

BINDURA UNIVERSITY OF SCIENCE EDUCATION

TOWARDS SUSTAINABLE SMALL-SCALE MINING IN MAZOWE, ZIMBABWE

BY

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DECLARATION

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STUDENT SIGNATURE

A handwritten signature in blue ink, appearing to read 'J. Kaphaizi', is written over a light blue rectangular background.

DATE: 16 NOVEMBER 2025

DEDICATION

I would like to dedicate this research to my lovely wife and children.

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Above all I give all the credit to God Almighty because life is all about His grace.

ABSTRACT

This study critically examines the drivers of unsustainable mining practices and investigates the institutional, social, and environmental dynamics shaping small-scale mining in Mazowe. Adopting a qualitative research paradigm allowed for an in-depth exploration of the lived experiences, perceptions, and institutional constraints affecting various stakeholders. Data were obtained through semi-structured interviews with 37 participants, including Ministry of Mines and Mining Development officials, Environmental Management Agency (EMA) officers, small-scale miners, and local villagers residing near mining sites. Thematic analysis was used to interpret the data, enabling the identification of recurring patterns and deeper structural issues within the sector. The results revealed four overarching themes. First, small-scale mining plays an essential socio-economic role by providing income, employment, and local economic stimulation. Second, despite its benefits, the activity contributes extensively to land degradation, water pollution, and ecosystem disturbance, largely due to weak enforcement capacity and limited compliance with environmental standards. Third, the study identified significant leadership gaps and poor coordination among miners, government departments, and regulatory institutions, which further complicate governance. Fourth, community participation in mining-related decision-making remains minimal, contributing to mistrust, conflict, and limited local ownership of mining activities. While the challenges were substantial, participants expressed readiness to adopt more sustainable practices when supported by clearer regulations, technical training, financial assistance, and improved institutional collaboration. The study concluded that strengthening institutional coordination, investing in capacity-building initiatives for miners, modernising mining legislation, improving environmental monitoring mechanisms, and ensuring meaningful community inclusion are critical steps towards achieving sustainability in the sector. By situating small-scale mining within broader debates on natural resource governance in Zimbabwe, this research contributes to scholarly understanding of small-scale mining in sub-Saharan Africa. The study also offers practical recommendations for policymakers, regulators, and mining communities seeking to enhance the viability and sustainability of small-scale mining in Mazowe.

Keywords: Sustainable mining, small-scale mining, Mazowe, Environmental Management Agency

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LIST OF ABBREVIATIONS

MMMD – Ministry of Mines and Mining Development

SSM – Small-Scale Mining

ASM – Artisanal and Small-scale Mining

EMA – Environmental Management Agency

EIA – Environmental Impact Assessment

AMD – Acid Mine Drainage

RDC – Rural District Council

SDG – Sustainability Development Goal

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The main objective of the study was to promote sustainable mining operations in Zimbabwe while focusing on small-scale mining operations in Mazowe, Zimbabwe. This chapter focused on the background of the study, problem statement, research objectives, research questions, research justification, significance of the study, research assumptions, delimitations and limitations of the study and the chapter summary.

1.2 Background of the study

Mining produces many of the essential raw materials and resources that propels societies and economies forward and technological developments to a greater extent. It stands as a key primary industry for development of many countries. However, traditional mining operations are known for their high energy consumption, high waste generation and emission of noxious gasses into the atmosphere and toxic effluent disposal into the environment. According to Sivakumar *et al.* (2019) and Guo *et al.* (2015), other negative effects of mining include topographic modifications, geological alterations, loss of vegetation, and disruptions to ecosystems. Traditional mining operations contribute to climate change by releasing greenhouse gas emissions such as methane, nitrogen oxides and carbon dioxide into the atmosphere through fuel combustion, on-site electricity generation, blasting, acid digestion, smelting, and other mineral processing techniques.

Main mining operations which release gases and waste include drilling, blasting, loading, hauling, crushing, milling, mineral processing and beneficiation processes. The effects tend to be substantial at local or small-scale mining level and tend to increase as the production scale intensifies where heavy machinery and bulk chemicals are used. This then plunged the mining industry in increased scrutiny, pressure and a diminished reputation for causing environmental harm despite providing the much-needed metals in technological advancements. However, many megastructures that most nations are proud of like the Burj Khalifa in Dubai, The Great Wall of China, Eiffel Tower in Paris, Panama Canal in Panama, and the Channel Tunnel which connects the UK to France just to mention a few, were built using materials that came as a result of mining. Some mining companies then shifted their operations by adopting greener production techniques and technology to promote sustainability (Ofinade, *et al* 2024).

