawback that was observed was the lack of community representation in these *‘professional forums’*.

Quantitative Data

3.5.3.5. Socioeconomic survey and documentary evidence

Liswanti *et al.*, (2013, p.1) define socio-economic surveys as: “tools that provide a means of improving understanding of local resource management systems, resource use and the relative importance of resources for households”. The other documentary evidence in the study included the following; IDP 2018/2019 Gert Sibande District Municipality, the IDP 2017 for Chief Albert Luthuli, the LED and the 2016 community survey Stats SA.

“The Integrated Development Plan (IDP) is the principal strategic planning instrument that guides and informs all planning, budgeting, management and decision-making processes in the Municipality and is informed by the Local Government: Municipal Systems Act, 2000 (Act No 32 of 2000)” (Nkosi, 2017, p.2).

“LED is a participatory process where local people from all sectors work together to stimulate local commercial activity, resulting in a resilient and sustainable economy. It is a tool to help create decent jobs and improve the quality of life for everyone, including the poor and marginalized...” (UN-Habitat) (Source: South African LED Network, 2015).

The socio-economic parameters included demographic details, poverty, employment, health status, and educational levels. Inferences were made from this information and compared against the situation on the ground. A database from a local Non-Profit Making Organisation (NPO) on school leavers, showing their educational qualifications and skills was used as a primary data source on a local scale. Questionnaires were also used to gather socio-economic data on the community.

3.5.3.6 Questionnaires

According to Bird (2009), questionnaires are a data collection technique in social sciences research that enables the gleaning of information based on expected behavioural norms and dogma on the problem under study. The questionnaires were formulated from the questions in the interview schedules; however they included demographic questions in more detail. It should be noted that there was very little difference between the questionnaires and the interview schedule; however it was imperative to rob in the questionnaire in-order to bridge the gap in cases where a telephonic or a one on one interview could not be possible done due to hectic work schedules of the participants. It also afforded individuality during house visits where the researcher found more than four people to interview given a limited time.

The study tapped data from the different stakeholders in Carolina, the community members, business people, IUCMA officials dealing with communities and other officials involved in mining. Thirty-seven questionnaires were completed. Twenty-two of the questionnaires were completed by community members. Ten were completed by the officials from DWS, while two by the IUCMA, while a mining official, agricultural engineer and a biotechnologist also completed the questionnaires during community and regulators' forums. The questionnaire completed by the biotechnologist was centred on the green economy and the use of biotechnology to facilitate the transition to a post-mining viable green-economy. While the mining official's questionnaire was centred on the role of mining companies in reducing the AMD imposed socio-economic problems. During the administering and distribution of the questionnaires among community members, where participants were busy, a questionnaire was

left and collected after a day or two after completion. It should, however, be noted that some of the questions were left unanswered, which posed an upper limit to data collection. The image overleaf shows questionnaires being administered in Carolina in Silobela Township during fieldwork and during a regulator's forum in Pretoria DWS Offices.



Figure 12: Image showing questionnaire administration in Carolina's Silobela township 13 November 2018

Source: Thandiwe Chidzingu (Fieldwork Material, 2018)

This method of administering questionnaires in the safety of their homes proved effective as the researcher was able to explain some questions in depth in vernacular because some of the terms used did not have a vernacular alternative, for example AMD. It thus eliminated the problem of having incompletely filled in questionnaires.



Figure 13: Image showing questionnaire administering in the DWS in Pretoria during a Regulators forum 24 October 2018

Source: Thandiwe Chidzungu (Fieldwork Material, 2018)

This method proved effective as experts hardly have time to respond to electronically sent questionnaires. In this case, they were diplomatically compelled to respond because it was posed as part of the researcher's presentation.

3.5.3.7 Mapping

It was imperative that mapping is incorporated for the purpose of establishing the study site which was the Carolina Quaternary catchment area X11B in Mpumalanga, South Africa. Maps are representations of space on either a global, national or local scale, which are socially constructed through how society experiences them (Lefebvre, 1991). The maps used were adapted from a variety of sources and modified through Geographical Information Systems (GIS) applications to suit the research topic and study area.

3.5.4 Data analysis

According to Polit and Hungler (1997), data analysis means to arrange, systematise and draw meaning from given data. The quantitative data were analysed using absolute frequency distribution. Fouche and Bartely (2011) described absolute frequency distribution as involving

the structuring of data by the frequency of a particular response to a particular question. Thus questionnaires, socio-economic surveys and interview responses informed such analysis. Qualitative data analysis involved recording, taking pictures and writing of data from one on one semi-structured interviews, questionnaires and community forums using tape recorders and diaries. The interviews took between 15-35 minutes long depending on the participant's experiences and knowledge around the problem. Furthermore, analysis involves reading through the data, organising, codifying and inferring themes and hence inferring meaning from the different data clusters (Cresswell, 2014). The data collection period which started in September 2018 continued into February 2019 until key concepts and trends could be extracted to form solid themes in the research.

For quantitative data, pie charts, tables, and bar graphs were used to display these trends and possible findings inferred. There was a compilation of a baseline profile, including information on demographics, employment, education, health and community attitudes and perception around AMD pollution and use of biotechnology post-mining. The pie charts, bar graphs and tables used were representation of the figures obtained from the different data collection tools from the field, while some were adapted from data from existing IDP documents, from Gert Sibande District Municipality 2018-2019 and Chief Albert Luthuli Local Municipality 2017 Mpumalanga, as well as the Mpumalanga Socio Economic Report of 2015, Community Survey 2016 Stats SA, Mineral Council reports from South Africa (Facts and Figures 2016) that were acknowledged.

3.6 Methodological reflections

The study focused on the relationship between SIAs and public participation. It also unpacked the extent to which SIAs can contribute to the ability of communities to transition into a post-mining phase. Moreover, the role of SIAs in mediating between the conflicted interest of mining communities and mining companies was interrogated. It is also intended to find out if SIAs can serve as a mechanism to provide real life, mainstream, and statistics based view for an effective assessment and addressing of the socio-economic impacts. Furthermore, determine the implications of the study on a wider scale, in Sub Saharan Africa, using the Carolina Catchment area X11B in Mpumalanga as the case study.

Limitations of the study were largely centred on the weaknesses of the data collection tools. Interviews were time-consuming. Limited but all-encompassing questions had to be asked. In

some cases, questionnaires had to be left as people were busy and on collection, not all of them were filled in. Some of the semi-structured interviews could not be done as people did not want a formal interview or were too busy hence unstructured interviews through simple conversations had to be done to glean information. It was difficult to find farmers to interview due to travel logistics in the rough terrain as the researcher was using a small car. However, in 2019 a farmer from Carolina who was interviewed telephonically offered to drive the research team in his four-wheel drive and we had a tour in the farm. On the other hand, an agricultural engineer working with farmers in Carolina filled in a questionnaire around the effects of AMD pollution on the viability of farming.

Mining officials were also difficult to get hold of as most of them seemed not interested in entertaining student researchers. Nonetheless, through the IUCMA contact person, one environmental mining manager was interviewed who had vast experience in the field and a questionnaire was also filled in by a mining official during community forums. The use of CHAT methodology had some limitations as was similarly observed by Munnik *et al.*, (2019, in Press, p.44) that: “it cannot be used in an ‘expanded learning’ (Engestrom) context, considering that such a process warrants a coherent group with a mandate for change and in a single institution”. Drawing a dichotomy between tools and rules was a challenge as some of the tools were rules used by both regulators and managers. Moreover, there was an overlap between subjects and the community, creating some confusion. Nonetheless, the use of an ethnographic approach put a lot of grey areas into perspective and overshadowed some of CHAT’s drawbacks.

The researcher also complied with the ethical policy of the University of the Witwatersrand during data collection. Human participants were engaged in data collection hence factors such as confidentiality, anonymity and mutual consent was considered. Consent is one of the key considerations in research. Potential participants were therefore informed about what the study entails and were allowed to be at liberty in so far as deciding whether to participate or not and were reassured that refusing to take part will not affect them in any way. The participants’ identity was always protected during individual interviews however, it was not possible during public forums and focus groups and this was pointed out to those who participated in these groups. Images were used with the consent of participants. Tape recorders, Laptops, and compact disks or USB sticks were kept safe away from easy access and have passwords so that no one can easily access the information. The scholarly on AMD pollution, SIAs, environmental policies, and government documents were acknowledged through proper and recommended referencing.

In conclusion, the methodology chapter provides a lens on how the research was carried out. It highlights the data collection methods and data analysis process. Moreover, it gives a narrative of how the different methods of data collection were administered including their strengths and limitations. The hardships the researcher encountered in the field and how they were dealt with to afford successful data collection.

CHAPTER FOUR

EMPIRICAL EVIDENCE

4.1 Introduction

The chapter focuses on the presentation of the research outcomes of the study. It is structured according to the research questions that inform themes of the study. The first section deals with the interrogation of public participation in SIAs. In the second section, the role SIAs can play in facilitating a transition into a post-mining economy is unpacked. The third section gives an account of the conflicting interests between mining companies and communities. A narrative of the role of SIAs in assessing and addressing AMD imposed socio-economic impacts on mining communities is presented in the fourth section. While the fifth section then deals with the possible entry points of SIA in public policymaking. The data gleaned from this process is graphically presented and some are presented through quotes from interviews and from documents and pictures gathered where need be.

4.1.1 The relationship between public participation and SIAs

At the core of SIAs is public participation, which is a formal process that incorporates active citizen participation into the social impact assessment tool. This warrants that questions around the knowledge of SIAs and public participation in mineral development are interrogated. During data gathering, the participants were asked questions around SIAs to test their knowledge of this assessment tool. **Table 1** below shows how they fared in this particular survey.

Knowledge of SIAs	No knowledge	Limited	Adequate	Total
Number of Participants	45	6	24	75
Percentage	60%	8%	32%	100%

Table 1: Showing knowledge of SIAs among the participants

Source: Researcher (Fieldwork, 2018/2019)

From the survey figures depicted above, 60% came from the communities who had no knowledge of SIAs, 8% had limited knowledge and were comprised of the educated members of the community who made inferences on what SIAs is. The 32% came from the regulators, local government, mining officials and experts who participated in the study and are aware of SIAs.

The participation in the study along gender and race demographics was also examined and the state of public participation inferred from this miniature survey. A disparity was noted as most of the participants were mostly male and of African origin as depicted graphically below.

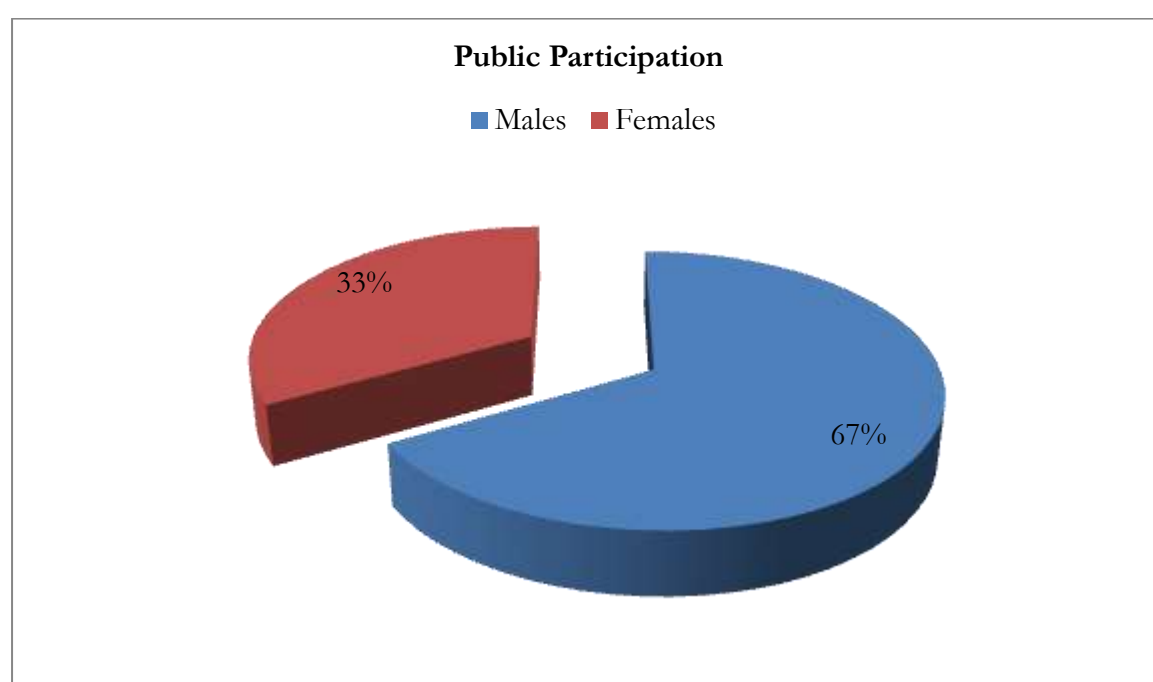


Figure 14: Pie chart showing participation in the study according to gender

Source: Researcher (Fieldwork data, 2018/2019)

From the graphic presentations of participation in the study, the 67% male proportion denotes that they are more men involved in developmental issues than the 33% female participation. An activist from Women Affected by Mining United in Action (WAMUA) during an interview, had this to say on these gender disparities: *“Women are hardly invited to attend public forums most of the decisions in society are taken by men and women are never given equal opportunity relative to men whose voices are audible but do not care about tomorrow”* (WAMUA Activist, 14 November 2018). One official during an interview further expressed that: *“Men do not care about anything else, but only employment”* (LED official 1, 22 January 2019). Another participant reiterated on the job bias saying: *“We hardly attend any community meetings but there are people who attend these meetings and in these meetings people’s main concern is jobs because there are a number of youths who are not employed, ignoring other issues”* (Interviewee 5,

28 September 2018). Another interesting observation was the race dynamics which were also examined among the participants.

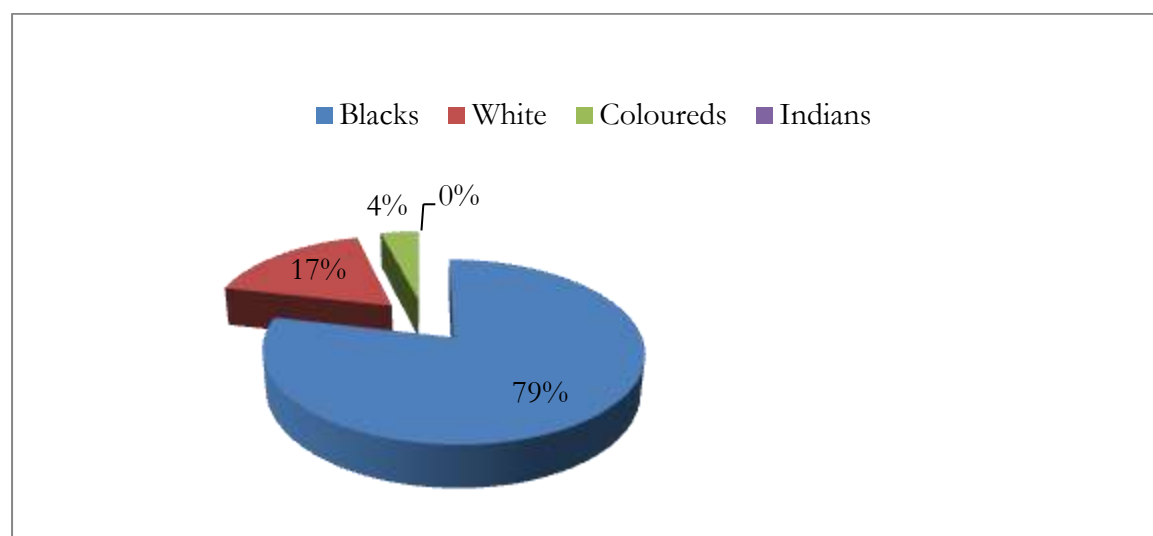


Figure 15: Pie chart showing participation in the study according to race

Source: Researcher (Fieldwork 2018/2019)

The black populace that took part in the study was 79% out of the total participants, 17% were white, 4% were coloureds or multiracial while no people of Indian descent took part. This perhaps is a reflection of the race demographic trend or interest in mining in Mpumalanga as a whole. When the participants were asked whether the public is consulted in mineral developmental projects the majority expressed concern, as they argued that there is no significant involvement of the community. Their responses were thus tabulated as shown below.

Participants' Responses	Number of participants	Percentage
Yes	3	4%
Limited	11	15%
No	61	81%
Total	75	100

Table 2: Showing knowledge public consultation/ involvement among participants

Source: Researcher (fieldwork, 2018/2019)

From the 75 participants; 81% said there is no public participation at all, while only 4% said it is there, and 15% said it is limited. This denotes a systematic weakness in the way public participation is done in communities and this will be unpacked in chapter five. Some participants

from the community in Carolina attributed the near non-existence of public participation during interviews expressing the following:

“We do not even know what mineral deposits are there, how big those resources are, how much they are worth, as the local government this makes public participation pointless to us (LED official 1, 22 January 2019).

