Assessment of alternative funding models for the rehabilitation of derelict & ownerless mines in South Africa.

Flacco Ndlovu

WITS Business School

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DECLARATION

I Flacco Ndlovu declare that this research report entitled 'Assessment of alternative funding models for the rehabilitation of derelict & ownerless mines in South Africa' is my own unaided work. I have acknowledged, attributed, and referenced all ideas sourced elsewhere. I am hereby submitting it in partial fulfilment of the requirements of the degree of Master of Business Administration at the University of the Witwatersrand, Johannesburg. I have not submitted this report before for any other degree or examination to any other institution.

Flacco Ndlovu

Signed at Johannesburg on 30th June 2021

Name of candidate	**Flacco Ndlovu**
Student number	**1945291**
Telephone numbers	**071 950 8777**
Email address	**flacco.ndlovu@gmail.com**
First year of registration	**2019**
Date of proposal submission	**31 October 2020**
Date of report submission	**30 June 2021**
Name of supervisor	Mdzikwa Julia and Dr. Kambidima Wotela

ABSTRACT

Author: Flacco Ndlovu **Supervisor** Mdzikwa Julia

Thesis title: Assessment of alternative funding models for the rehabilitation of derelict & ownerless mines in South Africa.

Limited funding hampers the pace of derelict mine rehabilitation in South Africa. This leads to their perpetual existence and continued negative impacts on surrounding communities. This research aimed to investigate alternative funding models, assess their utility and potential replication from the perspective of industry stakeholders. A cross-sectional study using both closed and open-ended questionnaires; was conducted. The study found preferred funding models to be government-issued bonds, impact bonds, green bonds, sovereign bonds, and sustainability linked bonds. Research findings were thus used to provide recommendations of alternative funding models that can be considered in derelict mine rehabilitation projects in South Africa.

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DEFINITION OF KEY TERMS AND CONCEPTS

AfDB – African Development Bank

Alternative Funding – For this study refers to alternatives from state funding.

AMD – Acid Mine Drainage

AMLRP - Abandoned Mine Land Reclamation Program

COCHLCO – Chilean Copper Commission

DMRE – Department of Mineral Resources and Energy

D&O – Derelict and Ownerless mines

EPA – Environmental Protection Agency

ESG – Environmental, Social, and (Corporate) Governance

EUR – Europe

Funding Models – For the study, the term also encompass funding instruments

GBP – Green Bond Principles

GoSA – Government of South Africa

ICMA – International Capital Market Association

MPRDA – Mineral and Petroleum Resources Development Act

MTEF – Medium Term Expenditure Framework

NAOMI – National (Canada) Orphaned/Abandoned Mines Initiative

OECD – Organisation for Economic Co-operation and Development

SDG – Sustainable Development Goals

SIB – Social Impact Bond

SII – Social Impact Investment

SPV – Special Purpose Vehicle

SRI – Socially Responsible Investment

UK – United Kingdom

UNEP – United Nations Environment Programme

USA – United States of America

1 INTRODUCTION TO THE RESEARCH

1.1 Background and context

1.1.1 The mining industry in South Africa

South Africa has a long mining history dating back to the 19th century (Tonder, Coetzee., 2009). Historically there was no legislation to address the environmental impact of mining. Swart (2003) and Tonder et al. (2009) note that there were no legislative requirements for formal mine closure before 1980. The initial legislation still had weaknesses in terms of addressing the environmental impacts of mining; they further note that the *Minerals Act 50 of 1991* (*Government Gazette*, 2004) was the first act that attempted to address this adequately.

Mainly due to inadequate legislative framework, some of the mines were not correctly rehabilitated at the mine closure stage but became derelict and ownerless(D&O). As a result, there are almost 6000 such mines in South Africa, covering different commodities (Cornelissen, Watson, Adam & Malefetse., 2019).

The Department of Mineral Resources and Energy in South Africa defines D&O mines as 'mines whose owners or mining rights or lease holders have abandoned and are not operating nor maintaining to mitigate and manage their associated safety, health and environmental impacts and can no longer be traced.' (DMR, 2009, p6).

These mines are an environmental hazard, which negatively affects the ecological system and result in the pollution of crucial resources like sub and surface water (Sibiya, 2019). They also pose serious health risks to affected communities in the vicinity (Moffatt & Pless-mulloli, 2003).

1.1.2 Derelict and Ownerless mines in South Africa

The South African constitution section 24 states that all persons have a 'right to an environment that is not harmful to their health or well-being and a right to have the environment protected for current and future generations.' *Constitution of the Republic of South Africa Act 108 of 1996* (*The Constitution of South Africa*, 1996). It is against this backdrop that the derelict and ownerless mines' liability falls back to the state. Rehabilitation of these mines is done through the Derelict and Ownerless Mines Rehabilitation Programme, conducted by the Department of Minerals and Energy (DMRE) in conjunction with Mintek and the Council for GeoScience (CGS). Currently, the programme focuses on rehabilitating asbestos mines, mainly due to the severity of the associated health hazards (Cornilissen et al., 2019).

1.1.3 Funding challenges

The financial liability to rehabilitate the D&O mines is a significant burden on the state and a constraint on the rehabilitation programme. In the past ten years, about 40 of the 257 asbestos mines were rehabilitated at a cost of approximately R800 million (Herman Cornelissen et al., 2019). It is estimated that it will take 800 years to rehabilitate the outstanding mines at a cost of more than R100 billion (Druten & Bekker, 2017).

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1.2 Research conceptualisation

1.2.1 The research problem statement

Past researchers have identified that the state's significant challenge in rehabilitating derelict and ownerless mines is the enormous financial outlay required. Cornilessen et al. (2019) determined that the substantial financial cost needed to implement the derelict mines' rehabilitation is a significant contributor to the slow progress in remedying the challenge.

The aspect of limited funding has been covered and highlighted by past researchers like Mhlongo & Amponsah-Dacosta (2016), Cornelissen et al. (2019) and (Rensburg, 2012). It is apparent that there is a need for significant financial resources above state funding. The focus of the past research papers has mainly been on highlighting the challenges without exploring possible solutions. This research suggests exploring various alternative funding models for the rehabilitation of D&O mines.

There has been a rise in sustainable development projects funding as investors seek to meet their Environmental, Social, and Governance (ESG) targets. Key players like the African Development Bank (AfDB) have been involved in sustainable development finance using different instruments since 2010 (AfDB, 2016). In September 2017, AfDB launched its Social Bond Framework, followed by the inaugural EUR 500 million 7 years Social Bond, and then in May 2018, the Bank issued its second social bond for EUR 1.25 billion (AfDB, 2018).

Other funding models, like outcome-based funding models, have proved to be effective in the health sector (Oroxom et al., 2018). However, the funding models have not yet been employed for the rehabilitation of mines in South Africa. This research seeks to explore alternative funding models that can be considered.

1.2.2 The research purpose (aim and objectives) statement

This research intends to investigate the different funding models that may be used as alternative funding for derelict mines and assess their efficiency as perceived by various key players in the South African mining and financial industries. The research also intends to evaluate if funders/investors will be willing to invest in the rehabilitation of D&O mines if incentivised by the Government. Alternative funding models that may be utilised to fund the rehabilitation of derelict mines as per evidence obtained from similar projects conducted globally / Africa will be assessed.

The research will help assess which alternative funding models are preferred by key players in the mining and financial sectors in South Africa. The factors that might contribute to the adoption/rollout of different funding models will also be investigated and critical success factors.

A systematic review of available literature will guide the development of an interview tool. The interview guide will be designed with both closed and open-ended questions. Questions will focus on the choice of the different funding models and factors contributing to adopting such models from the perspectives of both the investors and clients. Results will be analysed thematically, picking up interesting points expressed that will ensure that the ultimate research question is sufficiently answered.

1.2.3 The research questions

1.2.3.1 Question 1: What types of funding models have been used to fund the rehabilitation of derelict mines globally and successfully?

1.2.3.2 Question 2: What are the characteristics of projects funded via alternative funding models?

1.2.3.3 Question 3: To assess which funding models were preferred by key players in the mining and financial sectors in South Africa.

1.2.3.4 Question 4: What are the specifications and conditions that will influence the adoption of different funding models by key players.

1.3 Delimitations and assumptions of the research study

For this research, the following research assumptions were made:

Firstly, key players include investors, funders, philanthropists, and state representatives (GoSA - DMRE). Secondly, investors and funders refer to any company or organisation that was willing to fund the rehabilitation of derelict mines. Thirdly, given that some people who fit the scope of being interviewed are high profile interviewees, in certain instances, representatives were interviewed in their place. This was done to avoid delaying this report's progression due to the non-availability of the high profile individuals. Lastly, given that the field is generally untampered, it was thus envisioned that the scarcity of literature could potentially reduce the number of funding models investigated.

1.4 Significance of the research study

Over the years, the number of ownerless and derelict mines covering different commodities has accumulated to almost 6000 in South Africa (Cornelissen et al., 2019). These mines are an environmental hazard that negatively impacts the ecological system and results in water resources pollution (Sibiya, 2019). They also pose a severe health risk to affected communities in the vicinity. As having a safe and sustainable environment is a fundamental human right, the Government has thus taken it upon itself to rehabilitate the ownerless and derelict mines.

Although paramount to human survival, the cost to rehabilitate the D&O mines is a significant financial burden on the state. Funding constraints in the Government affect the resultant speed of the rehabilitation program. An investigation of alternative funding methods would bring about a massive relief on the budget and thus make available some funds to improve other issues within the mining industry. If the rehabilitation continues at a constrained pace, it is estimated that it will take 800 years to rehabilitate the outstanding mines (Druten & Bekker, 2017).

As the investigated alternative funding methods are largely outcome-based, it is also envisaged that more efficient ways of managing the rehabilitation process will be adopted and scaled up for future projects.

1.5 Preface to the research report

To this end, the report has six chapters. Following this introductory chapter, Chapter 2 provides a literature review covering the problem, the past studies, the explanatory framework and the conceptual framework. Chapter 3 discusses the research strategy, design, procedures, reliability and validity measures, and limitations. Chapter 4 and Chapter 5 present and discuss the findings, respectively, to interrogate our research questions, while Chapter 6 summarises and concludes the research.

2 LITERATURE REVIEW

The derelict and ownerless mines, also referred to as abandoned mines, legacy mines, orphan mines, and derelict mines, are a global phenomenon (Cornelissen et al., 2019). These mines are defined globally as mines that are no longer operational, with no mining rights or titles, and the rehabilitation liability cannot be allocated to an individual or company (Tremblay, G.A., Hogan, 2006).

The global spread of these mines is significant, and they are present in approximately all historical mining areas (Mavrommatis & Menegaki, 2017). The extent of the spread has not been fully documented. In the United States of America, the mines are estimated to be more than 500 000, 25% of which relate to health and safety matters and 5% to environmental issues. In Chile, they estimate that 52,4% of their 659 mines are abandoned (UNEP, 2001). Slovakia has reported abandoned mines above 17,000, while Hungary has 6000 (Mavrommatis & Menegaki, 2017). Australia and Canada are other countries with a massive burden of abandoned mines.