Hilson G. (2000) asserted that new technologies which range from more efficient energy sources and greater air and water quality management capabilities to more efficient tailings reprocessing and management are helping mines lower their environmental footprint while simultaneously reducing production costs and improving competitiveness. Many nations including France, Ireland, Portugal, Spain, the United Kingdom, Canada, China, Finland, and the United States of America have embraced ‘green mining’ since the 19th century (Ofinade, *et al* 2024). Green mining was initially focused on planting vegetation around the mining area but has expanded to include the most efficient use of non-renewable natural resources with the least negative effects on the environment thus being adopted as sustainable mining. Throughout a mine’s lifecycle, sustainable mining employs technologies to increase environmental efficiency and keeping the mining sector competitive. Mining can coexist with many activities and societies within the same environment by reducing energy and resource consumption as well as waste production from the exploration to the past-closure stage.

The Global Reporting Initiative (GRI) Sustainability Reporting Guidelines and Mining and Metals Sector Supplement provides the leading determination methodology for defining a company’s significant environmental, social and economic impacts which includes: the control, use and management of land, contribution to economic and social development, community and stakeholder engagement, labour relations, environmental management, an integrated approach to mineral use, and mine closure plan. Sustainability in mining involves a strong stewardship, investment in modern technologies, and embracing the drive to safe operations leading to economic growth (Tanda, Genc. 2024).

World over, mining operations produces billions of tonnes of waste each year in the form of rocks and tailings. Proper handling is therefore necessary to avoid possible environmental or social risks through harmful dust and gas emissions and water contamination through leaching and acid mine drainage (AMD). Failure to properly manage waste can lead to catastrophic disasters like the 2019 Brumadinho tailings dam disaster in Brazil which resulted in death of 259 people and 11 people were recorded missing. The failure produced an approximation of over 11million cubic meters of mining waste that spread 10km downhill and reached the Paraopeba River, a major tributary of the Sao Francisco River, which is called ‘The River of National Integration’ (Rota, *et al* 2020). In suitable conditions, sustainable mining can also be attained by re-treating waste which can result in high economic value at low operational cost and minimal environmental footprint. This will in turn see the transfer of historical tailings into modern tailings storage facilities (TSF) operated with higher environmental standards.

Elikhulu Tailings retreatment plant processes approximately 1.2Mt of historic tailings per month at an AISC of \$614/oz. (Pan African Resources).

Water is one of the main ingredients that is utilised in mining operations. Its use ranges from dust suppression to providing a milling medium, slurry transportation and storage and mineral processing. Huge volumes of water are utilised on a day-to-day operation by most mines. By using modern water treatment processes like desalination and use of flocculants and thickeners, mines can significantly optimise their water cycle by continuously reusing process water in a closed loop reducing to the point of eliminating liquid discharge to the environment. This reduces demand of fresh water in mining operations and also reduces the risk of contamination of nearby water sources. The risk of contamination of water sources by mining operations and AMD can be monitored and abated by continuous sampling, testwork analysis and modelling of operations. At Barberton Mines, Pan African Mine, a highly effective closed loop water recycling circuit reuses the bulk of the released groundwater and process water for other mining processes, including water supply in the tailings retreatment plants (Pan Africa Resources Report). Locally according to a report at Freda Rebecca Gold Mine (FRGM), they have incorporated a closed loop of recycling water at their processing plant to minimise demand for fresh water. Excess water is released into special purpose evaporation ponds, while rainwater is collected in tailings and pollution control dams and incorporated into the mine water system.

Mining is a huge consumer of energy in its operations. According to a Pan African Report (2024) global gold mining operations alone are estimated to consume an estimate of 132terawatt-hours per year. The drive for sustainability in mining favours the use of clean energy and the reduction in carbon emissions. Solar and wind provide clean energy which can power mining operations with zero emissions to the environment. A solar photovoltaic plant was mounted at Elikhulu Tailings retreatment Plant in Mpumalanga, South Africa with a capacity to provide 10MW of clean energy (Pan African Report). Onifade *et al* (2024) asserted that innovations like hybrid and electric mining trucks can lower the emissions of fumes in haulage operations within mines thus lowering environmental footprint. The emergence of new power generation technologies can revolutionise the way mining impacts the environment in energy consumption.