“Even if the mines involve us we are not well educated we were just equipped to be teachers, nurses and not skilled in relevant critical skills, so even if mines do public participation it is a mockery of the whole process as we don’t understand anything and the invites are usually written using legal language” (Interviewee 13, 13 November 2018).

“In some cases public participation invitation is done through print media, in most cases the advertisements for the invitation are in black and white hence not eye-catching and have a short deadline, communities do not take cognisance of such notices and as the date elapses mining companies take advantage and say public consultation was done and communities did not object” (Interviewee 13, 13 November 2018).

One mining official substantiated the weakness of public participation indirectly and said: *“Community participation or consultation are done in earnest during project proposals in order to obtain a mining license and thereafter there are no on-going participation programs unless there is a serious incident that warrants that all stakeholders meet to deliberate on the problem” (Environmental Mining Manager, 22 January 2019).* Another interviewee dealing with mining memorandums from the magistrate courts reiterated on the issue of invites for public participation saying: *“In court we receive memorandums from the department of minerals resources and we are requested to put it on the notice board every month, so the community can see and object to the mineral development in writing, but people are not well informed, even those who visit the courts hardly take cognisance of the memorandum on the notice board” (Interviewee 8, 14 November 2018).* Community mining activists from Carolina had this to say about public participation: *“There is no proper public participation, the application is approved and granted by the municipality without approval by the community, sending the memorandum for public input is just a formality” (Community Mining Activist 1, 28 September 2018).*

Appendix 14 confirms and provides evidence of some of the above-mentioned loopholes in public participation.

Communities in Carolina in response to non-existent viable public participation or consultation took initiative following the AMD pollution of the Boesmanspruit dam in 2012. *‘Reactive public*

participation` was done where the public through protests opened a platform for consultation between the community, mining companies and the municipality resulting in an investigation of which company was responsible for AMD pollution on the Boesmanspruit river. According to one participant: “No company took responsibility the municipality did not enforce any systems on how rehabilitation could be done, but the high court made a ruling that each family member should be supplied with 20 litres of water each day by the municipality although this was not strictly adhered to as not everyone got the 20 litres of water” (Community activist 2, 14 November 2018).

In conclusion, the above arguments point to a lot of hurdles public participation has to overcome for it to become a viable process. Right from the use of legal language on public participation invites, lack of transparency on who constitutes the community and makes decisions, illiteracy when it comes to understanding developmental initiatives and understanding the interlink between AMD pollution and socio-economic problems, moreover, the gendered disparities in public participation.

4.1.2 The role of SIAs in transitioning into a post-mining economy

Mine closure marks the end of a viable livelihood, promoting an exodus of people from post-mining landscapes to places offering a positive place utility. This has left behind ghost towns in some areas. The public and private sector worldwide are therefore making efforts to reclaim these post-mining landscapes. This has been facilitated by research initiatives through the introduction of new biotechnologies that create secondary economies post-mining. However, the study sought to find out the role of SIAs in this trajectory of transitioning to a post-mining economy. Questions around the introduction of new biotechnologies, the community's perceptions around such alien technologies into their native environment were asked. Moreover, questions around the viability of such technologies were asked to regulators who constitute experts in the green economy.

When members of the Carolina community were asked questions on the odds of a viable post-mining economy they had a lot to say: *“There is a need to invest in projects that do not necessarily need clean water, if we are to move to new economies post-mining” (Participant 1, 26 September 2018).* While one participant raised issues around compensation saying: *“There should be compensation funds that are established for the mining communities that are anticipated to be affected by AMD prior to mine closure, so it can be used for post-mining investments” (Participant 5, 28 September 2018).* Some participants said: *“Invest in*

bricklaying, recycling and harvesting of the black wattle as these may provide a source of income” (Participant 8,11 and 13 28 September 2018).

While members of the Carolina community were so optimistic about the possibilities of a post-mining economy, one mining official considered it gloomy and had this to say: *“DMR sits with funds for mines after closure, in some cases reimburses a portion of those funds and they expect mines to fork out more money on top of the money that they would have contributed that can be invested on post-mining communities following mine closure, it is something that will not happen” (Environmental Mining Manager, 22 January 2019).* On the issue of possible post-mining activities like in the case of wattle growing and harvesting as an alternative post-mining activity the official had this to say: *“Before any wattle growing and harvesting is done as a rehabilitation effort and post-mining economic activity a permit has to be obtained from the Department of Mineral Resources (DMR) so it is not an easily accessible economic activity” (Environmental Mining Manager, 22 January 2019).*

In light of all these responses around a post-mining life facilitated by biotechnologies, a survey was done among the participants to check their willingness or unwillingness towards the use of these new technologies. The results are shown in **figure 16** below.

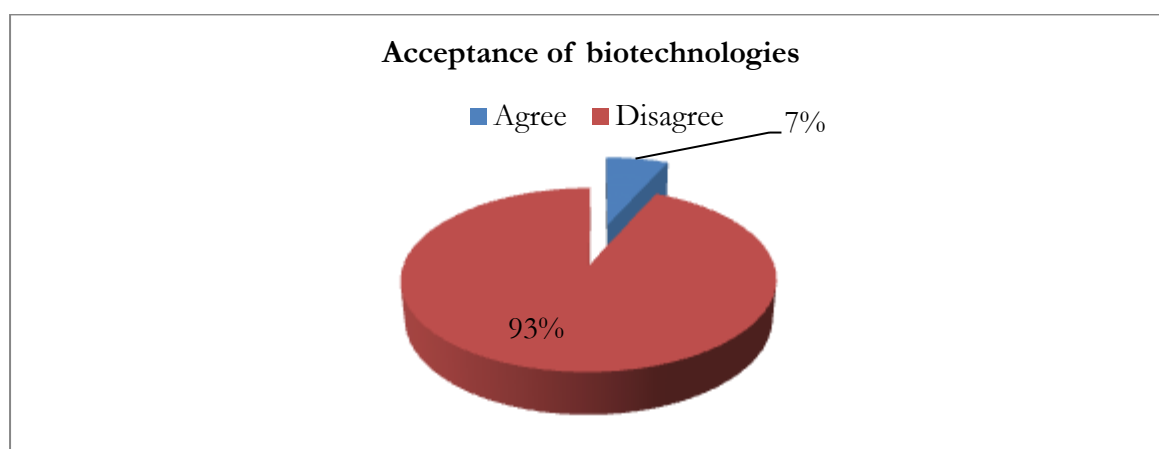


Figure 16: Pie chart showing acceptance of biotechnologies among community participants in Carolina

Source: Researcher (fieldwork, 2018/2019)

93% of the participants seemed to welcome the idea of new biotechnologies into the Carolina community. While, 7% had their misgivings around these technologies the main arguments being: *“These mining companies come to South Africa, exploit resources, degrade the environment, then go back and get new technologies to remedy the harm they have done at our own financial cost (Interviewee 13, 13 November 2018).* While others agreed saying: *“These new reclamation technologies also have their own*

environmental impacts which are also solved by getting new technologies again from the same nations, siphoning Africa dry of its financial and natural resources” (Interviewee 9, 11 and 14 13 November 2018).

Other community members exhibited a very positive attitude towards new biotechnologies post-mining. One interviewee said: *“Mining is not forever in Carolina hence we need and welcome any new technologies that will sustain lives post-mining” (Interviewee 5, 28 September 2018).* While another interviewee had mixed sentiments, at one time arguing against biotechnologies and at one point acknowledging that they may come in handy saying: *“We foresee intensifying agriculture using these new biotechnologies post-mining because we are actually rich in agriculture in Mpumalanga, but they also have their own peculiar impacts on our land” (Interviewee 13, 13 November. 2018).* One interviewee expressed that there are high odds of corruption in new investments and biotechnologies: *“If things were done according to the book after the land has been properly rehabilitated then agriculture could have been squeezed in but in Carolina its `kindergarten` they are playing, people are giving each other money” (Topi, 14 November 2018).* While another interviewee had this to say: *“Once the soil has been affected it is not easy to rehabilitate it, even when new technologies are brought to rehabilitate it or create new forms of sustenance, these new technologies may in turn bring impacts of their own on the environment that may not resonate well with existing traditional activities translating to socio-economic problems (Interviewee 13, 13 November 2018).*

In response to the upper limit AMD puts on the productivity of the land, other participants said: *“In areas where the land is still not rehabilitated we may force in agriculture processing setups if the land is not suitable for cultivation” (Topi, 14 November 2018).* In addition, Topi points to the other resources: *“We have titanium, manganese, and gold, to name a few minerals that we can look into apart from coal or even agriculture” (Topi, 14 November, 2018).* Other participants also identified other possible economic activities that are actually being done in Carolina such as: *“Timber logging which is a big business and can form part of the post-mining parallel economies, with most of the timber sold in Richards Bay, Monde and some is exported overseas. It also employs a lot of people” (Interviewee 9 and 14, 13 November 2018).*



Figure 17 (i-iii): images showing some timber logging in Carolina

Source: Thandiwe Chidzungu (Fieldwork Material, 2018)

One expert brings in an interesting insight into some of these agricultural activities in the post mining green economy: *“The agricultural crops that are grown in the green economy using these new biotechnologies are not used as food crops, for example, the sunflowers even the maize is used in the petrochemical industry”* (Community Forum report back, 22 January 2019).

A vast array of possibilities in a post-mining economy using biotechnology was brought forward by the experts who participated in the study. One expert said:

“From other countries we have learnt that opportunities include a diverse array of industries or land uses, recreational use of certain mining sites is possible which may add to tourism allure, where soil rehabilitation is possible and good quality water is available or can be made available crop farming is an option, rehabilitated opencast sites could be improved by planting rehabilitation crop like sweet sorghum or soya beans to improve soil fertility and these crops can be used as feedstock for a biofuel or green chemistry industry” (Biotechnologist, 21 February 2019).

When asked the kind of jobs that are likely to be created in these AMD impacted post-mining landscapes the biotechnologist gives a litany of employment opportunities:

“Water and soil resource management, farming related work especially growing and harvesting crops, logistics and transport jobs, engineering jobs in the short term to build the necessary infrastructure, for example, bio-refinery, maintenance work by technically skilled people, general finance, and business management” (Biotechnologist, 21 February 2019).

With all these positives, questions around any possible impacts these biotechnologies may impose on the biophysical environment were asked and his response was: *“There will be changes in river or stream flow characteristics when building constructed wetlands, lowering of underground water level if irrigation scheme is used and land changes for bio-refinery complex”* (Biotechnologist, 21 February 2019).

One cause of concern he raised was that the new jobs created are skills intensive and may see the importing of labour from other regions in the country at the expense of Carolina. On the other hand a few well-informed residents expressed concern on the odds of further exploitation as these new biotechnologies may also bring in new threats and risks to communities. Moreover, food security continues being compromised considering that the crops grown are not food crops. This causes a conflict of interests between the mining companies and mining communities. SIAs with its participatory approach then endeavours to span the gap through information dissemination and playing a mediating role between the conflicting interests of

affected parties. The next section attempts to interrogate this conflict of interest and how SIAs come in, to span the gap.

4.1.3 SIA as a mechanism for mediating between the competing interests, of impacted communities and mining companies

“Once you put a resource in a place or community, you are not only putting a resource but it becomes a source of conflict whereby some feel they have more entitlement than others...” (Karma Brown 20 November 2018, Public Dialogue on Extractive Industries).

Inferring from Brown’s remarks at the centre of natural resource extraction are competing interests between different stakeholders. The following narratives of conflict triggers were identified during the study: *“The white farmers are compensated very well, sell the farms and go to start a new life elsewhere. The black labourers and neighbours are left stranded with no compensation at all due to ignorance around the modus operandi of the farming, mining and land regulations” (interviewee 13, 13 November 2018).* This ignites conflicts between the mining companies and impacted native communities that are overlooked in such cases.

During an IUCMA focus group, discussion on public participation the following sentiments were shared: *“Mining companies hardly come to the people after getting their mining license and in most cases do not keep to their promises, especially that of infrastructural development” (IUCMA / Community Focus Group 28 September 2018).* This perhaps denotes a parasitic relationship that results in a conflict of interests between the duos. In response to these accusations one mining official had this to say: *“Our core business is to mine, not that of providing basic service delivery that lies within the jurisdiction of municipalities” (Environmental Mining Manager, 22 January 2019).* Thus mining companies put their own interest first at the expense of communities.

In addition one local government official brings in another conflict trigger saying: *“Mining companies bring their own skilled labour into the mines in Carolina and the only employment opportunities offered to locals is semi-skilled and unskilled jobs and these unskilled locals are also the first to be retrenched” (LED official 1, 22 January 2019).*

In light of these arguments, one regulator said: *“It is necessary to have in-depth social impacts assessments, during ELAs so that any socio-economic impacts emanating from mine development are fully addressed much to the satisfaction of impacted communities” (Regulator 10, 24 October 2018).* While another

DWS official reiterated saying: *“There is a need for SIAs specialist to be well acquainted with the needs of the community and the local conditions not just reaching it in a report”* (DWS official, 24 October 2018).

One activist who was part of the crew who was in the forefront during the 2012 AMD saga in Carolina had this to say: *“Mining companies have made efforts to deal with AMD pollution but the money was diverted to other things due to corrupt activities within local government leaving communities in limbo”* (Oral communication, 14 November 2018). Topi raises another source of conflict trigger expressing that: *“These mines extract coal in Carolina but we buy it packaged coming from Johannesburg at a high price, while we are the producers of the coal”* (Topi, 14 November 2018).

Substantiating the conflicted interest between mining companies and communities elsewhere in Africa, is the input from the interview held with the Roving advisor for three SADC countries; Zambia, Zimbabwe and Uganda who said: *“In Solwezi, Zambia when communities spoke out against mine water pollution the mining companies reacted and cancelled all Corporate Social Responsibility (CSR) programs they had with communities”* (Roving Advisor, 20 November 2018).

In conclusion, these conflicting interests issues between mining companies and mining communities mostly emanates from corruption, lack of transparency and ignorance on the issues on hand. Preference of imported skilled labour due to lack of a skilled populace in Carolina is another impetus for conflict. Moreover, the idea of not enjoying the benefits of having a resource is another conflict trigger. The ambiguity when it comes to a demarcation of roles around the provision of social amenities between the mines and the local government also gives an impetus to conflicts. SIAs then come in to address and assess these conflicts of interest by bringing indigenous knowledge and science communication together. Furthermore, advocating for an active citizen approach in mineral development and a collaborative platform between all relevant stakeholders to tackle the myriad socio-economic impacts of mining activities thereof.

4.1.4 Assessing and addressing AMD imposed Socio-economic impacts on mining communities in post-mining landscapes

It is befitting that in the backdrop of socio-economic impacts the socio economic baseline of Carolina is interrogated as a starting point. The population, race, employment, health and education demographics will be examined. This section seeks to provide an overview of the socioeconomic conditions of the community and its people as a whole referenced against the sub-region and the provinces. It is imperative that the socio-economic conditions related to the

specific community be included. As the socio-economic baseline provides a definition of the local community referred to here as the Carolina community. Most of the data come from the IDP of Chief Albert Luthuli (2017), Gert Sibande IDP 2018-2019. Stats SA 2011, Facts and Figures 2016, and the Community Survey conducted in 2016.