The Department of Mineral Resources and Energy in South Africa defines D&O mines as 'mines whose owners or mining rights or lease holders have abandoned and are not operating nor maintaining to mitigate and manage their associated safety, health and environmental impacts and can no longer be traced.' (Coetzee et al., 2008). There are about 6000 derelict and ownerless mines in the nation (Mhlongo & Amponsah-dacosta, 2018). Mines generally occupy vast surface areas and have a significant environmental impact (Swart, 2003). The adverse ecological effects of derelict mines are more pronounced and typically more severe(Mavrommatis & Menegaki, 2017). The host areas are left with unrehabilitated scattered waste rock dumps, open shafts, mining infrastructure, unsealed adits, altered landscapes, changes in groundwater regimes, contaminated soils etc. (Mhlongo & Amponsah-dacosta, 2018).

One of the significant environmental consequences of derelict mines is acid mine drainage (AMD). Sibiya (2019), Hobbs et al. (2008) and Tonder et al. (2009) identify AMD as a significant environmental challenge emanating from derelict mine dumps and tailings. The challenge has been described by Mutanga (2018) as a ticking time bomb, with human life, aquatic life and biodiversity at risk. There is also a myriad of other environmental impacts related to derelict mines with varying magnitudes. These include the advent of sinkholes, water pollution, air pollution, radioactivity etc. Active mines are usually the primary source of socio-economic activities in the host communities. Removing this source has adverse socio-economic impacts at mine closure, including loss of economic activity, infrastructure, and unemployment (Mhlongo & Amponsah-dacosta, 2018).

These challenges are more pronounced in derelict mines. According to Mhlongo & Amponsah-dacosta (2018), this includes loss of productive land due to derelict mines. The derelict mines also tend to attract illegal artisanal miners (zama-zamas) whose activities are usually associated with harmful socio-economic activities, including crime, health risks and environmental degradation (Mhlongo & Amponsah-Dacosta, 2016). The health and safety risks of derelict mines vary differently due to the proximity of the mine to the community and the commodities that were mined, and the remaining infrastructure. Land destruction can lead to ground subsidence and sinkholes Mutanga (2018)

The mentioned water and air pollution also pose significant risks to the affected community. Parents who were interviewed in a study of the health impact of coal mines in the United Kingdom (U.K.) described the effects as being akin to a plague (Moffatt &

Pless-mulloli, 2003). Air pollution associated with derelict mines can also lead to the advent of respiratory diseases. The current D&O rehabilitation programme focuses on asbestos mines due to the well documented adverse health effect of exposure to asbestos dust and fumes (Cornelissen et al., 2019)

The reasons for the existence of derelict mines are two-fold; the historical reasons why the mines were not adequately rehabilitated and the perpetuation reasons why the mines are still not rehabilitated after they were identified as socio, environmental health and safety risks. South Africa has a long mining history, spanning over 100 years; mining of gold in the country dates back to the 1880s (Tonder et al., 2009). Due to inadequate legislation, mines were usually left abandoned at the end of the mining cycle. Swart (2003) and van Tonder et al. (2009) note that there were no legislative requirements for formal mine closure before 1980. The initial legislation still had weakness in addressing the environmental impacts of mining; they further note that the Minerals Act, 1991 (Act 50 of 1991) was the first act that adequately addressed this.

The inadequate legislation framework was the reason for the initial accumulation of derelict and ownerless mines. In 2008, the DMRE, in its National Strategy for the Management of Derelict and Ownerless Mines in South Africa, identified the need to ensure that all D&O mines are rehabilitated as a strategic objective (Coetzee et al., 2008). In 2009 the DMRE appointed Mintek, a schedule 3b state-owned business entity operating in the mining sector, as the implementing agent for the rehabilitation of D&O mines, focusing on asbestos mines (Cornelissen et al., 2019).

Achieving this DMRE strategic objective is a mammoth task. The rehabilitation programme faces wide-ranging challenges which slow down the rehabilitation progress. Cornelissen et al. (2019) identified broad challenges faced in conducting the current D&O rehabilitation programme; they noted lack of legislature that deals directly with D&O mines, process-related delays and challenges like the tendering process, which has a mandatory three-month lag, short planning horizon related to limited funding and the current funding model, delays related to community challenges in the form of strikes and collective action. They also highlighted technical challenges leading to the reopening of previously rehabilitated mines by community members seeking to harvest resources with economic value like scrap steel and copper; this consequentially leads to the repeat rehabilitations, which weighs heavily on the already limited funds.

Mhlongo & Amponsah-Dacosta (2018) argue that there is still much to be done to rehabilitate derelict mines. This should include properly defining D&O mines; they also cite funding as the key stumbling block to the rehabilitation progress. Illegal miners were also listed as a significant hindrance to the programme's progress as their activities usually lead to the repetition of previously completed rehabilitation work. The current challenges, chief of which is the limited funding, contribute to the slow progress in addressing the derelict mines. Funding constraints mean that the implementing agent can complete about four mines per year. To date, only about 40 mines have been completed at a cost of about R800 Million (Cornelissen et al., 2019). Enormous financial outlay will be required to address the outstanding 6000 derelict mines.

The environmental, social and health and safety risks associated with derelict and ownerless mines have been well researched and covered by past researchers. The effects are relatively well known in the sustainable development field and documented globally and in the South African setup. Globally researchers like Mavrommatis & Menegaki (2017), Moffatt & Pless-mulloli (2003), Banks & Banks (2001) and Palma et al. (2019) have documented the various impacts of the derelict mines. In South Africa, the effects have also been relatively wide researched and documented. There is limited emergent

research that focuses on the impacts of unrehabilitated mines. Local researchers like Mhlongo & Amponsah-dacosta (2018), Tonder et al. (2009), Sibiya (2019) and Nzimande & Chauke (2012) have also significantly covered the area.

The historical research reasons for the existence of derelict mines, which mainly relate to inadequate legislative frameworks, limited monitoring resources and downturns in mining fortunes, are well documented. The root cause in this light has been well established and stated in many research reports. Mhlongo & Amponsah-Dacosta, (2016), Cornelissen et al. (2019), Tonder et al. (2009) and Druten & Bekker (2017) give a detailed historical account of how the mines became derelict. The DMRE has since improved its legislature to curb the recurrence of derelict mines. The Minerals and Petroleum Resources Development Act (MPRDA) of 2002 was introduced to curb the advent of derelict mines and address a myriad of other challenges within the minerals and petroleum sectors. Section 41 of the act requires mines to provide plans and financial assurances for eventual mine closure as per the financial provision guideline. The mine is therefore required to determine the closure obligation and report a financial provision to the DMR. Section 38 implies that the directors of a company or the members of a closed corporation may personally be subjected to punitive action for mine operations that led to damages to the environment and were not remedied.

2.1.1 Alternative funding models

The challenge of sourcing funds for the rehabilitation of these mines is a global phenomenon. In the United States of America (USA), they have the Abandoned Mine Land Reclamation Program (AMLRP), focusing on the reclamation of coal mines abandoned before 1977 funded by operational coal mines based on their production (Cornelissen et al., 2019). The US Environmental Protection Agency (EPA) also manages the Superfund, where the State provides funds to rehabilitate contaminated legacy mine sites(Cornelissen et al., 2019).

In Canada, in 2002, the National Orphaned/Abandoned Mines Initiative (NOAMI) was formed in response to requests from multiple stakeholders to federal, provincial and territorial mines ministers (Cowan & Mackasey, 2006; Tremblay & Hogan, 2016). The NAOMI is responsible for, among other things, assessing and making recommendations on suitable funding approaches for the rehabilitation of abandoned mines in Canada. The NAOMI is yet to finalise the funding toolkit (Tremblay & Hogan, 2016). While the different countries have varying funding approaches, the commonality is that the State takes responsibility for the abandoned mines. The various states either fund the rehabilitation programmes directly or through initiatives that they oversee.

In South Africa, limited funding for the derelict mines is a stumbling block on the progression of the rehabilitation of derelict mines. Due to funding constraints, only a few mines can be rehabilitated at a time, which leads to the perpetuation of the existence of D&O mines. The rehabilitation process requires massive cash flow outlays; in the past ten years, about 40 of the 257 asbestos mines have been rehabilitated at a cost of approximately R800 Million (Cornelissen et al. 2019).

The aspect of limited funding has been covered and highlighted by past researchers like Mhlongo & Amponsah-Dacosta, (2016), Cornelissen et al. (2019) and Rensburg (2012). It is apparent that there is a need for significant financial resources above the Medium-Term Expenditure Framework (MTEF) allocation by Treasury to DMRE. The focus of the past research papers has mainly been on highlighting the challenges without

exploring possible solutions. This paper seeks to address this knowledge gap by assessing alternative funding models.

The DMRE has expressed the need to try alternative funding to rehabilitate D&O mines (Coetzee et al., 2008). However, there are no reports of alternative funding models being used or explored by DMRE. The state can consider several alternative funding models/instruments, including tapping on the rising sustainable funding. Globally there is a growing rise in the financing of sustainable development projects as investors seek to meet their sustainable development goals (SDG). Mutanga (2018) argues that even though mining is not directly addressed in the 17 SDGs, there is a direct link with SDG 15 (Life on Land) and SDG 6 (Clean water sanitation). The identified SDGs are also directly related to the rehabilitation of derelict mines; thus, sustainable development funding models can also be considered.

The following models/instruments can be considered:

(1) Social Impact Investments

Mulgan et al. (2011) define social impact bonds (SIB) typically as circumstances whereby a 'payer (usually Government, at a national, regional or local level) agrees to pay for measurable improved outcomes of socio-economic projects, and this prospective income is used to attract the necessary funds from commercial, public or social investors to offset the costs of the activity that will achieve those better results'(Mulgan, Reeder, Elliot and Bo., 2011). The social impact bonds also called the pay for success models and outcome-based funding will help lighten the burden on the fiscus in the short term. The significant advantage of the model is that it allows the Government to fund only successful projects. The downside is that it comes at a premium to attract investors.

Edmiston and Nicholls (2018) argue that social impact bonds help transfer the risk to the service provider; this has the likelihood of improving efficiency and achieving the desired outcome. This tends to shift the focus away from the initial inputs and processes to the results, which have proved to be attractive to many policy domains. There has been a considerable growth in the SIB; in 2015, the UK outcome-based contracting was estimated to be at least £15 billion (Edmiston & Nicholls, 2018).

The Organisation for Economic Co-operation and Development (OECD) has identified that there is a growth in social impact investment (SII) around the world. The OECD defines social impact investment (SII) as 'the provision of finance to organisations addressing social needs with the explicit expectation of a measurable social and financial return'. SII investors can range from those willing to provide funding for organisations that cannot generate market returns to more traditional investors interested in also having a social impact (OECD, 2019).