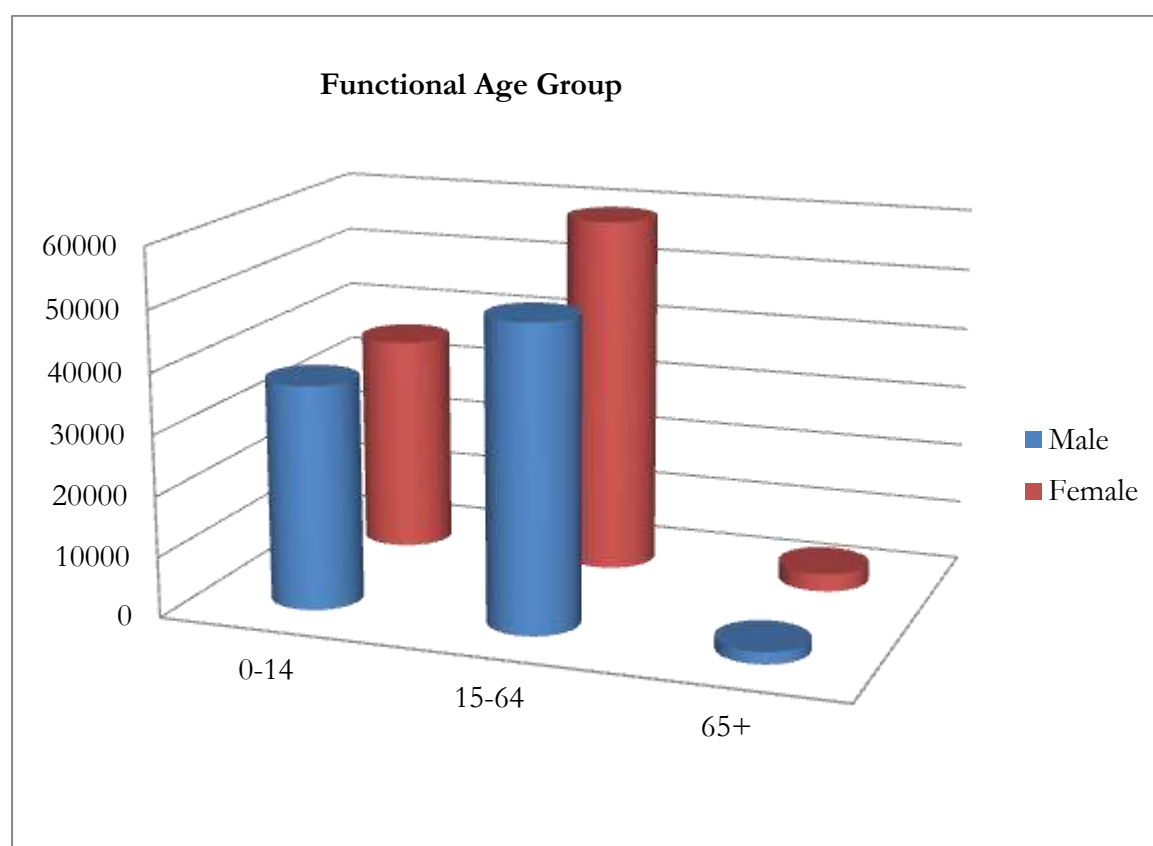


Figure 18: Population distribution by functional age group in Chief Albert Luthuli Municipality

Source: (Adapted from Stats SA 2011 cited in the Chief Albert Luthuli IDP 2017)

The Population distribution in Chief Albert Luthuli Local Municipality exhibited a relatively high number of females relative to males. The 0-14 age group had a very small difference in population distribution between the two gender groups. However, the 15-64 age groups had more females than males. This may be linked to such factors as a high mortality rate among man as they succumb to AIDS and the high migratory rates of males (Mpumalanga IDP, 2017). The dynamics in the numbers of the active group warranted the interrogation of employment trends in the coal sector nationally from 2004 to 2016. **Figure 19** overleaf gives us a snap shot of the employment situation in the coal sector nationally from 2004 to 2016.

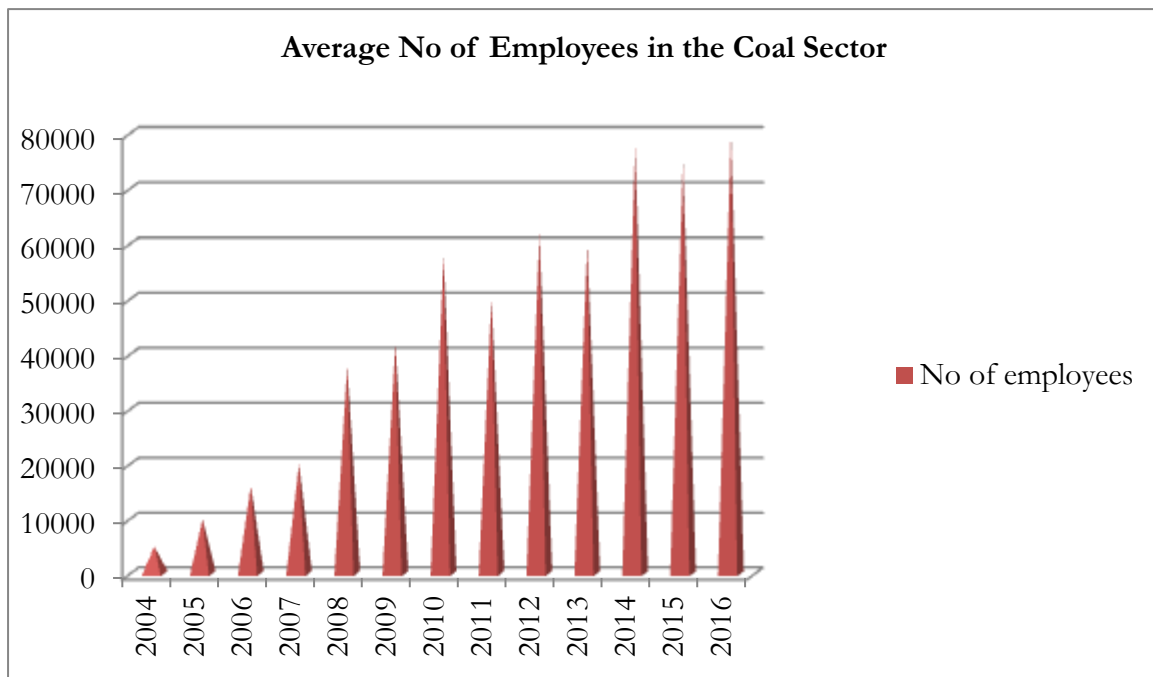


Figure 19: Trends in employment in the coal sector from 2004-2016 in South Africa

Source: Adapted from Department of Mineral Resources (Facts and figures 2016)

The employment trend in coal employment from 2004 to 2016 was characterised by a fluctuating pattern. From 2004 a general upward trend towards late 2013 was observed, with a drastic fall in 2014 to 2015 then it became stable till 2016. This also raised questions around the employment skills trend within the coal sector considering that the coal sector is skills intensive. Going down to the province where the study was carried out in the Mpumalanga province, **Figure 20** gave a snapshot of the skills distribution in Mpumalanga.

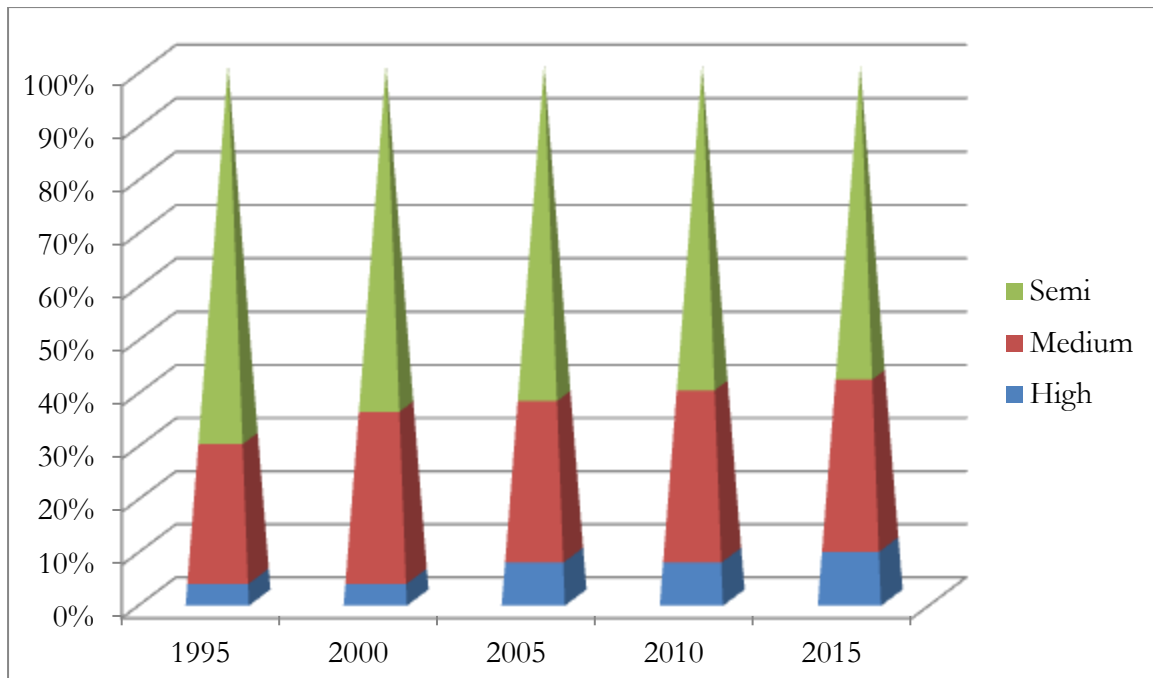


Figure 20: Bar chart showing employment according to skills trends in Mpumalanga South Africa from 1995-2015

Source: (Adapted from Quantec 2015, cited in Burton *et al.*, 2018, 13)

According to **Figure 20** above, most of the unskilled jobs dropped from 1995 to 2015. A shift was also noted on the intensification of skilled labour towards 2015. This warranted that questions about the employment trends in Mpumalanga's Gert Sibande District municipality be interrogated. Zeroing down to the employment trends in the local district municipality which is Chief Albert Luthuli where Carolina our study area is located. Data on employment trends were therefore gleaned from Mpumalanga's IDP (2018-2019) as the researcher did not have enough resources to carry out such a big exercise.

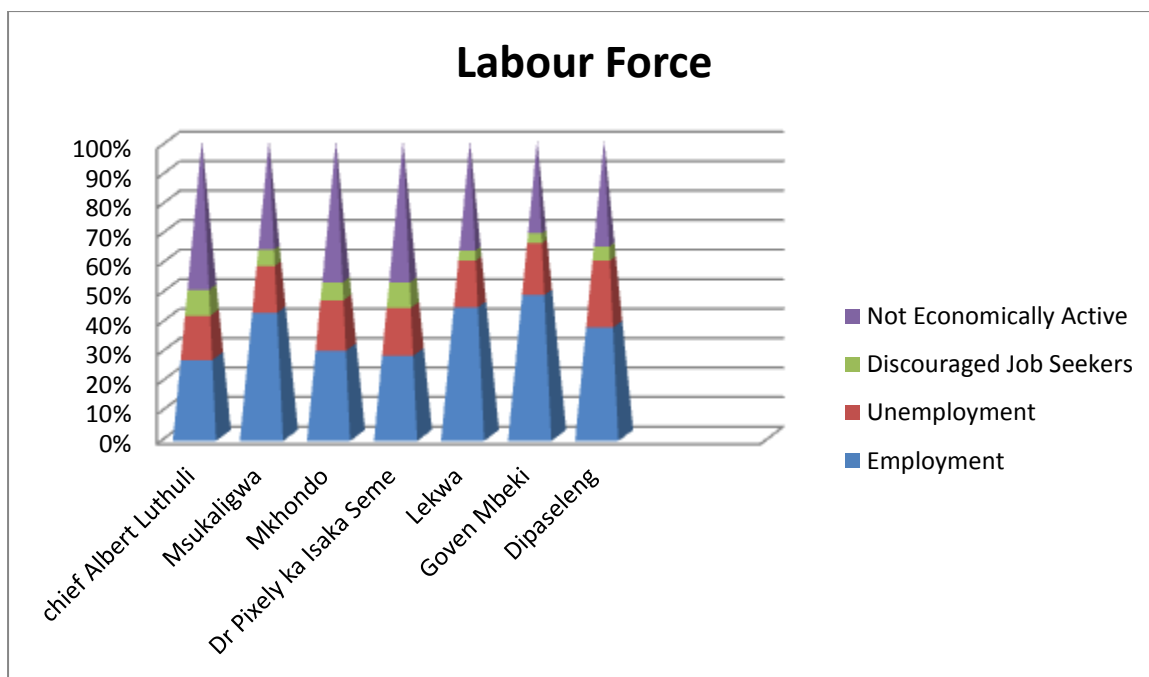


Figure 21: Bar chart showing employment trends in Gert Sibande District municipalities

Source: (Adapted from Stats SA 2011 cited in the Gert Sibande IDP 2018-2019, 39)

As depicted by the graph above, Chief Albert Luthuli (Carolina) had the second lowest number of employed people. This denotes that the majority of the economically active group was either unemployed or discouraged employment seeker. While it also had the second highest figure of the not economically employed.

According to Stats SA 2016 (as cited in the Chief Albert Luthuli IDP, 2017), the unemployment rate in the Chief Albert Luthuli was estimated at 32.7% in 2016 and the unemployment rate for the active group at 45%. While the poverty rate in this municipality was relatively high around 51.7%. The poverty rate has been defined by Nkosi (2017) as, the lowest monthly income capable of sustaining households earning below the poverty income. The bigger the family unit the larger will be the income required to sustain its members.

In terms of Education, the following socio-economic baseline was exhibited in the Gert Sibande District Municipality. This is shown by **Table 4** overleaf.

Education Indicators	Census		HIS Global Insight 2014
	2001	2011	
Population 20⁺ with no schooling	26.3%	13.4%	10.7%
Population 20⁺ with post matric qualification	5.5%	9.4%	9.6%
Functional Literacy rate%	59.3%	76.5%	79.5%

Table 3: Showing educational socio-economic baseline in Gert Sibande District Municipality

Source: (Adapted from the Mpumalanga Provincial Treasury, Socio-Economic Situation and Challenges of Gert Sibande 2015, cited in Gert Sibande Draft IDP 2018-2019)

The Population in the 20⁺ years with no schooling saw an upward trend from 2011 by 2.7% in 2014. The Population 20⁺ years with post matric qualification improved since 2011 but slightly deteriorated by 0.1% in 2014 lowest among the districts. The functional literacy rate 15⁺ years with grade 7 improved from 2011 by 3% in 2014.

Chief Albert Luthuli `s socio-economic baseline shows some unfavourable statistics in terms of employment, education, skills trend and population distribution from the statistics given by the IDP. (2018-2019). The impacts emanating from mine water pollution have not been given due recognition in impact assessments. This has led to an outcry of the mining communities. This warranted that an in-depth interrogation of the prevalent socio-economic impacts associated with AMD in this study and the mitigation role of SIAs be done

The myriad socio-economic impacts emanating from AMD in Carolina seem to have a direct relationship with each other. The health of residents has been adversely affected evidenced by reports of skin rashes, stomach ailments and a decline in women reproductive health in some cases after exposure to AMD. The bar chart below shows a three month statistics gleaned from

the Mpumalanga health department statistics on diarrhoeal and skin rash cases reported to be linked to AMD water pollution.

Age Group	September 2018		October 2018		November 2018		Total
Health Ailments	Skin Rashes	Diarrhoea	Skin Rashes	Diarrhoea	Skin Rashes	Diarrhoea	
0-14	2	16	1	6	-	-	25
15-64	-	4	-	6	-	-	10
65+	-	1	-	-	-	-	1
Total	2	21	1	12	-	-	36

Table 4: AMD related health ailments in Carolina, Mpumalanga recorded from September 2018-November 2018

Source: (Based on the three monthly statistics from the local hospital in Carolina, Fieldwork, 2018)

The water-related ailments in Carolina depict relatively high figures in the diarrhoeal conditions relative to the skin rashes. Most vulnerable to these ailments are the children age group from 0-14 years. This is perhaps linked to the developing immune systems that make them more susceptible to these harsh conditions in the water. There are no statistics on vaginal ailments related to AMD pollution that were obtained from the hospital. Nonetheless, data from the field point to their existence. One activist from WAMUA had this to say about the consequences of these water related vaginal ailments: *“We have developed some unusual rashes and discharges and this has caused breakups in relationships as some man felt the female partner was cheating on them, causing unnecessary conflicts”* (WAMUA, 14 November 2018). Reiterating on the same issue one participant said: *“The water affects our private parts we believe it is linked to its acidity, resulting in the labia and clitoris swelling up”* (Participant 17, 14 November 2018).

Elsewhere in Africa to substantiate this reality in mining areas, the Roving advisor for Zimbabwe, Zambia and Uganda dealing with mining communities in these countries asserted this during an interview: *“There are women who have come up complaining about the effects of AMD on their private parts after bathing with the AMD polluted water”* (Roving Advisor ActionAid, 20 November 2018)

Participants were also asked questions about the effects of AMD on their daily activities. The following responses during interviews were recorded: *“If I drink this water straight from the tap I fall*

sick and have to be rushed to hospital” (Interviewee 7, 28 September 2018). Another participant said: “We just continue drinking this water our bodies have adapted; however, we always wonder what effects this water will have on us in the not so distant future, especially to our small children who are still infants” (Interviewee 8, 14 November 2018). One participant had this to say: “I never drink water from the tap I rely on the water from the boreholes located in the schools that the Indian community dug for the Carolina community” (Interviewee 12, 14 November, 2018). Another respondent pointed to the effect it has on their clothes: “When you wash your white clothes with this water they are discoloured into a creamy, khaki colour” (Community Activist 3, 14 November 2018).