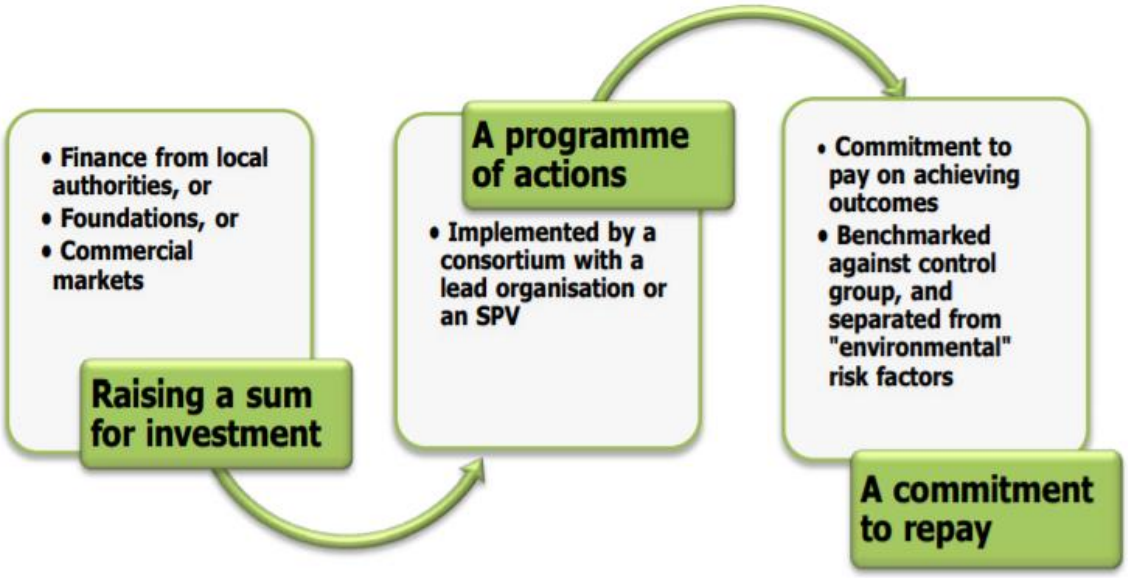

Figure 1: Social Impact Investment Models mechanism
Source: (Mulgan et al., 2011)

Social impact investing merges philanthropy and commercial investment. Typically, the charity focuses on achieving socio-economic goals with no expected financial returns, whilst traditional commercial investment mainly focuses on achieving financial returns. These two attributes thus complement each other and strengthen the case of social impact investing (OECD, 2019).

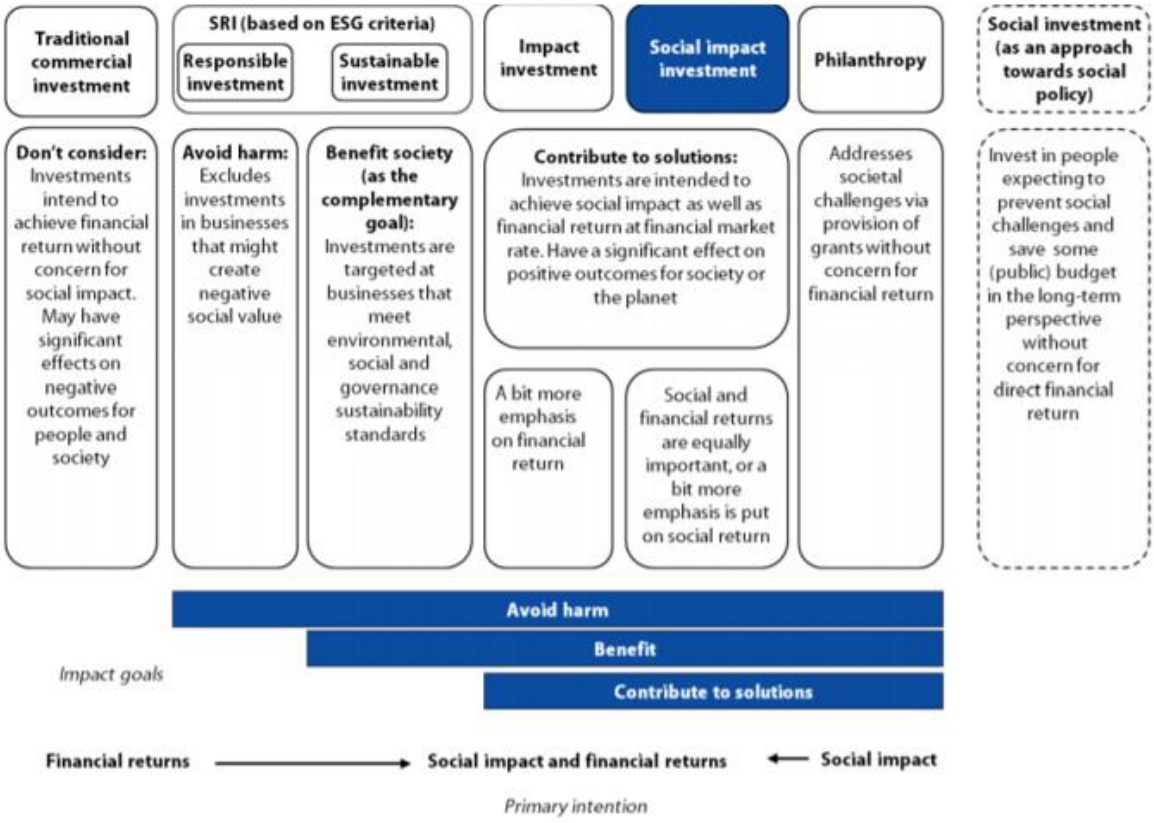

Figure 2: Social Impact Investment vs Other Alternative Funding Models

Source: (OECD, 2019)

Social Impact Bonds can be further sub-divided into philanthropic, commercial and public sector social impact bonds. The philanthropic social impact bonds funds are raised from philanthropists, the intended project/programme is then executed through an implementing agent, and the contracted state institutes pay for achieved outcomes (Mulgan et al., 2011). This will be an ideal model which is suitable for the rehabilitation of derelict mines. However, the rehabilitation of mines requires vast cash outlays, which may be challenging to raise through philanthropists.

In the public sector social impact bonds, a Government Department/Local Authority borrows the required funds from the market to finance a social impact programme. The Central Government then makes interim payments when particular milestones are achieved (Mulgan et al., 2011). This works more like an incentive programme where the Government Department/Local Authority only gets funded for achieving set impact goals.

This model can be set up with little difficulty with minimal role players. Like all other pay for success models, the major challenge will be on measuring the outcomes/impacts against set baselines. The cost of capital raised using this model is expected to be low, with minimal transaction costs and overheads. A financial asset is created in commercial social impact bonds, allowing financial market players (banks, pension funds etc.,) to invest in it. Social impact bonds are then invested into Special Purpose Vehicles (SPVs) with pay for success contracts with public entities(Mulgan et al., 2011). The investors will have access to information about the programmes that the SPVs are implementing; thus, they will assess the risks and returns of investing in the SIB.

The philanthropic social impact bond theoretically looks like the ideal model to adopt in terms of social impact investment. However, this will not be easy to implement to rehabilitate derelict mines; sourcing the required huge funds from philanthropists might not be possible. The public sector social impact bonds will thus be more practical, and an entity such as DMRE could adopt this approach in the rehabilitation of derelict mines.

(2) Sustainability Funding

Sustainable and responsible investment (SRI) is defined as a long-term oriented investment strategy that emphasises environmental, social and governance (ESG) factors in the criterion used to select securities. benefit society by influencing the behaviour of companies." SRI considers the impact of ESG effects created by companies/programmes they invest in (Jorn op den Camp, 2018).

Before investing in a company/programme, investors consider 'a company's performance concerning its effects on nature, its relationships with employees, clients and society, and the transparency of its governance' (Park, 2018). Sustainable investment attempts to formulate positive impacts by focusing investment in organisations that prioritise social justice and environmental sustainability (Park, 2018)

DMRE could raise a debt instrument like the sustainability linked bond to raise funds to rehabilitate derelict mines. Sustainability bonds, a hybrid of social and green bonds, support social and green projects or projects that expressly address social and environmental impacts (Park, 2018). This may be well received by investment companies who want to increase their ESG scores.

(3) Green Bonds

Park (2018) defines green bonds as a use of proceeds instruments that raise funds for low-carbon and climate-resilient 'green' projects. (Park, 2018). The International Capital Markets Association (ICMA) published the Green Bond Principles (GBP) that state that 'green bonds are any type of bond instrument where the proceeds or an equivalent amount will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible Green Projects' (ICMA, 2021).

(Clapp et al., 2016) point out that green bonds are fixed securities that are attractive to socially responsible investors who seek to strengthen their portfolios with eco-friendly instruments. This has led to global growth in investments in the bonds as investors respond to climate change and strive to meet the needs of the Paris Agreement (Park, 2018). However, green bonds are usually not the sole factor considered in project financing decision-making and are still relatively nascent (Tolliver et al., 2019).

For this cause, their exclusive use for rehabilitating derelict mines may be challenging to implement successfully. Although the use of proceeds of green bonds is earmarked explicitly for the finance of 'green' projects, it can be used to rehabilitate derelict mines whose perpetual existence impacts climate change. DMRE could issue a specific green bond to raise additional funds for the rehabilitation of such mines.

(4) Crowd funding

Crowdfunding is an increasingly popular technique of raising small amounts of money from a large number of individuals, usually over online platforms, to fund a project or endeavour (Hong & Ryu, 2019). Ironically, even with low expected returns, crowdfunding attempts seem to raise the desired funds successfully. The practice is thus closely linked to charity and philanthropy acts where the crowd funders derive intangible gratification through their actions (Hong & Ryu, 2019).

Crowdfunding has proved to be resilient and continues to grow during the Covid 19 pandemic, mainly spurred by new entrants into the space, like millennials (Chandler et al., 2021). Crowdfunding requires a strategic campaign and widespread exposure to the target participants to convince them to support the particular initiative (Tafesse, 2021). The narrative of the health, social, environmental and economic negative impacts of the derelict mines could be channelled into raising funds via crowdfunding. The concept itself has not been tested for this type of programme, but there is a good possibility of its potential success (Mulgan et al., 2011).

2.2 Summary and conclusion

2.2.1 Summary of literature reviewed.

South Africa has a long mining history dating back to the 19th century (Tonder et al., 2009). For a long time, the country had inadequate legislation which did not prioritise the protection of the mined environment; many mines were thus left unrehabilitated by various mining companies. As a result, there are almost 6000 such mines in South Africa covering different commodities (Cornelissen et al., 2019). The environmental, social, health and safety negative impacts of these mines are well researched and documented. The perpetual existence of the mines and associated risks and hazards constitutes a breach of fundamental human rights. Illegal mining activities in derelict mines exacerbates the risk and hazards. Illegal miners re-open previously sealed mine shafts and contribute to the pollution of waterways.

The historical causes of the derelict and ownerless mines' existence due to flawed legislation have also been well researched and documented. In 2002, through MPRDA, the DMRE put in measures to curb the resurgence of derelict mines. Current mines are now legally required to submit a mine closure and complete rehabilitation plan and have financial provisions to execute this. Literature also reveals limited funding as a significant cause for the slow pace of eradicating the existing derelict mines. Alternative financing, in addition to the current state funding of the D&O programme, will help speed up the process.

The use of alternative funding models, like the outcome-based models, to finance public programmes has been steadily growing in developed countries like the UK (Edmiston & Nicholls, 2018). It may have its place in the rehabilitation of derelict and ownerless mines in South Africa. The research, therefore, aimed to delve into the assessment of possible alternative funding channels to solve the problem of derelict and ownerless mines and their resulting harmful effects on humans and their environment.

3 RESEARCH STRATEGY, DESIGN, PROCEDURE AND METHODS

3.1 Research strategy

A descriptive observational study was conducted, which enabled the researcher to study and describe the distribution of variables on the research phenomenon without regard to any causal or other hypotheses (Aggarwal & Ranganathan, 2019). A descriptive study design allowed for adequate research into various projects funded by different funding models and a further prompt into which funding models can be adapted to rehabilitate derelict mines.

A study conducted in Canada to establish a toolkit of funding options for the rehabilitation of derelict mines employed a qualitative approach (Cowan & Mackasey, 2006). This study was interested in establishing funding options and investigating the phenomenon further as the area is under-researched. The approach enabled the researchers to assess the impacts of using alternative finding models and explain motivations and the decision-making procedures that influence the adaptation of such funding options. Intrinsically, the current study also employed research tools that allowed for collecting qualitative responses to obtain an in-depth understanding of funding models that could be used.