However, apart from the tap water one resident expressed her concern on the borehole water and said: *“The borehole water is also believed not to be 100% clean as the contaminants are believed to reach the water table; however, no tests have been carried out on this water to date to prove this claim” (Interviewee 13, 13 November 2018). In response to this one official from Gert Sibande during a tour to the water treatment plant in the Boesmanspruit Dam had this to say on borehole water: “No tests have been done on water from the boreholes in these communities because the Gert Sibande Disaster Management team can only do it at a fee and people are reluctant to part with cash” (Disaster Management official, 14 November 2018).*

Another aspect is that the health implications have a bearing on the economic aspect. Participants were asked to identify those activities that are affected and how they are affected and they expressed the following sentiments: *“When there is a diarrhoeal outbreak our work schedules as teachers are affected and it calls for the investment of more time which might not be available before examinations kick-off” (High School Teacher 27 September 2018). A health worker had this to say: “These diarrhoeal outbreaks in Carolina put pressure on the nursing staff and medication, given that there are only two clinics servicing the whole of Carolina” (Health worker local clinic, 27 September 2018).*

Questions around the awareness of the magnitude of people being affected by AMD were asked. Respondents had this to say: *“The department of health when approached by mining activist in Carolina to release statistics on AMD related illness they say the statistics are kept in the custody of the health department and the municipality only and they remain private and confidential, hence as activists they do not have a solid case to back their complaints on the effects of AMD on people’s health in Carolina” (Activist, 1 Carolina 28 September 2018).*

Elsewhere in Africa, the situation on health substantiates the situation in Carolina in terms of health implications and the little these mining companies do in mines around Africa:

“In Solwezi, Zambia diarrhoeal cases were rife, people complained, mines carried out the tests and confirmed that the water is AMD contaminated. Mines then promised to dig deeper boreholes lower than

the normal water table at 150metres, communities had to speak out against these problems- the mining companies reacted and cancelled any CSR programs they had with communities” (Roving Advisor, 20 November 2018).

Health implications are a mammoth task to deal with and prove considering what one interviewee said: *“The problem is in authenticating these claims, but you can see that there is a link between the pollution and the health issues” (Roving advisor, 20 November 2018)*

Not only is this water contamination prevalent in abandoned open pits a health hazard but is also a death trap. In Zimbabwe, the open pits containing AMD have become death traps to communities. One mining activists from CCPJ based in Marange, Zimbabwe had this to say during a public dialogue for Extractive Industries hosted by ActionAid South Africa: *“Mining companies have squandered minerals in Zimbabwe mining area in Marange and left open pits with AMD contaminated water that have seen people falling into them and dying” (CCPJ activist Zimbabwe, 20 November 2018).*

In response to these contributions, questions around the action mining companies or local government is doing to remedy this situation were raised. The participants said it is the church that came to its rescue instead: *“Boreholes were erected by the Muslim community in only two schools and this affects the people who live remotely away from them, compelling women and children to walk long distances to fetch water” (Community Activist 1, 28 September 2018).* Image 22 below depicts some of these water points in the schools donated by the Muslim community.



Figure 22: Images showing the safe water point in the schools that supply Carolina residents

Source: Thandiwe Chidzungu (Fieldwork Material, 2018)

One participant raised the issue of other health impacts as emanating from poor urban planning in Carolina where he said: *“a coal siding has been put in the middle of the town, near shopping and residential areas. Such that when it rains the coal dust is washed into streams that pass through residential areas, paddocks and joins the main water sources, contaminating it with sulphates”* (Interviewee 13, 13 November 2018). The images below show the coal siding and the stream where some of the coal is washed into Carolina.



Figure 23 (i-iii): Images showing the small stream where the coal is washed into and the coal siding in Carolina

Source: Thandiwe Chidzungu (Fieldwork Material, November 2018)

Following such narratives on the adverse impacts of AMD on the community’s well-being it was befitting to ask questions around compensation and possible displacements, especially among the farming community. According to one farmer representative: *“As the soil loses its agricultural potential some farmers have been displaced from Carolina to other areas in South Africa like Western Cape, leaving behind farm labourers in Carolina without any sustainable livelihood after losing their jobs in these derelict farms”* (Agricultural Engineer, 26 September 2018).

Elsewhere to substantiate the Carolina scenario is the Zambian experience as the Roving advisor expressed the following observations during an interview on mine initiated displacement and compensations respectively: *“People are displaced as families, but the compensation is standardised, a family with a six-roomed house is compensated the same amount with a person with a two roomed house and this does not equate to the monetary value of the houses”* (Roving Advisor, 20 November 2018).

While in Carolina during a dyadic interview it was expressed that: *“in some cases, these mines do not even relocate the people but just blast near people’s homes resulting in their houses cracking”* (Dyadic interview, 14 November 2018). On another note, these displacements raised questions around the impacts on culture and other occupations that people depend on. One interviewee narrated the story of a farmer friend saying: *“A farmer and a resident in Carolina involved in aquaculture had his fish dying in the dam and pond due to AMD pollution and lost this recreational site* (Interviewee 6, 26 September 2018).

On cultural impacts, some interviewees had this to say: *“Some families have had their grave sites removed such that it has been difficult to keep spiritual ties with their ancestors as the shrines were destroyed”* (Dual Interview, 27 September 2018). From field observations, some indirect impacts of AMD pollution that have adversely affected employment opportunities in water-thirsty industries have seen the development of alternative economic activities like sand digging in Carolina. The sand is dug for road making and building purposes but has encroached into a sacred area as shown by **Figure 24 (i and ii)** below.



Figure 24(i and ii): Images showing gravesite encroachments in Carolina

Source: Thandiwe Chidzungu (Fieldwork Material, 2018)

In some instances mines draw clean water from rivers and contaminate it with toxic material. One mining official expressed that: *“Mine water is usually associated with high aluminium and manganese; it is generally known that at low pH dissolved aluminium becomes toxic which numerous researches have associated it to fish mortality”* (Environmental Mining Manager, 22 January 2019).

Elsewhere, in Zambia one mining activists confirms the above observation and had this to say: *“One river in Zambia is divided into two where a mine uses one half of the river and the community uses the other for its domestic needs (CCPJ Mining Activist, Zambia” 20 November 2018)* As the water becomes polluted a livelihood for fishermen is taken away with dire consequences on nutrition and their financial sustenance. In Carolina other occupations like gardening have been adversely affected by AMD pollution as shown by field observations substantiated by interviews of the gardeners. One gardener says: *“The dirty water from the mines affects our yields and crop quality” (Gardener 1, 27 September 2018)*. See **Figure 25 (i and ii)** below.



Figure 25 (i-ii): Showing effects of AMD on crop quality in vegetable gardens in Carolina

Source: Thandiwe Chidzungu (Fieldwork Material, 2018)



Figure 26 (i-ii): Showing effects of AMD on crop quality in vegetable gardens in Carolina

Source: Thandiwe Chidzungu (Fieldwork Material, 2018)



Figure 27: Image showing the new Jojo Tank

Source: Thandiwe Chidzunu (Fieldwork Material, 2018)

The Jojo tank is a common feature in Carolina that is used to supply clean water for domestic use. Some of the crops within the garden seem to have improved in quality. See **Figure 26 (i and ii)** above. One of the gardeners expressed that: *“The Jojo tank ensures a clean supply of water for our crops improving their quality and making our business viable”* (Gardener 2, 27 September 2018). On the same note, an environmental expert had this to say: *“The good quality of some crops in the same stretch of land relative to the others might be due to their high metal tolerant levels* (Environmental Mining Manager, 22 January 2019).

In response to the above observations, there was therefore a need to find out how this mine water finds its way to the domestic streams. The community members had this to say: *“there is poor monitoring of water resources by municipalities who leave such responsibilities to the mines”* (Mining Activist 3, 14 November 2018). One mining official during an interview substantiated this citing one case in point in Mpumalanga: *“A mine’s core business is mining and not water treatment, the EMalableni water treatment plant has become a liability to the mine as the Municipality has deserted the project citing financial burden”* (Environmental Mining Manager, 22 January 2019).

One farmer that the researcher interviewed over the telephone and later visited his farm had a number of complaints about the effects AMD has had on his crops:

“There was no proper planning for a nearby open cast mine, the company has made minimal attempts to rehabilitate the land, and there is lots of subsoil washing off from the rehabilitated sites with soil pH levels of 3.9 that has affected our maize, beans and potato crops. The only solution we are being given is the addition of lime” (Carolina Farmer, 14 February 2019).



Figure 28 (i-ii): Showing AMD affected maize crop and invasive plants in a farm in Carolina

Source: Thandiwe Chidzungu (Fieldwork Material, 2019)

Another concern that the farmer raised during the telephonic interview was that they are not well informed on the impacts of mine water pollution on their crops as farmers: *“As farmers we do not know the exact short and long term impacts of AMD pollution and existing Catchment Agencies are doing very little to help us, the situation is actually catastrophic” (Carolina Farmer, 14 February 2019).* The magnitude of the problem is substantiated by the images shown below.



Figure 29 (i-ii): Images showing the state of the soil in the AMD affected farmland in Carolina

Source: Thandiwe Chidzungu (Fieldwork Material, February 2019)

This is exacerbated by poor rehabilitation that is done by the neighbouring mines. Some of the catastrophic images are shown below.



Figure 30 (i-iii): Showing the effects of poor rehabilitation on arable land in a farm in- Carolina

Source: Carolina Farmer (Fieldwork Material, 2019)

In addition to the above mentioned drawbacks of AMD pollution and poor rehabilitation one local government official said this during an interview: *“We do not have a specialised labour force around environmental management in local government therefore, no proper rehabilitation of former mines was done, as it is not our core activity we concentrate on basic service delivery”* (LED official 1, 22 January 2019). A mining official further made the following remarks on environmental monitoring: *“The mining area in Mpumalanga was too big without undertaking concurrent rehabilitation measures for closure in the past and this has compromised effective rehabilitation”* (Environmental Mining Manager, 22 January 2019).

It should however, be noted that other socioeconomic impacts are perhaps linked to the failure by the mining companies to keep to their CSR. This has affected the provision of educational facilities and skills development. Education was alluded to before at the beginning of this section. Its compromise also has other multiplier effects that exacerbate the adverse socioeconomic impacts in these mining communities. Most of the youths in Carolina have completed their matric but do not have the skills to work in these mines. The figures below give some insights on the state of education and skills inventory at a miniature scale. These figures are gleaned from the database of a local NPO that deals with assisting school leavers with employment in the mines in Carolina.

Qualifications	Grade 11 and below	Matric	Tertiary Diploma	Mining Relevant skills	No Skills	Other skills
No of School leavers	59	1118	3	344	313	517

Table 5: Educational skills structure in Carolina local Non-Profit Organisation (NPO) stats 2018

Source: Local NPO Database (Fieldwork, 2018)

The tabulated statistics show that 1118 of the youths in the database only had a matric qualification. About 344 had some mining relevant skills, while 313 did not have any skills whatsoever. 517 had other skills outside mining and 59 only had a grade 11 qualification. This puts a compromise on their chances of getting employment in the mines and simple comprehending some of the implications of mineral development in their well-being. Below are images of the local NPO flooded with curriculum vitae of school leavers and job seekers.

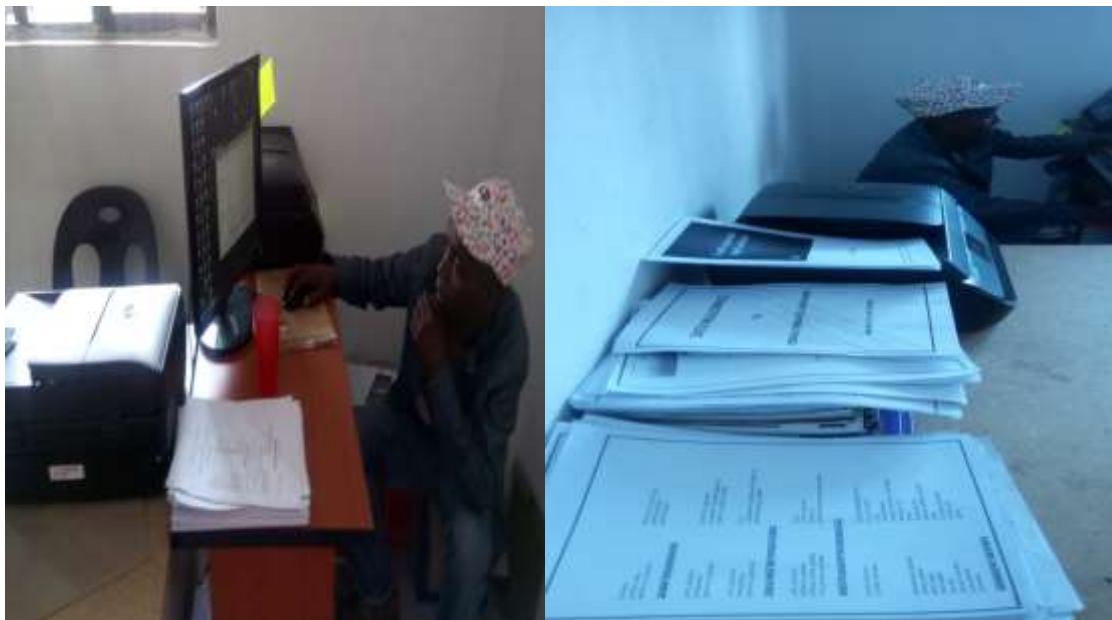


Figure 31: Image showing the local Non Profit making Organisation (NPO) office flooded with resumes for job seekers in Carolina

Source: Thandiwe Chidzingu(Fieldwork Material, 2018)

Furthermore, the Local Economic Development in the Chief Albert Luthuli Local Municipality under The Gert Sibande District Municipality is argued to be ineffective as one interviewee had this to say: *“LED is an unfunded mandate in South Africa, in Gert Sibande District Municipality when you need funds for the program you are always told to go to the private sector”* (LED Official 1, 22 January 2019)

Given such a state of affairs in the LED and Carolina being a Peri-urban area, opportunities for skills development are minimal. One interviewee had this to say on the issue around skills shortage in Carolina: *“Mining companies as a form of CSR should build vocational colleges to help the Carolina youth learn relevant skills critical to the main economic activities”*(Participant 8, 28 September 2018). While another interviewee expressed the following sentiments: *“Most of these youths in Carolina do not want to go to school”* (Interviewee 5, 28 September 2018). One community member interviewed articulated that: *“The mines should invest in establishing a technical college in Carolina where it trains the youth on the most needed critical skills in the mines, this will help alleviate the problem of outsourcing skills”* (Interviewee 6, NPO Secretary 26 September 2018). In support of the issue on vocational colleges a local government representative pointed to the fact that: *“There are no skills development colleges in Carolina the youth have to travel to Ermelo for Further Education and Training (FET) colleges. The only FET in Chief Albert Luthuli is in Glenmore but does not offer critical skills like mining engineering but only offers office job training”* (LED official 2, 22 January 2019). This poses an upper limit to skills development.

This is also worsened by the following; as officials from local government narrated: *“Msobo Coal is one mining company that does skills training locally at a small scale in the new Breyten training centre, while other companies offer at least 3 bursaries yearly”* (LED official 2, 22 January 2019). In addition to this one another local government official said: *“Mining companies bring their own skilled people into Carolina and most of the Carolina active group are employed as unskilled labour force when downsizing comes they are the first to be retrenched”* (LED official 1, 22 January 2019). The LED official expressed that what makes the retrenchment of the unskilled labour dire is: *“There are no employment creation initiatives in Chief Albert Luthuli, but just Poverty Alleviation Programs ”*(LED official 1, 22 January 2019). On the other hand: *“Skills training under Expanded Public Works Program (EPWP) takes 90 youths in bricklaying, plumbing and no critical skills are offered”*(LED Official 2, 22 January 2019). In view of the myriad socio-economic issues emanating from AMD pollution exacerbated by failures of mining companies to keep promises of the Social Labour Plans, questions around SIAs as a policy entry point in mineral development were imperative

4.1.5 SIAs as a possible entry point into public environmental policy

The governing processes eliminate the authoritative traditional process and bring in an interactive dialogue, collaboration and alliance formation (Van Kersbergen and Van Waarden, 2004). This creates an enabling environment for environmental policymaking. SIAs' role has been rather subservient in environmental impact assessments and it is high time existing policies take an active approach to SIAs.

A number of regulators had this to say about the use of SIAs as an entry point to public environmental policy making: *"SIAs guidelines lay down principles but do not say solutions and it is imperative that DMR comes on board"* (Regulator 1, 17 January 2019). While another regulator expressed that: *"Prior to mine development there should be community education programs around natural resource protection and SIAs through a balanced public participation process should ensure this"* (Regulator 3, DWS Official, 17 January 2019). In view of the above responses, some interviewees had this to say: *"The mining sector should come together to enforce something around resource protection"* (Environmental Mining Manager, 22 January 2019).

Existing Literature on the biases in legislation was further confirmed during interviews and questionnaire filling: *"Environmental impacts are biased towards the biophysical environment, public participation is done but the adverse social impact assessments are overlooked with the focus being on job creation"* (Regulator 1, 24 October 2018). In response to this bias, one respondent said: *"SIAs should remain an integral part of ELAs, however the scope needs to be expanded beyond public participation"* (Regulator 1, 24 October 2018). It was also articulated that: *"ELAs should be enacted as a separate assessment tool, but speak to environmental issues that will subsequently impact on community well-being"* (Regulator 2, 24 October 2018). Adding to these observations it was also argued that: *"An in-depth SLA is needed for the long term high impact developments but not lower impact developments"* (Regulator 3, 24 October 2018).