3.2 Research design

The descriptive observational study approach selected for the study can use varied designs such as case-control, cross-sectional, surveys and case reports, all with their advantages depending on the research problem they intend to address (Aggarwal & Ranganathan, 2019).

Quantitative designs are concerned with collecting and analysing numerical data to describe the sample, make predictions, and test causal relationships(Ragin et al., 2004). In contrast, qualitative designs are subjective in nature, and are much concerned with establishing answers to the whys and hows of the phenomenon in question. A qualitative study was conducted in this research.

This design was used to investigate preferred funding models from the perspective of key stakeholders through an evaluation of established variables. Qualitative research elements were used to understand the reasons assigned to selected funding models among identified key stakeholders.

3.3 Research procedure and methods

3.3.1 Research data and information collection instrument(s)

Data collection is an essential step in research; it needs adequate planning and structure as it controls what results will be obtained and if the research question is adequately answered (Hox & Boeije, 2004). The researcher made use of a semi-structured questionnaire and in-depth interviews. A systematic literature review was conducted to investigate the different alternative funding models employed in various sectors which could be adapted for use in the rehabilitation of derelict and ownerless mines.

The study was conducted amongst identified critical stakeholders in the rehabilitation of derelict mines area. The open-ended questions in the questionnaire were discussed during an in-depth interview session,

3.3.2 Research target population and selection of respondents

3.3.2.1 Research target population

A target population is a total group of people, individuals or units from which a sample is drawn (Aggarwal & Ranganathan, 2019). A study conducted to assess funding models for financing water infrastructure in South Africa targeted interviewing role players in the water infrastructure sector, financial institutions and public officials (Ruiters, 2013).

This study followed a similar approach; stakeholders from both the mining and financial sectors were the target population for the cross-sectional study. It is believed that for the funding options to be well received and have sufficient buy-in, all stakeholder insights and perspectives must be investigated and considered (Viveros, 2017). Therefore, all mining stakeholders from both the mining and financial sectors were selected as the target population for the cross-sectional study.

3.3.2.2 Sampling or selecting respondents from the target population

A sample is a representative extraction from the population, that when studied, its results can be generalised to the entire community.

The study conducted by Ruiters (2013) to assess funding models for financing water infrastructure in South Africa gave a higher weighting of role players directly involved in financing water projects. For this study, only those stakeholders key to the financing and management of derelict mines were considered. Purposive sampling is concerned with selecting participants based on a research criterion (Mohsin, 2016).

A total of 15 stakeholders were purposively selected to participate, such as philanthropists (2), investors (8), and the implementing team (3), the client/national government departments (2). This number was selected as a guide, and hence, the reach of data saturation remained a key determinant for the number of people who were eventually included in the study.

The researcher only managed to interview 12 participants.

3.3.3 Ethical considerations when collecting research data

Ethics is the branch of philosophy dealing with decision-making dynamics on what is right and wrong. Research ethics involve requirements on daily work, the protection of the dignity of subjects and the publication of the information in the research(Ragin et al., 2004). The researcher is an Engineer working in the field of Derelict mines. This research answered long-standing questions regarding alternative funding streams which can be used to relieve government spending and speed up the rehabilitation process.

The researcher was interested in the type of recommendations that this study has established and did not over-exert his knowledge and influence in any way. As this study aims to fill the knowledge gap identified in terms of funding sources, all responses were thoroughly investigated to seek clarity and increase the understanding of funding options from stakeholders' perspectives.

The research study protocol was presented to the Research Ethics committee for sufficient approvals to be granted before the study commenced.

The approval reference number is WBS/BA1945291/903. All key informants were advised on what the research study is about, and their consent for participation sought before the interview meetings. Participants were then asked to sign a written consent form (Appendix 1.11) as a formal participation agreement. Although the interview did not require any personal information about the informant, interviews were still conducted in a free environment without disturbances and open discussion.

The meetings were recorded with consent from the participants to ensure that the interviewer engages sufficiently with the interviewee and has reference notes to capture from the recordings thereafter. In addition, participants were assigned a unique identifier that enabled the observance of confidentiality to protect the information provided by participants.

3.3.4 Research data and information collection process

The first step of the research was to identify the stakeholders to be interviewed from the funders, investors, implementing partners, state departments and philanthropists. A telephone call was scheduled for initial introductions and that of the topic. Verbal consent for participation was sought thereafter, followed by written informed consent.

Participants were mailed the interview questionnaire and summary of the research objective to familiarise themselves with interview questions to allow for a fruitful discussion on the scheduled interview date. Interviews were then conducted using online virtual platforms. All participants were assigned a unique identifier that made it easier to identify them while protecting their identity, i.e. P02. The stakeholders were all thanked for their participation and promised a copy of the study finding upon study completion.

3.3.5 Research data and information processing and analysis

3.3.5.1 **Research data and information processing**

The key informant interviews produced a document trail in the form of interview notes, audio recordings. All audio recordings were transcribed verbatim to ensure a thematic analysis is conducted. All interview notes were labelled using the unique identifier assigned to each participant.

Preliminary literature analysis was conducted to understand the emerging relations between variables and source areas needing further elaboration and clarifications. This analysis was used to structure the interview guide and resultant prompts. The stakeholders were phoned to arrange one-on-one in-depth interviews. The consent forms were completed before the interview process, which was recorded. The recording was used to capture verbatim the contents of the interview. The transcripts were developed in order to identify significant themes and thus uncover the findings of the research.

3.3.5.2 **Research data and information analysis**

The qualitative data were coded and analysed thematically to assess and identify emergent themes. The thematic analysis ensures that appropriate recommendations are drawn from the research. Fereday & Muir-Cochrane (2006) clarified that thematic analysis is a procedure used to identify themes or highly valuable perceptions in unstructured verbal information. Hence, thematic analysis of information entails relationship identification inside qualitative data, and the emerging ideas become the

classifications for qualitative evaluation. Nowell et al. (2017) illuminated that thematic analysis is a qualitative research method commonly used across various methodologies and research queries. Thematic analysis is typically applied to verbal information, such as interview transcripts.

The researcher closely examines the data to identify common themes – issues, opinions, and patterns of the connotation that come up frequently. There are different methods to performing thematic analysis, but the most common form follows a six-step procedure that includes familiarisation, coding, generating themes, reviewing themes, defining and naming themes, and writing up (Nowell et al., 2017).

Thematic analysis is an adaptable procedure that can be successfully used in several different studies (Nowell et al., 2017). Braun & Clarke (2006) identified two approaches to thematic analysis known as the inductive and deductive approaches. According to the authors, an inductive approach involves allowing the data to ascertain themes, while a deductive approach involves having some predetermined themes the researcher expects the data would reflect, founded on theory or existing knowledge. In this study, the researcher chose the inductive approach in which the interview data determined the themes.

This qualitative evaluation employed a sample of twelve research participants comprised of stakeholders in the South African mining and financial industries. The interview transcriptions were captured into NVivo 12, and then each interview transcript was thoroughly read, and the most helpful evidence was coded into themes using the NVivo 12 programme. The twelve research participants were identified as P01 to P12 to protect their confidentiality, as decided at the beginning of the study. The coding process resulted in themes that would answer the research questions. In Figure 3, there are five nodes and sixteen child nodes that emerged from the unstructured qualitative interview data collected.

4 PRESENTATION OF RESEARCH RESULTS

4.1 Introduction

Chapter 4 is a presentation of the outcomes of the study. In this segment, the results are presented in the best observable manner to interpret better the qualitative data gathered. The essential ideas that surfaced from the evaluation were carefully chosen and then matched with the existing literature and statements from the research participants to answer the research questions. The research aimed to evaluate the different funding models that may be used as alternative funding for derelict mines and assess their efficiency as perceived by various key players in the South African mining and financial industries.

The analysis produced five themes which were labelled as 'characteristics of the funding models', 'preferred funding models', 'specifications influencing adoption of funding models', 'types of funding models' and 'unpreferred funding models'. These themes are presented under the following research questions:

4.1.1 Funding models used to fund the rehabilitation of derelict mines successfully

The central theme that emerged under this research question is 'types of funding models'. The research participants identified state funding as the primary source for the funding of rehabilitation of derelict mines. The views were primarily premised on that since the mines are derelict, the State should carry the liability to rehabilitate the mines and provide the citizens with a safe, healthy and sustainable environment.

The other identified funding options were commercial debt and private equity, mainly when licenses were issued for re-mining and rehabilitating abandoned mining dumps. This option was determined as applicable where commercial profit could be generated from re-mining/reprocessing derelict mine dumps while also rehabilitating them. The following quote supports this view:

"Private Equity and Commercial debt for the re-mining and rehabilitation of gold dumps …" (Table 1, P10)

The participants from state organisations mainly identified state funding as a model that can successfully rehabilitate derelict mines. In contrast, those in commercial institutes like banks and fund managers identified commercial debt and private equity as appropriate funding models. This was noted in the following quote:

"The second funding model was through the parliamentary budget for the DMRE to rehabilitate D&O dumps and sites which is inadequate so far." (Table, P11)

The reasons given by the participants working in commercial institutes were that commercial debts and private equity could only be applied in viable business ventures. At the same time, the State had a duty to serve the citizens without necessarily generating profit in the process.

In some cases, resources were donated by big mining houses to enable junior miners to rehabilitate abandoned dumps. It was inferred that the big mining houses did this as part

of their social contribution and incubation of smaller businesses. The following quotes support this finding:

"One option used was big mining houses donating the resources to assist juniors miners to rehabilitate derelict dumps." (Table 1, P12)

The results show that the types and sources of funding models that have been used for the rehabilitation of derelict and ownerless mines include big mining houses, capital markets, commercial debts, government funding, private equity, and self-funding.

4.1.2 Characteristics of projects funded via alternative funding models

The central theme which emerged under this research question was the 'characteristics of the funding models'. The participants used the characteristics of the alternative funding models, micro and macro factors to determine which projects could be funded. It was also observed that decisions were mainly guided by failure and success factors.

The participants in commercial institutes mainly identified meeting the ESG requirements as the main characteristic for receiving alternative funding. Most participants also described sustainability as the broader character that can be used to determine which projects to fund. Although still at a nascent stage in South Africa, funding of sustainability projects that meet ESG requirements was identified to be rising. One of the key drivers of the rise in ESG funding emanates from investors demanding higher transparency levels and their willingness to contribute to alleviating socio-economic challenges. These views are supported by the following quote:

"I think it is still a nascent sector with only 9 instruments listed currently with a market capitalisation of R9 billion. The sector needs to scale up and grow... However, for the success factors, I think the sustainability segment demonstrates your commitment and contribution to a sustainable economy, diversifies your funding instruments, provides the potential for improved pricing, allows access to deep pools of capital, appeals to a more diverse investor base, offers a highly regulated and secure trading environment, and allows you to match your capital raised to your asset's intention. In addition, it appeals to the increased market demand for these instruments and enhances your visibility and profile." (Table 1, P03)

The measurability of the intended outcomes and the enforceability of contracts also emerged as a determining characteristic. The participants further explained that this was driven by the need to protect the investment and ensure that intended use is achieved. The following quote supports these views.

"..Remedies – enforcement of remedies both from the contractual point and the rule of law in the nations. The contracts should be enforceability/ability to stipulate the remedies in an enforceable contract." (Table 1, P01)

Specifically, for the rehabilitation of derelict mines projects, private equity investors named the main characteristics required for funding as safety, security, profitable re-mining and profitable post-rehabilitation land use. The participants again attributed this to the protection of investment and investing in viable projects. The ensuing quotes support these findings:

"…I think there must be changes in the way things are done in the industry… illegal miners and communities, gold price fluctuations are some of the failure factors to consider…Sovereign issued bond: end line activities, how will the cash flows be managed… and whose the rehabilitation implementor…" (Table 1, P02)

In terms of the failure factors, the study found that there are agency problems in disbursing and managing funds. The participants further explained that this view was based on the risk of the funds being mismanaged. The following quote supports this view:

"I think there is a moral hazard of not using your own funds. Someone can pretty much do anything with someone else's money – agency problem. In addition, the outcomes may be difficult to measure/disputed and measuring may not be concise as expected. Also, agency problem on the parties that are tasked with disbursing funds and monitoring outcomes. In terms of the success factors, the social impact bonds give leeway to the sponsors to achieve their goals without the pressure of commercial returns and can be implemented with stipulated benchmarks. I am saying this as opposed to commercial debt or private equity… you can stipulate benchmarks timelines, quality of inputs…" (Table 1, P01)

In the main, the results show that sustainability projects that meet ESG requirements are more likely to attract alternative funding. The projects should also meet the success and failure factors. In terms of the failure factors, the study found that there are agency problems in disbursing and managing funds, and the outcomes may be challenging to measure.

It was also noted that particular outcome-based funding models like the social impact bonds give leeway to the sponsors to achieve their goals without the pressure of commercial returns. Further, the alternative funding sector is only at the nascent stage with few listed instruments.

4.1.3 Funding models preferred by key players in the mining sector in South Africa

The main themes that emerged under this research question are 'preferred funding models' and 'unpreferred funding models'.

Under the 'preferred funding models' theme, most participants identified different bonds that the State can issue. Various bond instruments were selected, including Government-issued impact bonds, green bonds, sovereign bonds, and sustainability linked impact bonds. Ironically, most participants from the financial institutes' main desired characteristic of all the proposed bonds were that it should somehow be sovereign guaranteed. The reason for this was also identified as security and protection of investment as the State was less likely to default on the bond. The following quote support this.s

"…I would say a government-issued impact bond with a return aspect which you only get if you meet the target. There is a character aspect to it, Government would likely not default on the bond, and they would have resources to monitor the outcomes and pursue a party that does not meet its contractual outcomes." (Table 1, P01)

"I think… for example, green bonds are preferrable in the rehabilitation of mined environment… because they have to ensure sustainability and also keep their business profitable, they don't want to

take a chance with their business; they want the business to grow up and also make the economy environmentally sustainable…" (Table 1, P04)

"…Social bonds, social impact bonds, sustainability linked bonds, green bonds … these are social and environmentally friendly instruments to consider when building an inclusive economy." (Table 1, P05)

"…social impact bonds and green bonds…issued by the government … would help in the funding of the rehabilitation of these abandoned mines and would bring about sustainability in our communities." (Table 1, P06)

A smaller percentage of the participants mentioned funding from non-profit organisations and grants. This was mainly proposed by participants from state organs and mining institutes. These participants believed that financial institutes would likely not be willing to participate in rehabilitating derelict mines. This is supported by the following quote:

"Since there is no commercial consideration in the rehabilitation activity, what you would consider is government funding or NGO funding or social impact funding or grants… " (Table 1, P12)

For the 'unpreferred funding model' theme that emerged, the participants identified private funding (equity or debt financing) as unsuitable or undesirable. The private equity investors who supported this were not willing to directly invest in government ventures like the rehabilitation of mines if there was no direct commercial benefit from the exercise. The following quote supports this.

"Any private funding. As an investor, I will not put my money if there are no proceeds from the rehabilitation process… any private funding. As an investor, I will not put my money if there are no proceeds from the rehabilitation process – I will consider it if given money to re-mined the dumps that still have commercial value and have the rehabilitation liability passed on to me. It has to, of course, make financial sense in that there is still profit after spending money on rehabilitation" (Table 1, P02)

A minority component of the participants identified donor funding/philanthropy as an unlikely/unsuitable source of funds for rehabilitating derelict mines. These participants believed that the funds will not be appropriately monitored and will be likely subjected to agency risks. They also thought that donors/philanthropists would be more willing to channel their funds to other humanitarian initiatives like dealing with pandemics (COVID-19, HIV etc.) The ensuing quote supports this.

"*From the perspective of a neutral party, the least preferably will be donor funding.... since the monitoring will not be as good since there is no commercial return incentive for achieving the goals. There is also a risk of a moral hazard from whoever is implementing and whoever is monitoring."* (Table 1, P01)

The results show that the preferred alternative funding models for the rehabilitation of derelict and ownerless mines in South Africa are Government issued impact bonds, green bonds, sovereign bonds, and sustainability linked bonds.

On the other hand, the results show that private funding is the unpreferred alternative funding model. In contrast, donor funding is the unlikely model for rehabilitating derelict and ownerless mines in South Africa.

4.1.4 Specifications and conditions that will influence the adoption of different funding models.

The central theme that emerged was 'specifications influencing adoption of funding models'. The specifications and conditions that came up were mainly concerned with the financial protection of the investor and investor confidence. The prevailing macro environment was identified as the reason for the apparent wariness of participants from the financial institutes.

The participants further identified measurability of performance, viable business outcomes, and enforceability of remedies. Proven use of proceeds was identified as a critical metric for funds to be channelled towards specific investment instruments like green bonds. The following quotes support these views.

"There should be measurability of performance, sellable incentive mechanisms, and enforceability of remedies. As an investor, before I put money/invest, the most important metric would be performance measurement." (Table 1, P01)

Most participants identified return on investment (ROI) as a critical requirement. The required return on investment was required to be 15% and upwards by some participants. The intuition behind these views was that, particularly in the South African setup, alternative investment in the rehabilitation of derelict mines was relatively untried. This is supported by the following quote.

"Rehabilitation is an expensive business, which can account for as much as 10% of mining costs in certain circumstances. Return on investment (ROI) should be greater than 15% and also investment exit options, investor protection clauses, and credibility of the issuer…" (Table 1, P09)

Additionally, participants from all sectors interviewed were concerned about the State's measures to curb the re-occurrence of derelict mines. The participants felt the State has a duty to put efforts in place to guard against this. The following quote supports this.

"In addition, there is now a requirement to provide financial assurance that the costs of rehabilitation will be met in the case of early or unplanned closure… that is there should be credibility, easy to understand…" (Table 1, P07)

The results show that the specifications influencing the adoption of alternative funding models for the rehabilitation of derelict and ownerless mines in South Africa are investor protection and credibility of the bond issuer.

4.1.5 Summary

The emerging themes and supporting quotes are summarized in the table below.

Table 1: Research participants' view on the different funding models linked to the interview questions

Interview Question	Theme	Supportive Quote
What would you consider to be the key success/failure factors of these models?	Characteristics of the funding models	*"Remedies – enforcement of remedies both from the contractual point and the rule of law in the nations. The contracts should be enforceability/ability to stipulate the remedies in an enforceable contract."* (P01) *"Sovereign issued bond: end line activities, how will the cash flows be managed… and whose the rehabilitation implementor…"* (P02) *"…still a nascent sector. Only 9 instruments listed currently with a market capitalisation of R9bn. The sector needs to scale up and grow."* P(03)
Of the models chosen above, which ones would you consider to be more suitable? What would you consider to be key factors in choosing a funding model? If the conditions mentioned before are in place, in the current South African macro environment, how likely are you to invest or recommend investing funds in your preferred model? If the funding instrument is sovereign guaranteed please select one of showing your likelihood of investing: Highly Likely, Likely, Neutral, Not likely.	Preferred funding models	*"… for example, green bonds are preferrable in the rehabilitation of mined environment…"* (P04) *"…Social bonds, social impact bonds, sustainability linked bonds, green bonds …"* (P05) *"…social impact bonds and green bonds …"* (P06)

What conditions would be critical for you to invest/recommend investing funds in the model for the rehabilitation of derelict and ownerless mines? What conditions would you consider to be a 'deal breaker' before investing funds in your preferred model?	Specifications influencing adoption of funding models	*"In addition, there is now a requirement to provide financial assurance that the costs of rehabilitation will be met in the case of early or unplanned closure."* (P07) *"In some developed countries, funding relates to health and safety matters and about 5% to environmental issues."* (P08) *"Rehabilitation is an expensive business, which can account for as much as 10% of mining costs in certain circumstances."* (P09)
What types of funding models/instruments have you employed in the funding of sustainable, development; social impact and ESG projects?	Types of funding models4	*"Private Equity and Commercial debt for the re-mining and rehabilitation of gold dumps…"* (P10) *"The second funding model was through parliamentary budget for the DMR to rehabilitate D&O dumps and sites which is inadequate so far."* (P11) *"One option used was big mining houses donating the resources to assist juniors to rehabilitate derelict dumps."* (P12)
For this question, please make reference to a project conducted using the alternative funding model discussed above.	Unpreferred funding models	*"From the perspective of a neutral party the least preferably will be donor funding...."* (P01) *"Any private funding. As an investor, I will not put my money if there are no proceeds from the rehabilitation process…"* (P10) *"A "social bond" is not just a name. The term refers to a specific class of instruments that investors use to achieve non-financial social objectives…"* (P03)

4.2 Conclusion

Chapter 4 has presented the results of this study. The data analysis results have been presented to evaluate the research participants' views on the different funding models that may be used as alternative funding for derelict mines and assess their efficiency as perceived by various key players in the South African mining and financial industries. Chapter 5 discusses the results with respect to the research questions.

5 DISCUSSION OF RESEARCH FINDINGS

Chapter 5 discusses the data analysis results presented in Chapter 4 with respect to the research questions.

5.1.1 Types of funding models used to fund the rehabilitation of derelict mines

The study's findings show that the types and sources of funding models used to rehabilitate derelict and ownerless mines include big mining houses, capital markets, commercial debts, government funding, private equity, and self-funding. The study found that most participants felt that the state should be liable for funding the rehabilitation of derelict mines since it has a duty to ensure a safe and healthy environment. The observations are in line with the practices adopted locally and globally, according to literature. In the United States of America (USA), the US Environmental Protection Agency (EPA) manages the Superfund, where the State provides funds to rehabilitate contaminated legacy mine sites (Cornelissen et al., 2019).

In Australia, the State provides for rehabilitating abandoned mines through the Mining Rehabilitation Fund Act (Cornelissen et al., 2019). The derelict and ownerless mines rehabilitation programme in South Africa is funded through the Medium-Term Expenditure Framework (MTEF) allocation by Treasury to DMRE (Cornelissen et al., 2019). The study also found that big mining houses sometimes contribute to the rehabilitation of derelict mines by voluntarily assisting smaller/junior miners.

In contrast, in the USA, the rehabilitation of coal mines abandoned before 1977 is funded by operational coal mines through the Abandoned Mine Land Reclamation Program (AMLRP) (Cornelissen et al., 2019). In Australia, self-funding is also employed because the State holds private landholders accountable for rehabilitating mines on their land (Cornelissen et al., 2019).

5.1.2 Characteristics of the alternative funding models for the rehabilitation of derelict and ownerless mines

The study findings show that sustainability projects that meet ESG requirements are more likely to attract alternative funding. The projects should also meet the success and failure factors.