In light of these views, it was therefore imperative to pose the question on the skills required for officials who carry Social Impact Assessments. A regulator said: *"The SIAs practitioners should be well acquainted with the community not just reaching a community through his or her report"* (Regulator 3, 24 October 2018). While another regulator expressed that: *"A holistic training of Impact Assessments specialist is warranted"* (Regulator 4, 24 October 2018).

The other concern raised was the issue of having too many regulations to be followed by the mining companies hence some regulators argued that: *"SLA should remain an integral part of ELAs as when there are too many systems one maybe neglected"* (Regulator 7, 24 October 2018). Another participant

reiterated saying: *“SIAs should remain an integral part of ELAs in order to discourage environmental managers and practitioners from working in silos”* (Regulator 9, 24 October 2018). One respondent negated the above views saying: *“SIAs should be enacted as a separate assessment tool in order for a detailed study to be conducted, nonetheless the natural and social scientists need to be coordinated such that they work together”* (Regulator 5, 24 October 2018)

While another scholar raised an underlying hurdle when dealing with mines and said that: *“Mines act as individual enterprises not on a regional basis, each mine owns its own liabilities and does not have to act with others in a regional strategy unless specifically drawn together e.g. in the Mine Waste Clean Up Bureau (MWCUB), mines will continue to act as individual enterprises”* (Munnik, DWS Report Back Presentation Pretoria, 17 January 2019).

It is also observed and confirmed from existing literature that SIAs has some structural drawbacks that compromise its credibility in so far as it is used as a policy entry point. One respondent articulated this: *“SIAs are usually commissioned by a natural scientist with limited comprehension of the community social setups, this poses an upper limit to the odds of influencing policy decisions”* (Regulator 1, 24 October 2018). A number of gaps thus still exist in policies that need to be revisited through further studies.

It should be noted that the above themes were presented as they appeared in the questionnaires and interview schedules. It was therefore imperative to reorganise them into a logical structure for the purpose of data analysis in the following chapter. The logical reorganisation is tabulated in Table 6 below.

THEMES
1. SIAs and its relationship with Public Participation
2. Social and Economic Impacts of AMD
3. SIAs fuelling the transition to a post mining phase
4. SIA as a mediator between the conflicted interest between mining companies and communities.
5. SIA as a possible policy enabler

Table 6: Showing a logical order of the study themes.

In conclusion, the research questions were fully answered as depicted by the research findings from the data garnered from questionnaires, interviews, public dialogues, community forums, the Mpumalanga provincial and district IDPs and participant observation. Firstly, it was noted that

there is a top-down approach to public participation that eliminates the impacted communities. Public participation is also rubber-stamped by municipalities. There is also a need to educate communities around resource protection and legislation if public participation in SIAs is to be effective. The odds of a post-viable mining economy is a possibility, however, there are a number of limitations that need to be considered ranging from; public perceptions around new biotechnology, food security issues and skills development. A litany of socio-economic impacts emanating from AMD both, directly and indirectly, were identified. SIAs can be used in the assessment and addressing of these myriad socio-economic impacts of AMD on mining communities. Last but not least existing policies still need to be sharpened to take into account socio-economic impacts and SIAs should not only provide guidelines but solutions to socio-economic and environmental issues. The data presented herein the chapter will be used to inform the preceding chapter that analyses and discusses the findings of the study

CHAPTER FIVE

ANALYSIS AND DISCUSSIONS

5.1 Introduction

The chapter analyses and discusses the empirical findings of the study narrated in chapter four. These findings were obtained from data garnered from participant observations, questionnaires, community forums, interviews, and public dialogues. Mpumalanga Provincial Treasury (MPT) - Socio Economic Review Outlook (SERO) 2015, Gert Sibande District Municipality 2018-2019 IDP, Chief Albert Luthuli Local Municipality IDP 2017, Stats SA Community Survey 2016 and Stats SA 2011, were also used. Data was interpreted and inferences made in the context of the themes as tabulated in **Table 6** shown in chapter 4. SIAs and its relationship with public participation were at the genesis of the discussion and analysis. Discussion and analysis of the AMD imposed socio-economic impacts on mining communities was also done. Then followed by, analysing the role of SIAs in fuelling a transition to a post-mining economy. Thereafter, the ability of SIAs to play a mediating role on the conflicting interests between communities and mining companies was discussed. The chapter then concluded with a discussion on SIA as a policy enabler.

5.2 SIA and its relationship with public participation

From the findings in chapter four the link between SIAs and public participation on issues around mineral development and the well-being of post-mining communities was unpacked. Public participation seems to exhibit a gender bias as the survey of participants done during fieldwork depicts more male participants of around 67% relative to women at 33% as shown in **Figure 14**. This may be linked to a patriarchal attitude towards issues on mineral development in the impacted community. This is further alluded to during the interview with the WAMUA activist who argued that women are seldom invited to attend public forums and they play a lesser role in decision making relative to men. She also emphasised that men's voices are audible but have a carefree attitude towards socio-economic and environmental sustainability. Such a state of affairs can perhaps be largely linked to the subservient role that culture puts women in, even if they are more knowledgeable about what is happening in the environment they shy away from talking about it. Moreover, the rural background is also a major contributing factor where

women are to be seen and not heard in African rural conservative cultures. While the man on the other hand, are more vociferous and open to interviews or public dialogues on issues around mineral development. This defeats the ideals of public participation echoed in participatory development By Gran (1983, p.32) as: “a self-sustaining process to engage free men and women in activities that meet their basic needs and beyond that, realise individually defined human potential within socially defined limits”.

It should, however, be noted that this particular landscape of gender bias is slowly but surely undergoing a transformation. Women Affected by Mining United in Action (WAMUA) and women taking leading roles in mineral development and environmental activism are evidence of change. The likes of the Nonhle Mbuthumas spearheading women participation and activism alongside man in the Titanium mining saga in the Amadiba crisis in Xolobeni Eastern Cape provide a case in point.

An obvious finding to emerge from the study is that depicted in **Figure 15** on race demographics, with blacks constituting 79% out of the total participants, whites consisting 17%, coloureds or multiracial 4% and no people of Indians descent took part. This perhaps is a reflection of interests in mineral development in Mpumalanga as a whole. While it also shows that the black impoverished majority constitutes the most affected people. This finding matches the conclusions from the report by Bobbin and Tragos (2018) that claims residents within mining concession areas or derelict and defunct mine sites are usually poor and constitute black communities.

Making more inferences from the findings that were brought to light in chapter four, public participation seems to be only rubber-stamped by municipalities. One court official during an interview acknowledged this arguing that municipalities send public invites to the magistrate court written in legal language for public input on mineral development and after sixty days they lapse if no objection is made mineral development continues (Interviewee 8, 14 November 2018). This is however, in accordance with Regulation 3 of the MPRDA Regulations GNR527 that states that: “interested and affected persons should be consulted during the mining permit application process. It further states that a notice should be published through the magistrate’s court, an applicable provincial gazette, and a local or national newspaper” (South Africa, 2004).

Nonetheless, the issuing of a public invite shows a formal requirement and an action above board on the part of the municipality. However, there were reservations during interviews with one community mining activists from Carolina arguing that sending the memorandum is just a

formality on the part of the municipality disguised as public consultation (Community Mining Activist 1, 28 September 2018). This is echoed by Kirkpatrick (2002) who expresses that public participation assumes a “green wash” bureaucratic exercise. This resonates with Theron *et al.*, (2007) who express that, public engagement is not a guarantee that their contributions will inform decision making by these mining companies. I therefore argue that this makes public participation a *pseudo* and autocratic masked approach characterised by a top down process.

Another finding regarding public participation is that communities are ignorant in so far as mineral development is concerned. One participant was of the view that even if the communities are involved in public participation they do not have relevant knowledge and critical skills around mineral development (interviewee 13, 13 November 2018). However, the integrated approach to SIAs will conscientise and empower communities that they are not *tabula rasa* but can make valuable contributions from their traditional experiences having lived and interacted with natural ecosystems in the area for years. I argue that this can form a useful foundation and springboard to build on scientific knowledge from. This draws from literature gleaned from Postma *et al.*, (2017) where they emphasize the forging of science communication and indigenous knowledge. It is further mirrored by Vanclay (2003a) in one of his seminal articles where he says the participatory approach to SIAs using public participation increases stakeholders’ comprehension of the nitty gritty of social change and how to navigate this particular space.

Inferring from the study by Tester and Mykes (1981) involving communities in public participation it provides awareness on the merits and demerits of developmental projects. Moreover, it is imperative to engage a neutral party with no vested interest in the project to honestly assess its likely impacts. Burge and Vanclay (1996) argue that the above moves are necessary for averting major planning disasters and related costs and conscientise communities on the pros and cons of supporting a particular project. It also helps avoid such cases emanating from lack of awareness, as cited in the scholarly review in chapter two, in an online publication. The “Tunatazama—a Network of Southern African Communities Living near Mines, reported how knowledge deficit led a community in an unplanned setting in EMalahleni, Mpumalanga, to neglect their livestock and their children drink and play in acidic water (Moraba 2015).

The above mentioned EMalahleni scenario depicts an element of environmental injustice, which Munnik (2012, p.4) argues that; “it exhibits a three-fold process that of exclusion from decision-making, enclosure of resources, and the imposition of externalities”. Drawing from the Hallows and Munnik (2016) study, environmental injustice in the Mpumalanga coalfields was exhibited through the failure to involve local communities on issues impacting on their socio-economic

well-being. This has seen the dissatisfaction manifesting through '*reactive public participation*' done through protests as highlighted in the findings on the 2012 AMD Protest in Carolina. Nonetheless, there is a limited success of '*reactive public participation*' through protests, as it is usually detrimental to other economic, infrastructural and viability of some sectors. This worsens the socio-economic situation as funds meant to help alleviate the AMD imposed socio-economic impacts are channelled to repairs, following damage to existing property during such volatile '*reactive public participation*' efforts. In some cases, the protest leaders are somehow silenced through job offers (Pers comm, 14 November 2018) and the impetus of wanting to see a resolve in mine water pollution dies down.

Moreover, it is said that the local government together with mining companies after such '*reactive public participation*' is done, they make promises to solve the problems. Following the 2012 AMD protest in Carolina, the high court ruled that each family member should get 20 litres of water each day from the municipality and this was not adhered to as households were getting less water than expected (Community Activist 1, 28 September 2018). On the other hand, interviewees expressed that no mining company took responsibility for the pollution, and the municipality did not enforce any systems on how rehabilitation could be done. However, it is believed that money to compensate this damage was clandestinely given to the municipality and diverted to other uses (Pers. comm, 14 November 2018). This speaks to the inclination to corruption office bearers in local government have when it comes to financial management thereby adding to the plight of these already impacted communities.

Another angle to environmental injustice is also highlighted in chapter four where a participant expressed that public participation or consultation is only done in earnest during project proposals in order to obtain a mining license, thereafter communities are excluded (Mining Environmental Manager, 22 January 2019). Furthermore, community forums that partake in the public consultation process is a defined group from the community and their main concerns are on job opportunities (Interviewee, 5 28 September 2018). This leads to partial coverage of issues on hand as the representing group may not be aware of all the community needs. Burge and Robertson (1990) allude to this finding in their study where they found that community forums have the weakness of maintaining existing community authority.

To reiterate on the finding on ignorance, it was observed during interviews that the majority of the participants from the community did not even know what AMD is, except the regulators and a few learned individuals from the community. This poses an upper limit to public participation as it becomes difficult for communities to fight for a cause which they have scanty knowledge

on. A view that Sumi and Thomsen (2001) concurs with, expressing that for local communities to respond effectively to mineral development they need to be well informed on the issues imposed by mining activities to be able to navigate the problem space on hand. It should however, be noted that most of the participants were aware that AMD pollution is the cause of the water problems although they described it as dust from the mine. Del Furia and Wallace-Jones (2000) in their study hence advocate for communities to have adequate and relevant information on resource protection for them to effectively influence the impact assessment reports and decision-making thereof. Mirroring this view is Lockie *et al.*, (2008) who argue that positive change may be overlooked and negative change underestimated if the public cannot informatively influence decisions due to ignorance.

In summary, it should be noted that even if an attempt to make equal and full representation from community members in terms of gender, race and the different members of the affected community groups, public participation on its own cannot equate to a formal and professional led SIAs process. SIAs are able to redress these weaknesses in public participation through information dissemination using qualified Social Scientists who have a hands-on approach and understand social change through their interactions with impacted communities.

5.3. Social and Economic Impacts of AMD

This section unpacks the findings on the socio-economic baseline of Carolina in the backdrop of socio-economic impacts imposed by AMD pollution. The population, race, employment, health and education demographics were examined. The following inferences from the socio-economic baseline were thus made:

The population depicted a young population with a high number of the economically active group. This denoted the need for intensified employment opportunities and skills development colleges in Carolina. Findings on the potential of these youths showed that population with no schooling was estimated at 26.3% in 2001, improved to 13.4% in 2011 and further improved to 10.7% in 2014. This shows some strides that the district has made in educational circles. The population 20⁺ with a post matric qualification was 5.5% in 2001 increased to 9.4% in 2011 and 9.6% in 2014, while functional literacy was 59.3% in 2001, 76.5% in 2011 and 79.5% in 2014 (Gert Sibande IDP, 2018-2019).

Given the above-mentioned findings, there is a cause of concern when looking at the employment structures in the local district municipality, depicting a high number of unskilled

labourers being made redundant from 1995 to 2015 period in **Figure 20**. It also shows an increase in the demand for skilled labour force towards 2015, reflecting a dire situation of unemployment given the limited skilled labour in the Carolina populace. This is made worse by the fact that LED is an unfunded mandate in South Africa, making it difficult to invest in vocational colleges as alluded to in the preceding section. This has resulted in a serious shortage of skilled manpower. The above mentioned state of affairs is substantiated by the unemployment rates in Chief Albert Luthuli that was estimated at 32.7% with the unemployment rate of the active group estimated at 45% according to the figures provided by 2016 Community Survey Stats SA (as cited in the Gert Sibande IDP 2018-2019).

With regards to the poverty rates, findings from the secondary data used show the poverty rate of Chief Albert Luthuli at 51% compared to the Provincial rate of 43.1%. According to the 2016 Community Survey of Stat SA (as cited in the Gert Sibande IDP 2018-2019), the poverty headcount (multi-dimensionally) of Gert Sibande improved by 1.2% from 2011 to 2016. The poverty intensity however, deteriorated by 2.5% in the same period compared to Chief Albert Luthuli (Carolina) the poverty headcount decreased from 2011 by 4.2% in 2016.

The poverty intensity in the District Gert Sibande still depicts an impoverished community that is living below the poverty datum line. This explains why the district municipality is still concentrating on Poverty Alleviation Programs instead of Employment Creation Programs as narrated by the LED official of Chief Albert Luthuli during an interview. However, unemployment being argued to be the main driver of poverty, I argue that the shift to poverty alleviation programs instead of employment creation offers a temporary solution to the real problem.

Findings on the health indicators showed water-related ailments ranging from skin rashes to diarrhoeal infections. Diarrhoeal and skin infections seem to affect children in the 0-14 age group as shown in **Table 4**. This perhaps is linked to their still-developing immune systems. Women interviewees brought a different aspect of water-related ailments, that of genital infections. The anecdotal increase in genital infections among women coming in contact with AMD can perhaps be linked to the pH balance of the vagina being disturbed by the low pH levels in the polluted water. No formal statistics were available from the hospitals on AMD linked genital infections. In some cases, the genital infections created conflicts between partners who suspected infidelity resulting in broken relationships.

In light of the above mentioned infections, some women lose the sole breadwinner and they are thrown into abject poverty. The high rates of poverty and unemployment are often linked with the high rates of HIV infections among young women. A major problem with these findings on health ailments is authenticating these claims. Martinez-Alier *et al.*, (2014) maintains that the absence of official health statistics on some health issues makes it difficult for the problems to be brought to the fore and dealt with. To reiterate the issue around health, responses to questions around the awareness of the magnitude of people being affected by AMD could not be ascertained. Respondents accused the department of health of withholding such statistics to activists as it disempowered them to fight against the known impacts of AMD on people's health in Carolina (Activist 1, 28 September 2018). As a result, this puts a compromise on making the health risks of AMD a consideration in environmental/public policy spheres.

One important finding was on the economic impact of these health problems which result in the loss of productivity at work when workers fall ill. For example, when there is diarrhoeal outbreak the work schedules for teachers are affected and pressure is also exerted on the nursing staff and medicine availability (School teacher and Health worker, 27 September 2018). Once the productive time is lost it can never be regained and it compromises viability and performance of the affected sectors. As a consequence, these impacted communities plunge deep into poverty as their standard of living is compromised.

Participants were also asked questions about the effects of AMD on their daily activities. Some of the participants complained about tap water that makes them sick and turns white clothes to a khaki colour. Most of them expressed that they either boiled the water or buy bottled water for drinking. I therefore, argue that boiling of water that is contaminated by AMD and not microbes reflects ignorance on the part of the communities and indicates an imperative for environmental education in Carolina. The above findings are echoed in the study by Blakeney and Marshall (2009) who identified several socio-economic impacts emanating from occupational injustices namely; the grimy appearance of clothes, the imperative to use infiltration methods for drinking water as well as buying bottled water.