The finding of sustainability and ESG projects is in line with global trends. In the recent years, there has been a notable rise globally in sustainable investing as investors seek to meet their Environmental, Social, and Governance (ESG) targets. Globally in 2019, sustainable investment assets were more than US$30, a 30% increase from 2016 (Mascotto, 2020).

The rehabilitation of derelict mines intends to address environmental and socio-economic challenges. Thus, the programme meets the above criteria, which can be leveraged to seek funding. The derelict mines programme can also be packaged to attract the growing financing of sustainable development projects, as investors seek to

meet their sustainable development goals (SDG). Mutanga (2018) argues that even though mining is not directly addressed in the 17 SDGs, there is a direct link with SDG 15 (Life on Land) and SDG 6 (Clean water sanitation).

In terms of the failure factors, the study found that there may be agency problems in disbursing and managing funds, and the outcomes may be challenging to measure. Giudice & Migliavacca (2019), in their analysis of agency problems for Social Impact Bonds, found that investors intuitively preferred funding projects with lower risks of agency problems and with fewer stakeholders involved.

The measurability of outcomes was also highlighted as a critical characteristic of projects funded. This is an inherent challenge on many forms of outcome-based funding (Mulgan et al., 2011). The current derelict mines rehabilitation programme measures outcome by the number of mines rehabilitated for a given amount of funding (Cornelissen et al., 2019).

Packaging the derelict mines rehabilitation programme to meet the mentioned characteristics is achievable. In South Africa, through the Department of Mineral Resources and Energy (DMRE), the State can consider adopting this strategy to attract alternative funding.

5.1.3 Funding models preferred by key players in the mining and financial sectors

Further, the results show that the preferred alternative funding models for the rehabilitation of derelict and ownerless mines in South Africa are Government issued impact bonds, green bonds, sovereign bonds, and sustainability linked bonds.

Social Impact Bonds can be further sub-divided into philanthropic, commercial and public sector social impact bonds. On a face basis, the philanthropic social impact bonds look like an ideal model suitable for rehabilitating derelict mines. However, the rehabilitation of mines requires enormous cash outlays, which may be challenging to raise through philanthropists.

The public sector social impact bonds will be ideal, and the model can be set up with little difficulty and minimal role players (Mulgan et al., 2011). The cost of capital raised using this model is expected to be comparatively low, with minimal transaction costs and overheads (Mulgan et al., 2011). An entity such as DMRE could adopt this approach in the rehabilitation of derelict mines.

The study found that social impact bonds are highly recommended. However, Giudice & Migliavacca (2019) found that SIBs have failed to attract meaningful private capital mainly due to how the risk is apportioned. The risk allocation mechanism is too unbalanced towards investors, which affects the viability of the model.

Green bonds were also identified as a preferable alternative funding model. Green bonds are a use proceeds model, where the type of projects that can be financed must meet a stipulated classification (Tolliver et al., 2019). The rehabilitation of derelict mines can meet the broader category under green projects. However (Tolliver et al., 2019)

found that there was less funding and reporting of projects not related to energy and greenhouse gas-related environmental measures.

Though viable on paper, green bonds may be difficult to implement in South Africa to rehabilitate derelict mines successfully. This will mainly be due to the classification of environmental rehabilitation of derelict mines. They may also be limited funding in the sector since the study revealed that the sector is still nascent with only a few listed instruments.

Another preferred funding model was sustainability linked bonds, a hybrid of social and green bonds that support social and green projects or projects that expressly address social and environmental impacts (Park, 2018). These are outcome-based instruments that bridge the gap between social bonds and social impact bonds. The study found that sustainability linked bonds allow issuers that can't ring-fence proceeds to participate/ raise sustainable finance and drive sustainability activity.

The sustainability linked bonds, being hybrid in nature, address the combined challenges of green bonds and social impact bonds. This option may be more viable to implement successfully. However, the possibility of limited funding may hamper it since the study revealed that the sector is still nascent with only a few listed instruments.

On the other hand, the results show that private equity funding is the unpreferred alternative funding model. Ironically, donor funding was found to be the unlikely model for rehabilitating derelict and ownerless mines in South Africa.

The study identified private equity as an unpreferred funding model primarily because private equity investors do not prioritise environmental and socio-economic issues, rather profitable investments. Zaccone & Pedrini (2020) had contrary results. Although they acknowledge that private equity is still mainly concerned with the return on investment, their investment in ESG projects is growing. The growth is spurred on by the need for risk management, value creation and also in response to external pressures.

Donor funding was identified as an unlikely source of funds for the rehabilitation of derelict mines. The premise for this was that philanthropists might not be able to supply the considerable cash outlays required for rehabilitating mines. Donor funding also tends to be volatile depending on economic cycles (Hughes & Luksetich, 2007). With the advent of COVID 19, donor funding is being withdrawn from different sectors and refocused on alleviating the impacts of the pandemic (Quevedo et al., 2020).

Based on the discussion and research findings, the preferred funding model will be a sovereign issued bond, ideally a sustainability linked bond. Although still nascent in South African, green bonds and social impact bonds were also found to be preferred.

5.1.4 Specifications and conditions that influence the adoption of different funding models by key players

And lastly, the results show that the specifications influencing the adoption of alternative funding models for the rehabilitation of derelict and ownerless mines in South Africa are investor protection and credibility of the issuer. The study identified investor protection as a critical condition for alternative funding of rehabilitating derelict mines. The desired protection was in the form of the strength of investment contracts, enforceability of remedies, the general rule of law and good corporate governance.

This finding is generally expected, Porta et al. (2000) highlight the need to support investors through government agents and the rule of law, and they closely link this with good corporate governance. Joseph & Glen (2012) found that the flow of investments into Latin America was closely related to the strength of the judiciary system and the rule of law. The issuer's credibility was also identified as a central condition for the adoption of alternative funding models. This was widely viewed as a risk mitigation mechanisms. The study determined that the market was likely to invest in bonds issued by the state; this was purely for risk reasons since the state would not be expected to default.

Most participants identified return on investment (ROI) as a critical requirement. The required return on investment was required to be 15% and upwards by some participants. The intuition behind these views was that, particularly in the South African setup, alternative investment in the rehabilitation of derelict mines was relatively untried. This, coupled with the required significant cash outlays, increases risks that are generally inherent in alternative funding. As compensation, investors thus expect to achieve higher returns on their investments.

5.1.5 Conclusion

Chapter 5 has discussed the results of this study. Based on the research, the source of funding that has been used to fund the rehabilitation of derelict mines includes big mining houses, capital markets, commercial debts, government funding, parliamentary budget, private equity, and self-funding. The study findings show that sustainability projects that meet ESG requirements are more likely to attract alternative financing. The projects should also meet the success and failure factors.

Further, it was found that the preferred alternative funding models for the rehabilitation of derelict and ownerless mines in South Africa are Government issued impact bonds, green bonds, sovereign bonds, and sustainability linked bonds. On the other hand, private equity funding is the unpreferred alternative funding model, while donor funding will be unlikely to be practical.

Lastly, the research reveals that the specifications influencing the adoption of alternative funding models for the rehabilitation of derelict and ownerless mines in South Africa are investor protection and credibility of the issuer.

6 SUMMARY, CONCLUSIONS, LIMITATIONS, AND RECOMMENDATIONS

6.1 Summary

Based on the research, the source of funding that has been used to fund the rehabilitation of derelict mines includes big mining houses, capital markets, commercial debts, government funding, parliamentary budget, private equity, and self-funding.

The study findings show that sustainability projects that meet ESG requirements are more likely to attract alternative funding. The projects should also meet the success and failure factors.

Further, the results show that the preferred alternative funding models for the rehabilitation of derelict and ownerless mines in South Africa are Government issued impact bonds, green bonds, sovereign bonds, and sustainability linked bonds. However, the results show that private funding is the unpreferred alternative funding model, while donor funding will be unlikely to be practical.

Lastly, the results show that the specifications influencing the adoption of alternative funding models for the rehabilitation of derelict and ownerless mines in South Africa are investor protection and credibility of the issuer.

6.2 Limitations of the study

The rehabilitation of derelict and ownerless mines is currently a field with limited players; hence there is limited knowledge around it. Some of the key informants from the finance sector had limited knowledge of the current rehabilitation programme.

The current Covid 19 environment also impacted the study since interview meetings could only be conducted via online platforms. Online sessions may have reduced the robustness of the discussions and denied the researcher the opportunity to gauge the respondents' body language. Some participants pulled out of the study, citing a lack of knowledge and reprioritisation to deal with Covid 19 related issues.

6.3 Recommendations

Based on the findings of this study, the following are the most feasible and practical recommendations on the different funding models that may be used as alternative funding for derelict mines in South Africa:

1. Encourage the Government (DMRE) to consider social impact bonds, green bonds, sovereign bonds, and sustainability linked bonds as alternative funding models for rehabilitating derelict and ownerless mines in South Africa.
2. Continue the conversation through conference presentations and symposiums to quickly track the rollout and implement alternative funding models to rehabilitate derelict mines.

6.3.1 Orientation for further studies

The ensuing direction could be exploited for additional studies:

To investigate the impact of sustainability linked bonds and social impact bonds as alternative funding models for rehabilitating derelict and ownerless mines in South Africa using a quantitative research method.

Commercially beneficial post-rehabilitation land use could be further investigated as an incentive for attracting private finance.

6.4 Conclusion

Chapter 6 completes and offers recommendations on the different funding models that may be used as alternative funding for derelict mines and assess their efficiency as perceived by various key players in the South African mining and financial industries. The conclusions and recommendations stemmed from the data analysis outcomes conducted in Chapter 4 of this study. More so, these conclusions have been supported by the contemporary literature on this subject matter in Chapter 5.

7 REFERENCES

AfDB. (2016). *Why Africa Needs Green Bonds*. *7*(2), 1–8.

AfDB. (2018). *Stepping up climate action in Africa* (Issue September).

Aggarwal, R., & Ranganathan, P. (2019). Study designs: Part 2 - Descriptive studies. *Perspectives in Clinical Research*, *10*(1), 34–36. https://doi.org/10.4103/picr.PICR_154_18

Banks, S. B., & Banks, D. (2001). *Abandoned mines drainage : impact assessment and mitigation of discharges from coal mines in the UK*. *60*, 31–37.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Coetzee, H., Sebake, M. D., Board, M. D., Africa, S., Heath, G., Gold, S., & Croukamp, L. (2008). *Strategy for the management of derelict and ownerless mines in South Africa Department of Mineral Resources The National Strategy for the Management of Derelict and Ownerless Mines in South Africa Published by : Department of Mineral Resources Ownerless M*. *January*.

Cornelissen, H., Watson, I., Adam, E., & Malefetse, T. (2019). Challenges and strategies of abandoned mine rehabilitation in South Africa: The case of asbestos mine rehabilitation. *Journal of Geochemical Exploration*, *205*(June), 106354. https://doi.org/10.1016/j.gexplo.2019.106354

Cornelissen, Herman, Watson, I., Adam, E., & Malefetse, T. (2019). Challenges and strategies of abandoned mine rehabilitation in South Africa : The case of asbestos mine rehabilitation. *Journal of Geochemical Exploration*, *205*(June), 106354. https://doi.org/10.1016/j.gexplo.2019.106354

Cowan, W. R., & Mackasey, W. O. (2006). *Rehabilitating abandoned mines in Canada: A toolkit of funding options*. *October*, 49.

Druten, E. S. Van, & Bekker, M. C. (2017). *Towards an inclusive model to address unsuccessful mine closures in South Africa*. *117*, 485–490.