Apart from the tap water, some concerns were raised on the safety of the borehole water which is never tested as testing comes at a cost which the community is reluctant to carry according to an official from the Gert Sibande District municipality (GSDM) (Pers. comm, 14 November 2018). Some participants raised a concern on the kind of effects the water will have on them in the not so distant future, especially to small children who are still growing (Interviewee 8, 14 November 2018). A concern that The Federation for a Sustainable Environment (2017) alludes

to saying that, sustained exposure to AMD-polluted drinking water may lead to increased rates of abnormal skin conditions, cancer, and mental retardation. Morris *et al.*, (2012) observed a weakness in identifying these ailments articulating that it is biased on physical manifestation at the expense of possible emotional ill health.

The above scenario speaks to a poorly serviced and mismanaged local government in the province. The non-existence of qualified personnel to deal with environmental issues is a major contributor to these problems apart from AMD. This is substantiated in the GDMS (2018-2019) which points to insufficient capacity in Local Municipalities to perform environmental management functions, aging infrastructure, limited resources for environmental functions and limited environmental management tools in municipalities.

From the fieldwork findings, local community members interviewed maintain that the SLPs never contribute much to community development. With some interviewees pointing to poor roads and stagnant development in Carolina, let alone poor service delivery especially of safe drinking water. Taking all these issues into consideration, the findings of the study depict a discord between the imagined realities of a better life among communities that remain a mirage and the SLP promises by mining companies prior to the granting of a mining permit.

Other findings on the AMD imposed socio-economic impacts are related to poor rural planning in Carolina evidenced by the coal siding which was put along-side residential and shopping centre in Carolina. When it rains the coal dust is washed into streams that pass through paddocks and residential areas joining the main water source contaminating it with sulphates (Interviewee 13, 28 November 2018). Such poor rural planning depicts remnants of the apartheid legacy in so far as space, value, class and race are concerned. The areas where blacks resided were always on the pollution receiving side expressing the social construct of space in line with existing class, race and power struggles (Lefebvre, 1991).

Another socio-economic concern brought to the fore was food security as agricultural viability became compromised given the high AMD pollution. With one farmer expressing that farmers do not know the exact short and long term impacts of AMD pollution (Carolina farmer, 14 February 2019). The loss of viability in their food crops is depicted in **Figure 25(i) and (ii)** shown in chapter four. This substantiates studies by Munnik (2010) who talks about agriculture and mining having an antagonistic relationship. Meaning that agriculture and mining cannot mutually coexist. I however, argue that the introduction of new forms of farming such as metro-farming that involves vertical farming off the impacted soil or ground can become viable options

and allow for mutual existence of post-mining landscapes and food crop production. A case in point is the South African entrepreneur Samkeliswe Chunda's cheaper infrastructure consisting of a vertical stand where one can plant as many rows of plants as possible off the ground which she named "*Metro Farming*" (SAnews on the sidelines of the 2018 Science Forum).

Findings on issues of compensation have been discussed briefly in the section above. In most cases, unfair compensation is linked to ignorance. For example in the black communities ignorance is linked to low literacy levels associated with little knowledge on mining legislation, land claims, and their constitutional rights. The only part of the community with extensive knowledge around legislation came from the community mining activists during fieldwork. These activists however, do not have enough resources and political muscle to fight these mining giants who are politically empowered. These findings concur with the study by Swanepoel and De Beer (2011) who argue that the poor suffer from information deficit and their ability to influence issues and policies affecting their well-being are compromised. While also confirming Krause and Snyman (2014) who observe that communities affected by mining are poor, cannot easily access justice and their socio-economic rights are violated.

Elsewhere to substantiate and make a comparative analysis in passing to the Carolina scenario is the Zambian experience on the unfairness in compensation. This, however, brings another side of the coin to the argument around compensation where compensation tends to be standardised. For example, a family previously occupying a six-roomed house is compensated the same amount with a person with a two-roomed house (Roving advisor Action Aid, 20 November 2018). This point to that compensation in mining is imbued with a lot of unfair practices. In some cases, people are not affected by mining activities directly but by the compensation thereof that takes them from a better position to a worse off position in life.

Findings as narrated in chapter four points to the cultural impacts and displacements linked to mining developments. Some families are said to have had their grave sites removed such that it has been difficult to keep spiritual ties with their ancestors (Dual interview, 27 September 2018). From field observations, some economic activities that are not water thirsty have encroached onto a gravesite as shown in **Figure 24**. All this puts an upper limit to traditional and cultural practices as grave sites in African traditional dogma are considered to be sacred sites. These are impacts that are impossible to compensate and cannot be reversed or equated to any amount of monetary compensation.

While the black impoverished communities seem to be the worst affected white farmers are also affected. **Figure 28 to Figure 30** shows the disastrous consequences of poor rehabilitation by a mine that has affected a white farmer's arable land. According to the soil chemical analysis report from the Agri Environmental Lab tests done, it depicts pH levels ranging from 3.9-4.4 in the six samples taken in the arable land of the particular farmer (Oral telephonic communication and WhatsApp image of a lab report 14 February 2019). These confirm the findings by Tiwary *et al.*, (2001) who identified a myriad of AMD characteristics, ranging from very low pH values, high sulphate concentration and high metal loading. The farmer claims that the concerned mining company is doing very little to mitigate the situation, while the mining company argues that it is historic pollution that they cannot be held accountable for. This also speaks to the issue of who is liable given the changes in mine ownership and therefore warrants further debate and studies within the Environmental management scholarly, policymakers and mining coordinating bodies.

In conclusion, this point to the central role SIAs can play in assessing and addressing the challenges mining activities impose on mining communities, through information dissemination. Moreover, SIA can facilitate collaboration between impacted stakeholders, advocating for active citizenship, environmental protection awareness and knowledge sharing.

5.4 SIAs fuelling the transition into a post-mining economy

At the core of sustainable development is the perpetual necessity to meet the present and future generation's needs. This is also imperative to mining economies and communities. SIAs henceforth, play a pivotal role in the transitioning of mining communities to a post-mining phase in a sustainable fashion.

A number of findings around this issue were narrated in chapter four. Most of the community members had concerns with the level of AMD contamination in most of their water resources, such that they were mostly advocating for investing in less water-thirsty economic activities post-mining like; bricklaying, recycling, and harvesting of the black wattle (Participants 8,11 &13, 28 September 2018). On the issue of possible post-mining activities, as in the case of wattle growing or harvesting as an alternative economic activity, one interviewee pointed to that before any

wattle growing is done as a rehabilitation effort and post-mining economic activity, a permit has to be obtained from DMR (Mining Official, 22 January 2019). This shows that not all possible post-mining economic activities are easily accessible, considering the red tape involved in engaging in such economic activities.

While one participant expressed that there should be compensation funds to be set aside and used for post-mining investments (Regulator 5, 24 October 2018). A concern however, rose with one mining official articulating that the paradox is that the Department of Mineral Resources (DMR) sits with funds for mines for the after closure, in some cases reimburses a portion of those funds and expects mines to invest in post-mining communities (Environmental Mining Official, 22 January 2019). This, therefore, may mean funds to invest in post-mining communities are not available, given the trust deficit between mines and the DMR, which explains why we have ghost mining towns in most of our former mining areas.

One of the fundamental findings was on the community `s perceptions and attitudes on the use of biotechnology to aid this transition to a post-mining economy. **Figure 16** depicts the findings from the survey with 93% of the participants being for the use of biotechnology to aid the transition to a post-mining phase, while the 7% represented those who had their misgivings around these technologies, claiming that they are aimed at siphoning Africa dry of its natural and financial resources. This argument holds water considering that it seems to be a closed system. This is best described in **Figure 32** overleaf which is largely informed by the findings from the field.

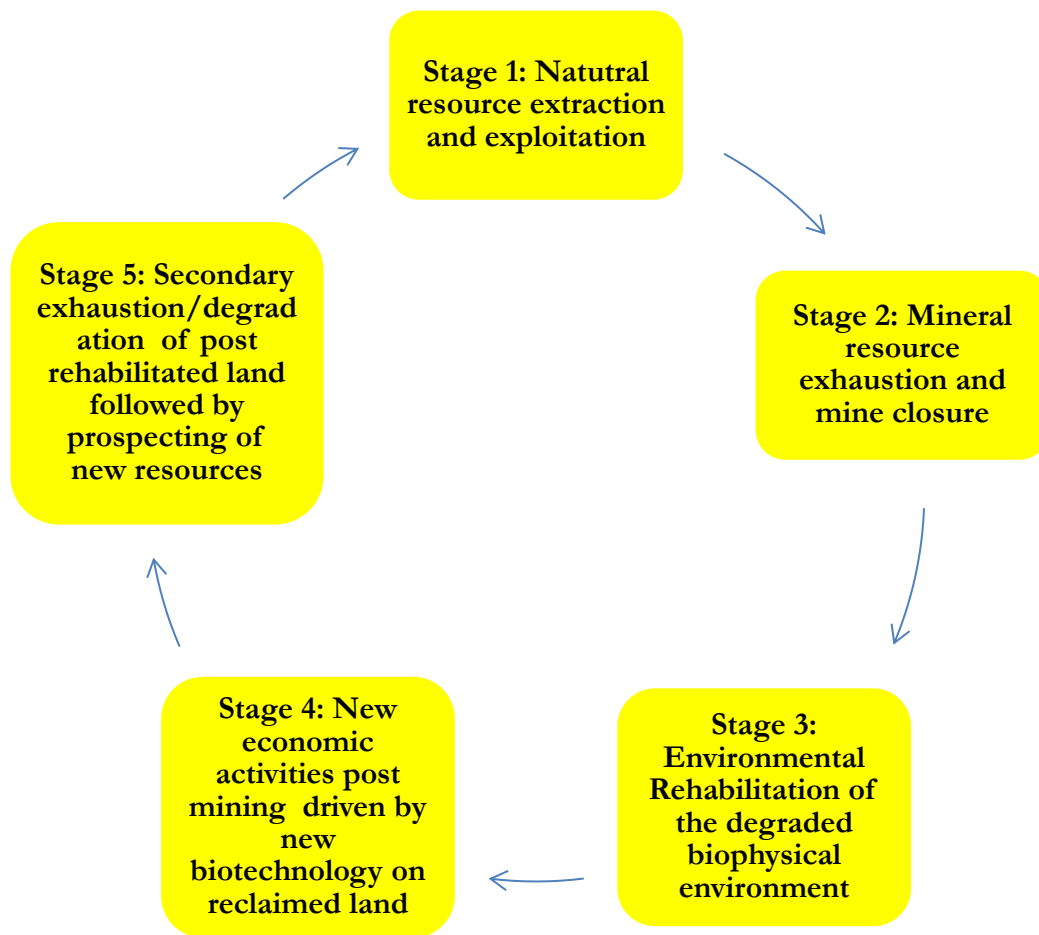


Figure 32: Showing the Mineral Resource Exploitation Cycle as perceived by some individuals of impacted mining communities

Source: (Based on Fieldwork Notes, 2019)

The Mineral Resource Exploitation Cycle involves the extraction and exploitation of natural resources, as they get to exhaustion mine closure occurs and environment degradation becomes more pronounced. Once that happens new biotechnologies in the name of reclamation are brought to the degraded sites, which in turn impose their peculiar impacts on the already fragile landscapes and in the long term *secondary degradation/exhaustion* of the landscape occurs. Prospecting of new resources occurs followed by their extraction and exploitation as substantiated by the findings in chapter four.

In view of this Mineral Resource Exploitation Cycle, one interviewee mirrored the above observations expressing that once the viability of the soil is compromised it becomes difficult to rehabilitate it again. The new biotechnologies may in turn, bring impacts of their own on the environment that may not resonate well with existing traditional activities, which translates to socio-economic problems (Interviewee 13, 13 November 2018). I therefore, argue that the ideal

should be natural resource exploitation while there is concurrent rehabilitation. This will see minimal environmental degradation and allow for rehabilitation that can open way for new and sustainable land uses thereby providing an ideal walk away plan for mines after closure, moreover leaving viable post-mining communities. SIAs through information dissemination which forges local knowledge and science communication may afford the transition into a sustainable post-mining community.

One obvious finding was the intensification of agriculture post-mining in Carolina, as an agricultural area. Some interviewees expressed that through the new biotechnologies it is possible to go back to farming which has and will continue being the mainstay of their livelihoods (Interviewees 8, and 13 14 November, 2018). One participant advocated for squeezing in agriculture processing setups where the land is still not fully rehabilitated (Topi 14 November 2018). Instead of growing food crops agricultural crops like sunflowers and maize were identified for use in the petrochemical industry (Community forum report back, 21 January 2019). One biotechnology expert expressed that rehabilitated opencast sites could be improved by planting rehabilitation crops like sweet sorghum or soybeans that may improve soil fertility on rehabilitated opencast sites. In turn, these crops can be used as feedstock for a biofuel or green chemistry industry (Biotechnologist, 22 January 2019). This however, has the drawback of that it compromises on food security as these crops are not meant for human consumption. The findings seem to acknowledge that there is an upper limit which AMD pollution puts on the productivity of the land.

They also point to other resources such as; titanium, manganese, and gold to name a few minerals that they can invest in apart from coal mining (Topi, 14 November 2018). Timber logging that is currently in operation was also identified as a potential post-mining activity that can be intensified (Interviewee 9 and 14, 13 November 2018). One biotechnologist identified the recreational use of certain mining sites which may add to tourism allure. From the above findings there seem to be possible alternative post-mining activities which communities can engage in, that may be viable in the post-mining degraded landscapes.

A number of possible employment opportunities were also identified namely; water and soil resource management jobs, farming related work, logistics, and transport jobs. Engineering jobs in the short term to build necessary infrastructure e.g. bio-refinery, maintenance work by technically skilled people, general finance and business management were also identified (Biotechnologist, 21 February 2019). This is mirrored in Kitula (2006, p.409) a study which echoes the view that: “Community perceives in order of importance; employment, improved

infrastructure, the selling of food crops and other businesses as the main benefits from mining activities in their community”. The only drawback with an area like Carolina is that the identified jobs are skills intensive and may see the importing of labour from other regions in the country or internationally at the expense of Carolina youths. This confirms Muntingh (2011) who observes that a notable drawback of new technologies post-mining in poor countries is that knowledge and experience are provided and controlled by transnational companies, limiting indigenous skills development. This exacerbates the socio-economic plight of these impacted communities especially in terms of employment prospects.

In conclusion, biotechnologies may also bring in new threats and risks to communities putting an upper limit to a smooth post mining transition. Moreover, food security continues being compromised considering that the crops grown are not food crops. While in positive light biotechnologies provide a form of employment, prevents the post-mining landscape from being a wasteland, add to its aesthetic value and provides a form of some sustainability post-mining. SIAs with its participatory approach can add to this potential by forging in science and indigenous knowledge communication, which can bridge the gap and afford a smooth transition to a post mining phase without any conflict of interest between community needs and the mining companies.

5.5 Conflicting interests between mining communities and mining companies

Mining developments are imbued with a lot of conflicts, emanating from their failure to keep up with their promises to communities. From the findings in chapter four, a myriad of possible conflict triggers between mining communities and mining companies were narrated.

One finding pointed to issues around a once off public participation to facilitate the getting of the Social license as another conflict trigger (IUCMA/Community Focus Group 28 September 2018). This perhaps denotes a parasitic relationship that mining companies have with communities. Once they obtain their Social license they never keep to the demands of the Social Labour Plans (SLPs). This is confirmed by Forrest and Loate (2017) who are of the view that EIAs are driven by economic and political imperatives, such that the need to hasten to license overshadows social and environmental concerns. Nonetheless, Joyce and Macfarlane (2001) are of the view that SIAs can provide a set of spectacles to see through this, but it is however seen as a procedure and a study carried out for environmental permitting purposes.

This therefore, speaks to the need to empower SIAs through legislation or policy and make it become a binding activity that goes beyond environmental permitting based on the reports produced. Responding to the above claims on SLPs, one mining official argued that the core business of mines is to mine, not that of providing basic service delivery that lies within the jurisdiction of municipalities (Mining Environmental Manager, 22 January 2019). I therefore argue that it reflects a parasitic agenda mining companies have, once they get their Social license to mine, they forget about the promises they made to the communities, instead they impact negatively on their well-being. In actual fact, according to CALS (2016), the SLPs are binding documents mines have to adhere to after getting mining rights.

The existing trust deficit between mining communities and the mines gives an impetus for communities to shift all the blame to the mines even if the failures are caused by the local and national government. This causes a lot of upheaval in the mining communities which Joyce and Macfarlane (2001) argue that they have the potential to repel other investments in development and community wellbeing. To address these socio-economic conflicts, Joyce and Macfarlane (2001) argue that SIAs can help identify these underlying problems and put in place pro-active programs to reduce their vulnerability, for example, a mine helping in solving land claims.