Edmiston, D., & Nicholls, A. (2018). Social Impact Bonds: The Role of Private Capital in Outcome-Based Commissioning. *Journal of Social Policy*, *47*(1), 57–76. https://doi.org/10.1017/S0047279417000125

Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development. *International Journal of Qualitative Methods*, *5*(1), 80–92. https://doi.org/10.1177/160940690600500107

Government Gazette, 469 Prevention 4 (2004). http://www.nsw.gov.au/sites/default/files/Government_Gazette_2_December.pdf#page=15

Giudice, A. Del, & Migliavacca, M. (2019). *Social Impact Bonds and Institutional Investors : An Empirical Analysis of a Complicated Relationship*. https://doi.org/10.1177/0899764018797480

Hobbs, P., Oelofse, S. H. H., & Rascher, J. (2008). *Management of Environmental Impacts from Coal Mining in the Upper Olifants River Catchment as a Function of Age and Scale Management of Environmental Impacts from Coal Mining in the Upper Olifants River Catchment as a Function of Age and Scale*. *0627*. https://doi.org/10.1080/07900620802127366

Hox, J. J., & Boeije, H. R. (2004). Data Collection, Primary vs. Secondary. In *Encyclopedia of Social Measurement* (pp. 593–599). https://doi.org/10.1016/B0-12-369398-5/00041-4

Hughes, P., & Luksetich, W. (2007). Income Volatility and Wealth: The Effect on Charitable Giving. *Nonprofit and Voluntary Sector Quarterly - NONPROFIT*

VOLUNT SECT Q, *37*, 264–280. https://doi.org/10.1177/0899764007310416
Jorn op den Camp, D. R. (2018). *SOCIALLY RESPONSIBLE INVESTMENT PERFORMANCE*. 7–8.
Joseph, L. S., & Glen, B. (2012). *Foreign Direct Investment in Latin America : The Importance of Judicial Strength and Rule of Law 1*. 193–202. https://doi.org/10.1111/j.1468-2478.2011.00690.x
Mascotto, G. (2020). *ESG Outlook : Five Key Trends Are Driving Momentum in 2020*. *March*, 1–7.
Mavrommatis, E., & Menegaki, M. (2017). Setting rehabilitation priorities for abandoned mines of similar characteristics according to their visual impact: The case of Milos Island, Greece. *Journal of Sustainable Mining*, *16*(3), 104–113. https://doi.org/10.1016/j.jsm.2017.10.003
Mhlongo, S. E., & Amponsah-dacosta, F. (2018). *International Journal of Mining , A review of problems and solutions of abandoned mines in South Africa*. *October*. https://doi.org/10.1080/17480930.2015.1044046
Mhlongo, S. E., & Amponsah-Dacosta, F. (2016). A review of problems and solutions of abandoned mines in South Africa. *International Journal of Mining, Reclamation and Environment*, *30*(4), 279–294. https://doi.org/10.1080/17480930.2015.1044046
Moffatt, S., & Pless-mulloli, T. (2003). *"' It wasn " t the plague we expected ." Parents ' perceptions of the health and environmental impact of opencast coal mining*. *57*, 437–451.
Mohsin, A. (2016). A Manual for Selecting Sampling Techniques in Research. University of Karachi, Iqra. University. *Munich Personal RePEC Archive*, *2016*, 1–56.
Mulgan, G., Reeder, N., Aylott, M., & Bo, L. (2011). *Social Impact Investment : the challenge and opportunity of Social Impact Bonds*. *March*, 1–38.
MUTANGA, S. S. (2018). Cleaning up after mines are long gone. *The Future of Mining in South Africa: Sunset or Sunrise?*, 232.
Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods*, *16*(1). https://doi.org/10.1177/1609406917733847
Nzimande, Z., & Chauke, H. (2012). *Sustainability through responsible environmental mining*. *August 2011*, 15–18.
OECD. (2019). *Social Impact Investment for Sustainable Development*. https://doi.org/10.1007/978-3-319-71067-9_65-1
Oroxom, R., Glassman, A., & Mcdonald, L. (2018). Structuring and Funding Development Impact Bonds for Health: Nine Lessons from Cameroon and Beyond. *CGD Policy Paper*, *January*. https://www.cgdev.org/sites/default/files/structuring-funding-development-impact-bonds-for-health-nine-lessons.pdf
Palma, P., López-orozco, R., Mourinha, C., Lourdes, A., Helena, M., & Alvarenga, P. (2019). Science of the Total Environment Assessment of the environmental impact of an abandoned mine using an integrative approach : A case-study of the " Las Musas " mine. *Science of the Total Environment*, *659*, 84–94. https://doi.org/10.1016/j.scitotenv.2018.12.321
Park, S. K. (2018). Social Bonds for Sustainable Development: A Human Rights Perspective on Impact Investing. *Business and Human Rights Journal*, *3*(2), 233–255. https://doi.org/10.1017/bhj.2018.6
Porta, R. La, Lopez-de-silanes, F., Shleifer, A., & Vishny, R. (2000). *Investor protection and corporate governance*. *58*, 3–27.
The Constitution of South Africa, 3 American Journal of International Law 691 (1996). https://doi.org/10.2307/2186692
Quevedo, A., Peters, K., & Cao, Y. (2020). *The impact of Covid-19 on climate change and*

disaster resilience funding Trends and signals.
Ragin, C., Nagel, J., & White, P. (2004). Workshop on the scientific foundations of qualitative research. *National Science Foundation*, *11*.
Rensburg, D. L. S. C. L. Van. (2012). *A multidisciplinary approach for the assessment of rehabilitation at asbestos mines in South Africa*. *2002*, 1237–1244. https://doi.org/10.1007/s12665-012-1650-y
Ruiters, C. (2013). Funding models for financing water infrastructure in South Africa: Framework and critical analysis of alternatives. *Water SA*, *39*(2), 313–326. https://doi.org/10.4314/wsa.v39i2.16
Sibiya, B. K. (2019). *Geo-environmental and physical risk associated with the derelict and ownerless gold mines from Transvaal- Drakensberg and Barberton Greenstone Belt Gold Fields , Mpumalanga Province , South Africa Bonginkosi Knowlege Sibiya* (Issue July).
Swart, E. (2003). *The South African legislative framework for mine closure*. *October*, 489–492.
Tolliver, C., Keeley, A. R., & Managi, S. (2019). Green bonds for the Paris agreement and sustainable development goals. *Environmental Research Letters*, *14*(6). https://doi.org/10.1088/1748-9326/ab1118
Tonder, D. Van, Coetzee, H., Esterhuyse, S., & Wade, P. (2009). *South Africa ' s challenges pertaining to mine closure — development and implementation of regional mining and closure strategies*. *May 2014*. https://doi.org/10.36487/ACG
Tremblay, G.A., Hogan, C. M. (2006). Initiatives At Natural Resources Canada To Deal With Orphan and Abandoned Mines. *Proceedings of the Thirtieth Annual British Columbia Mine Reclamation Symposium. Organized by The British Columbia Technical and Research Committee on Reclamation. Smithers, BC. June 19 – 22, 2006*, 11.
Tremblay, G. A., & Hogan, C. M. (2016). Managing Orphaned and Abandoned Mines – A Canadian Perspective. *Dealing with Derelict Mines Summit*, 1–25. https://www.crccare.com/knowledge-sharing/derelict-minessummit/%0Apresentations
UNEP, C. (2001). Abandoned Mines-Problems, Issues and Policy Challenges for Decision-Makers. *Santiago, Chile*.
Viveros, H. (2017). Unpacking stakeholder mechanisms to influence corporate social responsibility in the mining sector. *Resources Policy*, *51*(March), 1–12. https://doi.org/10.1016/j.resourpol.2016.10.014
Zaccone, M. C., & Pedrini, M. (2020). *ESG Factor Integration into Private Equity*.

8 APPENDICES

9 APPENDIX 1.1: DATA COLLECTION INSTRUMENT(S)

Wits Business School

Appendix 1.1a Information Sheet and Consent Form

My name is Flacco Ndlovu, I am a postgraduate student from the Wits Business School. I hereby request your consent to participate in the research study taking among investment, banking and mining industry stakeholders. **The objective of the research is to assess alternative funding models that can be utilised for the rehabilitation of derelict and ownerless mines and also to evaluate their utility and potential for adaptability.** Please read through this form carefully before signing and accepting to participate in this study.

Derelict and ownerless mines are defined as mines whose owners or mining rights or lease holders have abandoned and are not operating nor maintaining to mitigate and manage their associated safety, health and environmental impacts and can no longer be traced. Since the owners cannot be traced the liability of these mines falls back to the state.

The study entails investigating the most preferred alternative funding model/s trough literature review and case reports and interviews of purposively sampled stakeholders. Key informant interviews, will also be conducted in order to understand reasons that influence preference in terms of factors contributing to success, outcomes funded, budget cost and other contributing factors influencing preference. Interviews will be conducted via an online meeting on the dates and times selected by the participant prior to the interview date. The consent process will be conducted before each of the data collection timepoints to ensure that participants are comfortable.

Information that will be obtained from you will be used in this study only and the results obtained used to make recommendations of the most suitable funding options that can be considered in the rehabilitation of derelict and ownerless mines. The interview will take approximately between thirty and sixty minutes of your time. Anonymity and confidentiality will be maintained as much as possible at all times. Whatever answers you give during interview will be treated with utmost strict confidence and your name will not appear in the questionnaire only a unique identifier will be given to you for the purposes of this research. There will be no physical discomfort that you will suffer

Wits Business School

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during the interview as there will not be any invasive procedures, administration of drugs or collection of any specimen during the study and hence safety is guaranteed.

No personal information will be collected just perception and viewpoint on the research study as an industry expert.

There are no incentives offered for participation in the study in terms of money. I also wish to point out that your participation in the study is voluntary and should you wish to withdraw; you may do so at any time and no penalty will be imposed on you.

CONSENT

I have read and understood the objectives of the study and the fact that the information that I provide will be used only for the purposes of the study. I am willing to participate in the study and therefore give consent below.

Participant's signature_____

Date_____

Witness's signature_____

Date_____

In case of any queries or further information, please contact the following persons:

1. **Principal investigator** – Flacco Ndlovu (194 5291)

Telephone: 071 950 8777

2. **Supervisor** – Julia Mdzikwa

Research Supervisor Wits University

Telephone: 083 318 0691

Wits Business School

Appendix 1.1b: Questionnaire 1

ssment of alternative funding models for the rehabilitation of derelict and ownerless mines in Sout

Section A: Demographics

1. What is you sex?

- ☐ Male
- ☐ Female
- ☐ Prefer not to say

2. What is your age group?

- ☐ < 25 years
- ☐ 25-34 years
- ☐ 35-44 years
- ☐ 45-54 years
- ☐ 55-64 years
- ☐ 65 years and more

Section B: Organisational Characteristics

1. In which sector does your organisation operate in South Africa? e.g. Investment, Regulatory authority, Philanthropy, Funding agency etc

   _____

   _____

2. How long have you been in your current position?

- ☐ 0-5 years
- ☐ 6-10 years
- ☐ 11-15 years
- ☐ 16-20 years

☐ 21 years and more

3. What is your job function?

☐ Fund Manager

☐ Portfolio Manager

☐ Investment Associate

☐ Chief Executive Officer

☐ Other (please specify): _____

SECTION B: CHOICE OF FUNDING MODEL

1. What types funding models have you employed in the funding of sustainable, development; social impact and ESG projects.

Probes:

2. What models would you consider to be suitable for the funding of the rehabilitation of derelict and ownerless mines? And why those?

Funding model selected: (rank them, by order of appropriateness)	Reason:

3. What would you consider to be the key success/failure factors of these models?

Model	Success factors	Failure factors

4. Of the models chosen above which ones would you consider to be more suitable? And why?

5. Of the models chosen above which ones would you consider to be least suitable? And why? (Summary)

	Questions	Responses
1.	Which funding models do you prefer	e.g. Green bonds/ outcome based funds / social impact bonds
2.	Why?	
3.	Of the models identified, rank your preference on a scale of **1** (least) to **5** (most)	
4.	Preferred model	

SECTION C: FACTORS TO CONTRIBUTING POTENTIAL ADOPTION OF FUNDING MODEL

1. What will you consider to be key factors in choosing a funding model?

2. What conditions would be critical for you to invest/recommend investing funds in the model for the rehabilitation of derelict and ownerless mines?

3. What conditions would you consider to be a 'deal breaker' before investing funds in your preferred model?

4. If the conditions set in 2 above are in place, in the current South African macro environment how likely are you to invest/recommend investing funds in your preferred model?
    a. Highly Likely
    b. Likely
    c. Neutral
    d. Not likely

5. For the following questions, make reference of a project conducted using the alternative funding model discussed above-:

	Questions	Responses
1.	Name of project and funding model used Is there any literature on how the project was implemented? (published or grey literature appreciated)	
1.	What model characteristics contributed to the success of the project	*Project cost*,
2.	What matrix was used to measure success	

1.	What is / was the project cost	
2.	Project duration	
3.	What outcomes were measured	
4.	What were the other considerations	*Financial returns, risk assessments, type of implementer*

1.1 Background and context

South Africa has a long mining history dating back to the 19th century (Tonder, Coetzee., 2009). Historically there was no legislation to address the environmental impact of mining. Swart (2003) and Tonder et al. (2009) note that there were no legislative requirements for formal mine closure before 1980. The initial legislation still had weaknesses in terms of addressing the environmental impacts of mining; they further note that the *Minerals Act* (Act 50 of 1991) was the first act that attempted to address this adequately.

Mainly due to inadequate legislative framework, some of the mines were not correctly rehabilitated at the mine closure stage but became derelict and ownerless (D&O). As a result, there are almost 6000 such mines in South Africa, covering different commodities (Cornelissen, Watson, Adam & Malefetse., 2019).

The Department of Mineral Resources and Energy in South Africa defines D&O mines as 'mines whose owners or mining rights or leaseholders have abandoned and are not operating nor maintaining to mitigate and manage their associated safety, health and environmental impacts and can no longer be traced.' (DMR, 2009, p6).

These mines are an environmental hazard, which negatively affects the ecological system and result in the pollution of crucial resources like sub and surface water (Sibiya, 2019). They also pose serious health risks to affected communities in the vicinity (Moffatt & Pless-mulloli, 2003).

1.2 Funding challenges

The financial liability to rehabilitate the D&O mines is a significant burden on the state and a constraint on the rehabilitation programme. In the past ten years, about 40 of the 257 asbestos mines have been rehabilitated at the cost of approximately R800 million (Cornelissen et al., 2019). It is estimated that it will take 800 years to rehabilitate the outstanding mines at the expense of more than R100 billion (Druten & Bekker, 2017).

1.3 The research purpose (aim and objectives)

The research intends to investigate the different funding models that may be used as alternative funding for derelict mines and assess their efficiency as perceived by various key players in the South African mining and financial industries. The research also intends to evaluate if funders/investors will be willing to invest in the rehabilitation of D&O mines if incentivised by the government. Alternative funding models that may be utilised to fund the rehabilitation of derelict mines as per evidence obtained from similar projects conducted globally / Africa will be assessed.

The research will help assess which alternative funding models are preferred by key players in the mining and financial sectors in South Africa. The factors that might contribute to the adoption/roll-out of different funding models will also be investigated and critical success factors.

An investigation of alternative funding methods would bring about a massive relief on the budget and thus make available some funds to improve other issues within the mining industry. If the rehabilitation continues at the constrained pace, it is estimated that it will take 800 years to rehabilitate the outstanding mines (Druten & Bekker, 2017)

10 APPENDIX 2.1: ONE-PAGE BIO OF THE RESEARCHER INCLUDING A DECLARATION OF INTEREST IN THE RESEARCH AND FUNDERS, IF ANY

Flacco Ndlovu, a BSc (Hons) Civil Engineering holder with 14 years of experience in engineering design, construction, and project management, was the researcher of this dissertation.

He has been involved in the design, supervision and management of projects in broad engineering sectors like construction, energy and mining. He is currently engaged in mine closure and rehabilitation projects in the public sector, with more than four (4) years in the industry.

Although the researcher is involved in the field of study has was not influenced by this. The results were analysed and discussed from a neutral point. Although the researcher's tuition was funded through an employee improvement bursary, this research was not separately funded or commissioned by the company.

11 APPENDIX 2.2: ETHIC DOCUMENTATION

Graduate School of Business Administration
University of the Witwatersrand, Johannesburg

Wits Business School Ethics Committee
Constituted under the University Human Research Ethics Committee (Non-Medical)

Ethics Clearance Certificate

Ethics protocol number: WBS/BA1945291/903
This certificate is only valid with a legitimate ethics protocol number and signed by the Researcher (below).

Project title	Assessment of alternative funding models for the rehabilitation of derelict & ownerless mines in South Africa.
Investigator / Researcher	Mr Flacco Ndlovu
Nature of Project	MBA (Research Article)
Decision of the Committee	Approved, provided stakeholders and participants are guaranteed confidentiality.
Issue Date of Certificate	2021-04-09
Expiry date	Date of submission of the project report
Chairperson	Prof Anthony Stacey ☎ +27 11 717 3587 +27 82 880 4531 Anthony.Stacey@wits.ac.za

Declaration by Researcher

One copy must be signed by the Researcher and returned to the Chairperson of the Wits Business School Ethics Committee.

I fully understand the conditions under which I am authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I undertake to resubmit the protocol to the Committee.

Signature

10/04/2021
Date:

12 APPENDIX 3.1: ADDITIONAL TABLES FOR RESEARCH FINDINGS

Table 2: Interview questions, important literature review concepts, and emergent themes

Interview question	Important literature review concept	Emergent theme
(1) What types of funding models/instruments have you employed in the funding of sustainable, development; social impact and ESG projects?	Alternative funding models	Types of funding models Big mining houses Capital markets Commercial debt Environmental levy Government funding Parliamentary budget
(2) What models would you consider to be suitable for the funding of the rehabilitation of derelict and ownerless mines? And why those?	Suitable funding models for the rehabilitation of derelict and ownerless mines	Government issued impact bonds Green bonds Sovereign bonds
(3) What would you consider to be the key success/failure factors of these models?	Characteristics of the funding models for the rehabilitation of derelict and ownerless mines	Characteristics of the funding models Failure factors
(4) Of the models chosen above which ones would you consider to be more suitable?	Suitable funding models for the rehabilitation of derelict and ownerless mines Preferred funding models	Preferred funding models Government-issued impact bonds
(5) What would you consider to be key factors in choosing a funding model?	Suitable funding models for the rehabilitation of derelict and ownerless mines Preferred funding models	Specifications influencing adoption of funding models
(6) What conditions would be critical for you to invest/recommend investing funds in the model for the rehabilitation of derelict and ownerless mines?	Specifications influencing adoption of funding models Preferred funding models	Specifications influencing adoption of funding models Preferred funding models

(7) What conditions would you consider to be a 'deal breaker' before investing funds in your preferred model?	Specifications influencing adoption of funding models Unpreferred funding models	Specifications influencing adoption of funding models Unpreferred funding models Donor funding Private funding
(8) If the conditions mentioned before are in place, in the current South African macro environment, how likely are you to invest or recommend investing funds in your preferred model?	Specifications influencing adoption of funding models Preferred funding models	Specifications influencing adoption of funding models Preferred funding models
(9) If the funding instrument is sovereign guaranteed please select one of showing your likelihood of investing: Highly Likely, Likely, Neutral, Not likely.	Specifications influencing adoption of funding models Preferred funding models	Specifications influencing adoption of funding models Preferred funding models
(10) For this question, please make reference to a project conducted using the alternative funding model discussed above.	Alternative funding models	

Figure 3: The coding framework

Nodes

Name	Sources	References	Created On
Characteristics of the Funding Models	4	9	16/04/21 16:03
Failure Factors	3	4	16/04/21 16:29
Success Factors	3	9	16/04/21 16:28
Preferred Funding Models	3	7	16/04/21 16:05
Government Issued Impact Bonds	12	22	16/04/21 16:24
Green Bonds	1	2	16/04/21 17:05
Sovereign Bonds	9	9	16/04/21 16:53
Sustainability Linked Bonds	10	29	16/04/21 17:07
Specifications Influencing Adoption of Funding Models	12	200	16/04/21 16:13
Types of funding Models	12	197	16/04/21 15:58
Big Mining Houses	9	145	16/04/21 16:01
Capital Markets	10	28	16/04/21 16:18
Commercial Debt	11	30	16/04/21 16:22
Environmental Levy	10	133	16/04/21 16:51
Government Funding	11	37	16/04/21 16:50
Parliamentary Budget	9	118	16/04/21 16:01
Private Equity	11	20	16/04/21 16:14
Self Funding	11	11	16/04/21 16:16
Unpreferred Funding Models	12	12	16/04/21 16:36
Donor Funding	10	10	16/04/21 16:38
Private Funding	10	18	16/04/21 16:55

Source: NVivo 12

Table 3: Code book showing the emergent themes

Name	Description	Sources	References
Characteristics of the Funding Models	Characteristics of the funding models	4	9
Failure Factors	Failure factors of the funding models	3	4
Success Factors	Success factors of the funding models	3	9
Preferred Funding Models	Preferred funding models in the mining and financial sectors in South Africa	3	7
Government Issued Impact Bonds	A preferred funding model in the mining and financial sectors in South Africa	12	22
Green Bonds	A preferred funding model in the mining and financial sectors in South Africa	1	2
Sovereign Bonds	A preferred funding model in the mining and financial sectors in South Africa	9	9
Sustainability Linked Bonds	A preferred funding model in the mining and financial sectors in South Africa	10	29
Specifications Influencing Adoption of Funding Models	The specifications and conditions that influence the adoption of funding models	12	200
Types of funding Models	Types of funding models to fund the rehabilitation of derelict mines	12	197

Name	Description	Sources	References
Big Mining Houses	A funding model for funding the rehabilitation of derelict mines	9	145
Capital Markets	A funding model for funding rehabilitation of derelict mines	10	28
Commercial Debt	A funding model for funding rehabilitation of derelict mines	11	30
Environmental Levy	A funding model for funding rehabilitation of derelict mines	10	133
Government Funding	A funding model for funding rehabilitation of derelict mines	11	37
Parliamentary Budget	A funding model for funding rehabilitation of derelict mines	9	118
Private Equity	A funding model for funding rehabilitation of derelict mines	11	20
Self-Funding	A funding model for funding rehabilitation of derelict mines	11	11
Unpreferred Funding Models	Unpreferred funding models in the mining and financial sectors in South Africa	12	12
Donor Funding	An unpreferred funding model in the mining and financial sectors in South Africa	10	10
Private Funding	An unpreferred funding model in the mining and financial sectors in South Africa	10	18