Closely linked to land claims were findings on the question around compensation where a number of issues were raised. Firstly one interviewee pointed to the disparities in compensation between white farmers and black farmers and labourers. White farmers are compensated very well and then they migrate to areas like Western Cape which offers a positive place utility in farming. The black labourers and farming neighbours are not or inadequately compensated causing conflicts (Interviewee 13, 13 November 2018). These are discussed in depth in the next chapter on assessing and addressing the socio economic impacts of mining on communities.

Another common conflict trigger was around the importing of skills from other places to work in Carolina. It is observed that mining companies bring their own skilled labour into the mines in Carolina and the only employment opportunities offered to locals is semi-skilled and unskilled jobs (LED official 1, 22 January 2019). These unskilled labourers are also the first casualties during retrenchments. This speaks to why communities always fight with mining companies when it comes to keeping their promise of employment creation. Which in actual fact needs to be addressed through SIAs, where skills or education profiles of a particular community are identified and assessed against the needs of the mine's labour demands. This will help inform the kind of skills present and therefore mines can be taken to task to establish vocational colleges to

cater to their labour needs as part of SLPs. In Carolina where the highest concentration of mines is, there is only one vocational training college (LED officers 1&2 22 January 2019).

These findings are further mirrored in the responses obtained from a number of regulators in the questionnaires they filled. One regulator expressed that it is necessary to have an in-depth social impacts assessments, during EIAs so that any socio-economic impacts emanating from mine development are fully addressed to the satisfaction of impacted communities (Regulator 10, 24 October 2018). This is also reiterated in one questionnaire where it is expressed that there is a need for SIAs specialist to be well acquainted with the needs of the community and the local conditions not just reaching it in a report (DWS official, 24 October 2018).

Topi in his experience as a mining community activist brought in the aspect of corruption during an interview. He argued that Mining companies have made efforts to deal with AMD pollution but the money is diverted to other things by local government, causing a lot of dissatisfaction among communities. Topi also raised the issue of ploughing back to communities as one source of conflicting interest between mines and communities. The paradox is the fact that coal is mined in Carolina but the Carolina resident has to buy it packaged from Johannesburg at a price equal to the price a Johannesburg resident pays for it (Topi, 14 November 2018).

Findings from a comparative analysis from Solwezi Zambia expresses that when communities spoke out against mine water pollution, the mining companies reacted and cancelled all CSR programs they had with communities (Roving Advisor, 20 November 2018). This is also further mirrored in the Zimbabwean situation where the mining companies left AMD contaminated open pits in Marange which have become death traps to the locals much to the dissatisfaction of communities (CCPJ Mining activist, 19 November 2018). This confirms the observation made above on mining companies having a parasitic relationship with communities. Mining companies need to always gain, at the expense of communities, once the community voices it triggers conflict. Joyce and Macfarlane (2001) express that there was serious discourse in Peru over the credibility of SIA and EIA because of such competing interest issues.

SIAs can therefore, come in an effort to assess and address these conflict of interest by bringing indigenous knowledge and science communication together through integrated SIAs with effective public participation. A view supported by (Glass, 1979; Cavric, 2011) who express that, public participation promotes collaboration between all the proposed development's stakeholders which promotes mutual understanding subsequently reducing conflicts. It is noted from existing literature that when the public is involved they get to make the preferred decisions

around the development and this reduces conflict as was the case in the Bauxite mine Alcoa mentioned in chapter two (Burton *et al.*, 2012). On the contrary Connor *et al.*, (2009) further argues that the ability of the coal mining industry to monopolise knowledge base and access to resources over local communities gives it greater political muscle. The emphasis of SIAs on the need to collaborate using a multi-stakeholder approach engaging neutral parties will reduce the power disparities between the mining companies and the community. Moreover: “the technical model of SIA focuses on economic well-being as measured by income and employment, the political model emphasizes social well-being, self-determination, and the pivotal role of cultural values and social institutions” (Usher 1993, 112). SIAs also advocates for a qualified Social Scientist who is in touch with communities and can help explain the social change, guide how the change can be managed and controlled much to the satisfaction of communities.

In summary the conflict in mineral development can be described as resembling a cold war fought using resource extraction, exploitation, and political power by rich mining companies against the impacted and impoverished communities within mining concession areas. SIAs then come in to mediate on these conflict triggers advocating for affected stakeholder collaboration, indigenous knowledge, and science communication and providing environmental/public policy entry points

5.6 SIAs as a policy enablers

From the findings in the study, it was deemed necessary that a collaborative platform should be set up that is all-inclusive and may give SIAs reports an inlet into environmental policy. Issues around community education programs on natural resource protection, prior to mine development were raised as imperatives to an integrated SIAs approach. The argument was that SIAs have the potential to promote environmental awareness and ensure a balanced public participation process that can help inform policy (Regulator 3, DWS official, 17 January 2019).

The existing literature on EIAs was further confirmed that it has a bias towards the biophysical environment and public participation is done but the adverse social and economic impacts are overlooked with the focus being on job creation” (Regulator 1, 17 January 2018). To remedy this some findings advocated that EIAs should be enacted as a separate assessment tool, but speak to socio-economic environmental issues that will subsequently impact on community well-being (Regulator 2, 24 October 2018). In the same vein, one finding pointed to that an in-depth SIA is needed for the long term high impact developments but not lower impact developments

(Regulator 3, 24 October 2018).). Alluding to this, one respondent supported the idea of SIAs being a separate assessment in order for a detailed study to be conducted, nonetheless, the natural and social scientists need to be coordinated such that they work together”(Regulator 5, 24 October 2018)

On the contrary other findings were on the issue of having too many regulations to be followed by the mining companies hence expressed that SIAs should remain an integral part of EIAs as when there are too many systems one may be overlooked (Regulator 7, 24 October 2018). In the same spirit, another participant reiterated saying, SIAs should remain an integral part of EIAs to prevent environmental managers and practitioners from working in silos (Regulator 9, 24 October 2018)

Imbued in all these findings is the increasing recognition of the importance of SIAs in policy considering that human beings are at the centre of Sustainable Development, Sustainable Science, Social Development and Community Development. The Minerals Council of South Africa (MCSA) (n.d) mirrors these ideals pointing to up-skilling of local communities, job retention and legislative long term investment initiatives as sustainability policy enablers. The United Nations General Assembly (1987) expresses the closely knit relationship between SIAs and sustainable development that provides a platform for the collaboration of environmental policies and development strategies.

The United States Council on Environmental Quality (USCEQ) (1986) expresses that there has been recognition of the importance of SIAs in policy pertaining to environmental modification that ensures a holistic approach to the three components of the environment. In chapter four another aspect is raised on the structural drawback that compromises SIAs`s credibility in so far as a policy entry point is concerned. This was narrated by some participants during a regulator`s forum. The first observation is that SIAs are usually commissioned by a natural scientist with limited comprehension of the community social setups, hence imposing an upper limit to the odds of influencing policy decisions (Regulator 1, 24 October 2018). On the contrary, Lockie *et al.*, (2008) point to a positive shift in SIAs where social impacts are considered of utmost importance and Social scientists are part of the impact assessment teams. Another responded expressed that a holistic training of Impact Assessments specialist is warranted (Regulator 4, 24 October 2018). I argue that, this perhaps is an ideal move that may prevent policy capture by authorities who use the less informed natural scientist in writing these reports. Nonetheless, a number of gaps still exist in policy that needs to be revisited through further studies.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The chapter consists of the conclusion, recommendations and suggested areas for future studies. These are focused on bringing to the limelight key issues that have been identified in this thesis and the recommendations thereof. In view of this, the chapter exhibits a four-fold section. **Section 6.1** is an introduction. **Section 6.2** provides a précis of the key conclusions. **Section 6.3** presents the recommendations and the final **Section 6.4** presents suggested areas for future research.

6.2 Key Conclusions of the Study

This study sought to explore the role of Social Impact Assessments in assessing and addressing AMD related socio-economic impacts in post-mining communities. A study of the Carolina quaternary catchment area X11B Mpumalanga in South Africa was done. The most significant finding within this study is the gap in EIAs that needs to recognise the growing importance of socio-economic issues alongside the biophysical challenges posed by mineral development. This recognises the importance of SIAs in policy which comes packaged with considering that human beings are at the centre of Sustainable Development, Sustainable Science, Social Development and Community Development.

The introduction of biotechnologies represents an element of Sustainable Science that facilitates the transition to post-mining economic activities and hence Sustainable Development. SIAs can thus conscientise communities on some of the risks and threats involved in using these biotechnologies so that communities make informed decisions and avoid conflicts. Moreover, it was noted that there is confinement of socio-economic impacts to jobs only in mineral development tending to overlook issues around health, food security and other occupations that are impacted.

While public participation is deemed a fundamental appurtenance in mineral development, on its own it cannot equate to a formal and professional led SIAs process. SIAs experts come in as

capacity builders for the affected stakeholders given the little knowledge communities have around mineral development. Although only a portion of the community made up of community activist is well informed they do not have enough resources, education and the political muscle to fight these mining giants who are more knowledgeable and political empowered.

SIAs are also argued to play a mediation role within the conflicting interests of communities and mining companies, as they advocate for indigenous knowledge and science communication as an imperative in public participation. This affords SIAs to alleviate such conflict triggers as unfair compensation and avoiding cultural impacts that are impossible to compensate and that cannot be reversed. It was also noted that a parasitic relationship exists between mining companies and communities, once mining companies obtain the social license they never keep to the demands of the SLPs. SIAs advocate for SLPs and demand that mines should contribute to developing skills of their employees, upgrade local roads as well as providing other social amenities such as; housing, water, and sanitation. It was also observed that in some instances mines remain the centres of shooting in the backdrop of failure of local government to provide service delivery to these mining communities. I argue that mines should also be very honest about their capabilities and not promise new developments beyond their threshold limits otherwise they will have to deliver.

More often than not SIAs are commissioned by a natural scientist with limited comprehension of the community social setups thereby imposing an upper limit to adequately inform policy decisions. A myriad of AMD imposed socio-economic impacts namely; health ailments most notable genital diseases among women with subsequent strained sexual relationships, crippling of daily occupations that need clean water and encroaching of economic activities in sacred sites were identified. Interruptions of educational programmes and pressure on health resources following diarrheal outbreaks were also noted during the study. There was recognition that SIA through its participatory approach may establish a leeway into legislation and influence public environmental policy.

6.3 Recommendations

While public participation is an important accessory in mineral development its structural weaknesses need to be alleviated through an integrated SIAs process. It is therefore imperative that SIAs are commissioned by qualified Social Scientists who have a hand on experience with the real problems communities face through their prolonged interaction with the communities.

Relative to Natural Scientist who have always done EIAS but have limited contact with the communities and have a biophysical bias in their approach. The study thus recommends the following:

- There is a growing need to give SIAs legislative power through policy and declare it a binding activity that goes beyond environmental permitting.
- A yearly review of SLP over a 5 year period after which the Social license to operate is renewed or withdrawn depending on the cleanliness of the environmental, socio-economic audits needs to be considered
- SLPs can also be used as a barometer to measure environmental and socio-economic compliance of environmental managers such that it directly impacts on their yearly packages if not adhered to and this may go a long way in improving compliance.
- Essentially an integrated approach to the SIAs process that incorporates all genders in the impacted communities needs to be done to bring the different plights to the fore. As in some instances, these impacts are gender peculiar; a case in point is genital infections in women and causality with the acidity of AMD impacted water.
- The thesis also recognises that SIAs report recommendations on impacts and mitigation efforts should allow easy access to post-mining activities without going through the '*Red Tape*'. A case in point in South Africa is the harvesting of the black wattle in post-mining landscapes that requires permission from the Department of Mineral Resources (DMR) first before it can be undertaken post-mining.
- SIAs should also be able to provide a collaborative platform for the DMR, Department of Health, Local Government, Impacted Communities, Legislators and Mining Companies to mitigate the environmental and socio-economic impacts in mineral resource extraction. This will ensure an effective and all-inclusive public consultation process that is imbued with transparency, and honesty.
- There is a need for SIAs to provide a platform for translation of the legal language in memorandums that are in English into local languages to allow legislation to become accessible to the impacted communities. This will promote understanding and inclusivity of impacted communities and reduce the conflicts between affected communities and mining companies.

The above recommendations can also expose historical environmental injustices that culminated to social injustices and human right violations which through SIA could facilitate the prosecution of offenders. Consequently, these initiatives may pave the way for an effective entry point for

SIAs as a stand-alone assessment focused on social and economic aspects and giving them the same significance as the biophysical aspect emphasised in EIAs.

6.4 Future research

Based on the findings, future research is warranted that looks at legislating SIAs beyond a permitting license in mineral development. The effectiveness of using an integrated approach to SIAs that incorporates all affected stakeholders should be interrogated. Part of this integrated research approach should take in consideration that some impacts only affect women, and if they are not actively involved such impacts are not brought to the attention of relevant authorities. A gap in implementation in South Africa around the need for SIAs to provide a collaborative platform for a myriad of stakeholders in order to facilitate a walk away plan after closure for mining companies is brought to the fore. Moreover, SIAs need to facilitate conversations and research on the availability of social capital to promote different technologies around mine closure and to facilitate for an economically viable post-mining transition for impacted mining communities.

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APPENDICES

Appendix 1 Ethics clearance certificate

 Research Office	
HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL) RT4/49 - CHIDZUNGU	
CLEARANCE CERTIFICATE	PROTOCOL NUMBER - H18/07/02
PROJECT TITLE	Perspectives on the role of social impact assessments in solving AMD imposed socio-economic problems in post coal mining communities: A case of Carolina Catchment area X11B, Mpumalanga, South Africa
INVESTIGATOR(S)	Miss T Chidzunu
SCHOOL/DEPARTMENT	GAES/
DATE CONSIDERED	20 July 2018
DECISION OF THE COMMITTEE	Approved
EXPIRY DATE	12 August 2021
DATE 13 August 2018	CHAIRPERSON  (Professor J Knight)
cc: Supervisor: Professor D Simalele 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)	
We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and we guarantee to ensure compliance with these conditions. Should any departure be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. <u>Agree to completion of a yearly progress report.</u>	
 signature	20 / 07 / 2018 Date
PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES	

Appendix 2 Permission letters from IUCMA Mpumalanga

		
Suite 801, 8th Floor The WUSA Building 17 Street Street Mombela	Private Bag 311214 Mombela 1200	Tel: 013 753 9030 Fax: 013 753 2786

E-mail: sibiya@inkomaticma.co.za
Contact: 078 8035 276
Ref: 11/1/2/5
Date: 01.08.2018

RE-ASSISTANCE TO STUDENTS TO DO RESEARCH

Dear Sir/Madam

The Inkomati-Usuthu Catchment Management Agency hereby confirms with Wits University that it will do its best to assist Thandiwe Chidzingu to do her Research with Institution. The IUMA has assigned Tony Sibiya to assist her with any information relevant to her research studies until she completes the assignment.

Thank you

Tony Sibiya
 Institution & Participation Division



Mr TP Nyakane-Akoko (Chairperson) | Mr MT Mfwenko (Deputy Chairperson) | Dr J. Vheentma | Dr H. Robberson | Ms SO Ngweni
 Mr PA Tshabangu | Mr P. Venter | Mr JM Mofoketele | Dr TK. Ndlovu (Ex-Officio)

		
Suite 801, 8th Floor The WUSA Building 17 Street Street Mombela	Private Bag 311214 Mombela 1200	Tel: 013 753 9030 Fax: 013 753 2786

Enquiries: Hsauri Mafubela
Reference: 11/1/2/5
Email: hsauri@iucma.co.za
Tel: 013 753 9030
Date: August 2, 2018

Ms. Thandiwe Chidzingu
 University of the Witwatersrand

By email

Dear Ms. Chidzingu

Research interview for your studies: Perspectives on the role of Social Impact Assessments in solving AMD imposed socio-economic problems in post coal mining communities in Carolina catchment area X11B, Mpumalanga, South Africa.

With reference to your letter dated 05 June 2018, The Inkomati Usuthu-Catchment Management Agency (IUCMA) hereby wishes to grant you the opportunity to conduct the research with the identified official (Tony Sibiya) in the respective area of research.

The IUCMA wishes you the best in your academic endeavors.

Yours faithfully



Mr. HM Mafubela
 Assistant Manager: Institutions and Participation

Mr TP Nyakane-Akoko (Chairperson) | Mr MT Mfwenko (Deputy Chairperson) | Dr J. Vheentma | Dr H. Robberson | Ms SO Ngweni
 Mr PA Tshabangu | Mr P. Venter | Mr JM Mofoketele | Dr TK. Ndlovu (Ex-Officio)

Appendix 3 Invite MWCB February 2019



21 February 2019

Towards a Circular Green Economy Development in the Upper Olifants Basin

Consultative Session:
Academics and Consultants Stakeholder group
EY Conference Facility
Sandton
21 February 2019

AGENDA

Desired Outcomes

Collective understanding of the current reality and likely future scenarios for the area.

Identification of Stakeholders Involvement and Influence in the area.

Presentation of the Green Engine and Identification of Linkages, synergies and next steps for MWCB.

Facilitators: Roger Dickinson & Teboho Sejake



Appendix 4 Report back January 2019 Carolina Mpumalanga



Invitation to a follow-up and finalising workshop on the Wits mine water remediation and re-use project, on 21 January 2019, at the Featherbed Lodge in Carolina from 10:00 to 14:00, including lunch.

The follow-up workshop is intended to finalise a conceptual model for the cleaning and use of contaminated coal mine water to establish a sustainable bio-based economy on the Mpumalanga Highveld. The project is funded by the Volkswagen Foundation, housed at the Global Change Institute at the University of the Witwatersrand, and co-funded by the Water Research Commission, and carried out by Dr Ferdinand Postma, Dr Victor Munnik, and Ms Thandiwe Chidzungu.

The workshop will report on work so far, and focus on a number of final questions.

DRAFT AGENDA

10:00 Welcome and introduction

10:15 Feedback on research (Ms Chidzungu)

10:30 Detailed explanation of technology, questions and discussion (Dr Postma)

11:10 Presentation of draft conceptual model (Dr Munnik)

11:45 Discussion of conceptual model, with specific attention to

- role of the mines
- local government as decision maker on land use, and job opportunities (LED)
- regulator responsibilities
- community involvement
- project way forward

13:00 Lunch

14:00 Departure

The project is developing an understanding of the perspectives and agendas of stakeholders in the quaternary catchment X11B (Carolina, Mpumalanga) as input into a conceptual model for proposed technology interventions in remediation and using treated water in a bio-based economy, with special emphasis on the creation of job opportunities after coal mining has ceased. It will explore a number of technology options for this purpose and consider economic aspects of such plans. **For a fuller summary of the project see the project website www.postmininglife.org.**

Please respond asap to

Dr Victor Munnik - victor@victormunnik.co.za



Appendix 5 Report back session January 2019 Pretoria DWS Office.



Dear DWS officials

Please save the date for a follow-up and finalising workshop on 17 January 2019, in DWS Offices, Pretoria (exact venue to be confirmed). Timing: 10:00 to 13:00, to be confirmed.

The follow-up workshop is intended to finalise a conceptual model for the cleaning and use of contaminated coal mine water to establish a sustainable bio-based economy on the Mpumalanga Highveld. The project is funded by the Volkswagen Foundation, housed at the Global Change Institute at the University of the Witwatersrand, and co-funded by the Water Research Commission, and carried out by Dr Ferdinand Postma, Dr Victor Munnik, and Ms Thandiwe Chidzingu.

The project is developing an understanding of the perspectives and agendas of stakeholders in the quaternary catchment X11B (Carolina, Mpumalanga) as input into a conceptual model for proposed technology interventions in remediation and using treated water in a bio-based economy, with special emphasis on the creation of job opportunities after coal mining has ceased. It will explore a number of technology options for this purpose and consider economic aspects of such plans. **See attached for a fuller summary of the project OR the project website www.postmininglife.org.**

We are particularly keen to hear from DWS officials how they respond to this idea for inclusion in a conceptual model, and what advice they may have for us. We trust that this will make a contribution to forward thinking about coal mine rehabilitation with a focus on mine water.

Contacts

Dr Ferdinand Postma - ferdinand.postma@wits.ac.za

Dr Victor Munnik - victor@victormunnik.co.za



Appendix 6 Invite IUCMA stakeholder meeting Mpumalanga November 2018



Suite 801, 8th Floor The MAXSA Building 13 Streak Street Mbombela	Private Bag X11214 Mbombela 1200	Tel 013 753 9000 Fax 013 753 2788
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INKOMATI-USUTHU
CATCHMENT MANAGEMENT AGENCY

Enquiries: Tony Sibiya
Ref: 11/1/1/2/3/2
E-mail: sibiyat@iucma.co.za
Tel: (013) 753 9048/0788035276
Date: 15.10.2018

To: All Stakeholders

RE: NOTICE OF THE UPPER-KOMATI CATCHMENT MANAGEMENT FORUM MEETING

The chairperson of the Upper-Komati Catchment Management Forum would like to notify all water users and stakeholders of the upcoming forum meeting to be held as follows:

Date : 12th November 2018

Venue: Carolina—Featherbed Guest House

Time : 09h30 for 10h00

It is imperative that all stakeholders be part of this forum to ensure effective participation in the management of water resources.

Confirmations to be communicated with the official on the contact details indicated above for logistical arrangements.

Your positive response will be much appreciated.

Kind Regards



Chairperson

Ms TP Nyakane-Maluka (Chairperson) | Mr MS Mthembu (Deputy Chairperson) | Dr PE Molokwane | Ms SD Wiggins | Mr RA Tshabangu
Mr PJ Venter | Mr N Govender | Mr JM Mathebula | Dr TK Gyedu-Ababio (Ex-Officio)

Appendix 7 Invite GCI researchers in conjunction with the DWS Pretoria October 2018



Dear DWS officials

Invitation to Introductory Workshop, 24 October 2018, DWS Offices, Pretoria (exact venue to be confirmed). Timing: 10:00 to 13:00

You are invited to participate in an introductory workshop to explore the cleaning and use of contaminated coal mine water to establish a sustainable bio-based economy on the Mpumalanga Highveld. The project is funded by the Volkswagen Foundation, housed at the Global Change Institute at the University of the Witwatersrand, and co-funded by the Water Research Commission, and carried out by Dr Ferdinand Postma, Dr Victor Munnik, and Ms Thandiwe Chidzunu.

The project will develop an understanding of the perspectives and agendas of stakeholders in the quaternary catchment X11B (Carolina, Mpumalanga) as input into a conceptual model for proposed technology interventions in remediation and using treated water in a bio-based economy, with special emphasis on the creation of job opportunities after coal mining has ceased. It will explore a number of technology options for this purpose and consider economic aspects of such plans. See attached for a fuller summary of the project OR the project website www.postmininglife.org.

We are particularly keen to hear from DWS officials how they respond to this idea for inclusion in a conceptual model, and what advice they may have for us. We trust that this will make a contribution to forward thinking about coal mine rehabilitation with a focus on mine water.

Contacts

Dr Ferdinand Postma - ferdinand.postma@wits.ac.za

Dr Victor Munnik - victor@victormunnik.co.za

Please RSVP by 17 October 2018

Draft Agenda

- 10:00 Open, welcome and purpose of the meeting (Dr Munnik)
- 10:15 Introduction to project and end result (Dr Postma)
- 10:30 Introduction of technical options (questions and discussion) (Dr Postma)
- 11:00 Introduction to Social Impact Assessment (Ms Chidzunu)
- 11:30 Introduction to activity systems method (Dr Munnik)
- 11:45 From the perspective of the regulator: responses to proposed treatment and use of mining waterGroup discussion using activity systems method (Open Discussion)
- 13:00 End of meeting



VolkswagenStiftung



Appendix 8 Introductory workshop Carolina Featherbed Lodge



Invitation to Introductory Workshop, 26 September, The Featherbed, Carolina (88 Van Riebeeck Str, Carolina)

10:00 to 14:00, including lunch

You are invited to participate in an introductory workshop to explore the cleaning and use of contaminated coal mine water to establish a sustainable bio-based economy on the Mpumalanga Highveld. The project is funded by the Volkswagen Foundation, housed at the Global Change Institute at the University of the Witwatersrand, and co-funded by the Water Research Commission, and carried out by Dr Ferdinand Postma, Dr Victor Munnik, and Ms Thandiwe Chidzingu.

The project will develop an understanding of the perspectives and agendas of stakeholders in the quaternary catchment X11B (Carolina, Mpumalanga) as input into a conceptual model for proposed technology interventions in remediation and using treated water in a bio-based economy, with special emphasis on the creation of job opportunities after coal mining has ceased. It will explore a number of technology options for this purpose and consider economic aspects of such plans. See attached for a fuller summary of the project OR the project website (www.postmininglife.org – going live 10 September).

Contacts

Dr Ferdinand Postma - ferdinand.postma@wits.ac.za

Dr Victor Munnik - victor@victormunnik.co.za

Draft Agenda

- 10:00 Open, welcome and purpose of the meeting (Dr Munnik)
- 10:15 Introduction to project and end result (Dr Postma)
- 10:30 Introduction of technical options (questions and discussion) (Dr Postma)
- 11:00 Introduction to Social Impact Assessment
- 11:30 Introduction to activity systems method (Dr Munnik)
- 11:45 Group discussions using activity systems method (Dr Munnik)
- 12:30 Small group report backs (Dr Munnik)
- 13:00 Way forward (next meetings) and lunch



Appendix 9 Questionnaire for the Carolina community

Appendix 9 Questionnaire for the Carolina Community



Title: Perspectives on the role of Social Impact Assessments in solving Acid Mine Drainage imposed socio-economic problems in post coal mining communities. A study of Carolina Catchment area X11B, Mpumalanga, South Africa

TARGET GROUP:

Community Members

AIM: Identify, assess and address the Socio economic impacts of AMD on the Carolina community

B. QUESTION

1. What do you understand by AMD? _____

2. Which economic and social activities have been affected by AMD pollution in Carolina? _____

3. Are there any farmers or community members who have been displaced following the threats of AMD to their economic activities? If yes where have they moved to? _____

4. Have you or anyone in your family been affected by waterborne diseases, emanating from the effects of AMD? If yes Explain _____

5. Are there any clinics and hospitals nearby servicing the area? _____

6. Do you foresee any viable post mining economic activities in Carolina? If yes explain _____

7. What are your views about biotechnologies, do you think they can solve AMD pollution in your community? _____

8. Are you ever involved in public participation as the Carolina community? if yes explain _____

9. What do you understand by Social Impact Assessments (SIAs)? _____

Appendix 10 Questionnaire for the Department of Water and Sanitation DWS Officials

QUESTIONNAIRE: OFFICIALS Department of Water and Sanitation



Survey Questions : Officials

Designation: _____ Number of years in the field _____

Educational Qualification : Matric ☐ Tertiary ☐ University degree/Masters/PHD ☐

AGE: 18-35 ☐ 36-43 ☐ 44-64 ☐ 65+ ☐

Tick where appropriate

Q1. What does Social Impact Assessments as the DWS, being custodians of South Africa's water resources mean to you?

Q2. What measures have you undertaken with regards to Acid Mine drainage threat from mines on our water resources as a department?

Q3. What help or intervention have you given to affected communities in terms of declining food supply emanating from AMD pollution on their water resources?

Q4. Are there any new technologies that you have invested in, that may reduce the effects of AMD on water and may subsequently help impacted communities? **Q5.** How do you compel these polluting mining companies to account through your policies?

Q6. Do you think SIA should remain an integral part of an EIA or should it be enacted as a separate assessment too? Explain

Q7. Do you have people dealing with Social Impact assessments in your department ? **Yes / NO.** if your answer is yes, what kind of qualifications do they hold? *Circle the most appropriate:* **Natural Scientist** or **Social Scientist**

Q8. To what extent can EIAs specialist understand and connect with socio-economic impacts imposed by mining on post mining communities?

Appendix 11 Interview schedule for communities

Interview Schedules for communities



Designation/ employment: _____

Educational Qualification : Matric ☐ Tertiary ☐ University degree/Masters/PHD ☐

Age: 18-35 ☐ 36- 54 ☐ 55-64 ☐ 65+ ☐

Tick where appropriate

Q1. What do you understand by Acid Mine Drainage?

Q2. How have the communities been affected by AMD?

a). In terms of their Health b). Economic Activities c) Food security

Q3. Are you aware of any measures that have been undertaken with regards to Acid Mine drainage threat from mines on water resources in Carolina?

Q4. Are communities involved in public participation in mining developments

Q5. As a community member what do you think should be done to deal with the problems of AMD in Carolina

Q6. What are the main issues you have with mining companies as impacted communities?

Q7. What economic activities post mining do you envisage for communities in AMD impacted areas?

Q8 What are your perceptions or thought about new biotechnologies that are being introduced on post mining landscapes

Q9. Do you have any plans for the future as mines seem to be closing ?if yes explain

Q10. What do you understand by Social Impact Assessments?

Appendix 12 Questionnaire for biotechnologists

Questionnaire for Biotechnologists



Title: Perspectives on the role of Social Impact Assessments in solving Acid Mine Drainage imposed socio-economic problems in post coal mining communities. A case of Carolina Catchment area X11B, Mpumalanga, South Africa

AIM: To find out the potential of a post mining economy given new biotechnologies and the likely impacts thereof both positive and negative.

Survey Questions :Biotechnologists

1. What are the likely opportunities of a viable post mining economy in Carolina amid AMD pollution
2. What kind of jobs are likely to come from these AMD affected post mining landscapes?
3. Identify some of the AMD affected resources that can be harnessed through biotechnologies in Carolina into profitable use?
4. What are the impacts of introducing such biotechnologies to;
 - i) The-biophysical-environment
 - ii) Food security

Appendix 13 Questionnaire for mining officials

QUESTIONNAIRE/INTERVIEW SCHEDULE: MINING OFFICIALS.



Thesis Title: Perspectives on the role of Social Impact Assessments in solving Acid Mine Drainage imposed socio-economic problems in post coal mining communities. A case of Carolina Catchment area X11B, Mpumalanga, South Africa

Survey Questions:

Designation: _____ Number of years in the field ____

Educational Qualification: Matric ☐ Tertiary ☐ University degree/Masters/PHD ☐

Age: 18-35 ☐ 36-53 ☐ 54-64 ☐ 65+ ☐

Tick where appropriate

Q1. What do you understand by Acid Mine Drainage?

Q2. What effects has AMD had on

(i).Agriculture

(ii).Health

(iii).Other occupations?

Q3. From a mining perspective how effective is public participation in mineral development?

Q4. What usually triggers conflict between mining companies and mining communities?

Q5. Are there any new technologies that have been invested in, that may reduce the effects of AMD on water and may subsequently help impacted communities?

Q6. How can these polluting mining companies be compelled to compensate the affected-communities?

Q7. What do you understand by Social Impact Assessments?

Q8. Do you think SIA should remain an integral part of an EIA or should it be enacted as a separate assessment tool? Explain?

2018-03-04 14:07

04080516-03204 >>



Private Bag 5500, Wilkes, 1035, Tel: 011 453 0500, Fax: 011 453 1000
Educators Centre, First Floor, Mowat's Drive, Wilkes, 1035

File ref: **MTD6541/17320744-ER**

THIS DEED OF GIFT HAS BEEN MADE AND SIGNED AT WITBANK ON 01 DAY OF MARCH 2018.

Smaller
REGIONAL MANAGER
~~REGIONAL MANAGER~~ REGION
DATE: 2/03/2018



Appendix-15 List of participants in the study

	Data collection method					
Participants	Interviews	Questionnaires	Focus Group	Community & Regulators Forums. Public dialogue	Date	Venue
Residents	15	22	2		Sept 2018 Oct 2018 Nov 2018	Silobela/ Carolina
Community mining Activist	3				Oct 2018 Nov 2018	Silobela
IUCMA officials & Stakeholders meetings		2	1	5	Sept 2018 Oct 2018 Nov 2018 Feb 2019	Carolina Featherbed lodge
Agricultural engineer Farmer	1	1			10/2018 7/02/19	Carolina Telephonic interview
Mining Official	1	1			22/01/19	Company premises Middleburg
Local government officials	2				22/01/19	Local Government Offices Carolina
Regulators (DWS) Mine Water Coordinating		10	2	1 1	24 /10/18	Pretoria Sandton

Board (MWCB)					17/01/19	
					21/02/19	
WAMUA	1				14/11/18	Carolina
CCPJ	3			1	12/2018	Johannesburg Oribi hotel
ACTION AID						
Biotechnologis t Expert		1			Feb 2019	
Total	25	37	5	8		75

Total number of participants as per data collection method.

Source: Researcher



FULL NAME : THANDIWE CHIDZUNGU
STUDENT NUMBER : 1312738
YEAR : 2019
COURSE NAME : GEO 98003A
LECTURER : PROFESOR MULALA DANNY SIMATELE & DI FERDINAND POSWA
DATE OF SUBMISSION : 22/07/2019
TOPIC (in full) : Perspectives on the role of
Social Impact Assessments in
solving Acid Mine Drainage
Imposed socio-economic
impacts in post mining communities
A Study of Carolina
Catchment area X118 in Mpumalanga,
South Africa

DECLARATION

I THANDIWE CHIDZUNGU (Student number 1312738)
am a student registered for MSc Geography by Dissertation in the year 2018 - 2019

I hereby declare the following:

- * I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong
- * I confirm that the work submitted for assessment for the above course is my own unaided work except where I have explicitly indicated otherwise
- * I have followed the required convention in referencing the thoughts and ideas of others.
- * I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own work or that I have failed to acknowledge the source of the ideas or words in my writing.

Signature [Signature]
Date 22/07/2019