Zimbabwe is endowed with over 60 different minerals which are widely distributed across the country with the greenstone belt and the Great Dyke being the major host of these minerals. Mining in Zimbabwe is a key industry towards economic growth with the sector generated a

record US\$5.6billion in export earnings in 2022 up from \$5.1billion in 2021. Major minerals produced include gold, PGMs, diamonds, nickel, chrome, coal, lithium and black granite. The mining sector accounted for approximately 80% of national exports in 2002 employing more than 38,000 formal jobs and 500,000 artisanal and small-scale miners and contributing over 20% to government revenue (Chamber of Mines Annual Report, 2022).

Mining operations in Zimbabwe are governed by the Mines and Minerals Act (Chapter 20:05). The Act works hand in hand with the Environmental Management Act (Chapter 20:27) amongst other regulations, which led to the formation of the Environmental Management Agency (EMA) in 2007 (Chimhowu, Manjengwa and Feresu, 2010). Both regulations among other legislations are geared towards the promotion of sustainable development in mining activities. However, the mining sector in Zimbabwe faces numerous challenges which includes environmental degradation, social conflicts and economic instability. The majority of small-scale miners in Zimbabwe are into gold mining. According to government statistics the bulk of gold is extracted by artisanal and small-scale miners. However, gold leakages are also associated with that which is extracted by artisanal and small-scale miners as they tend to sell their gold to unlicensed gold buyers which are scattered across the country. The Zimbabwe Ministry of Finance and Economic Development (2015) acknowledged that the country is losing approximately \$1.8billion USD annually particularly through the smuggling of minerals. (Tanda, Genc 2024).

Mazowe is a town in Mashonaland Central Province in Zimbabwe which is situated about 37km north of Harare, the capital city of Zimbabwe. It is situated within one of Zimbabwe's most prolific gold belts, making it one of the towns which are characterised by vast artisanal and small-scale mining activities, especially in the gold mining sector (Mtetwa and Shoko, 2021). It also hosts a lot of vibrant farming activities, conducted by both communal and commercial farmers. There is one large scale mining house in Mazowe, namely Mazowe Mine (Jumbo Mine) which was placed under care and maintenance in 2018. Most small-scale mines are characterised by small, limited working capital, mediocre mining machinery, and unskilled workforce including the management. Again, most of the small-scale mines do not have Environmental Impact Assessment certification, a key requirement by the Environmental Management Act before commencement of mining operations. This in turn results in environmental degradation during mining operations and poor working health conditions for mine workers. (Ministry of Mines and Mining Development report 2024).

1.3 Problem Statement

Against the background in the preceding statement, the problem is that many small-scale miners in Mazowe lack adequate knowledge on sustainable mining operations, and the benefits associated with it. Even following traditional mining guides is limited due to lack of skilled manpower, and adequate capital to sustain smooth running of operations amongst most small scale miners. Technological constraints, inadequate infrastructure, poor occupational health and safety standards and unsustainable resource management are also some of the challenges faced by small scale miners. Most of them do not have mine closure plans and land rehabilitation plan. Traits of sustainable mining includes environmental stewardship, community engagement, economic viability, efficient resource usage, safety and health practices, and transparency and accountability which include engagement with stakeholders and adhering to global standards. The environmental and social impacts of small scale mining are of significant concerns that need to be addressed.

Despite the importance of sustainable mining practices, there is a lack of comprehensive research and understanding of the specific challenges faced by small scale miners in Mazowe and opportunities for promoting sustainable mining in the region. This knowledge gap hinders the development and implementation of policies and interventions to address sustainability issues within the small-scale mining community. Again, with the current legislation which promotes sustainable mining, there seems to be a lack in the leadership in the enforcement and management of small-scale mining activities. Therefore, there is a need to conduct a research study that assesses the socio economic and environmental impacts of small-scale mining activities in Mazowe that also identifies the key challenges faced by small scale miners in achieving sustainable mining practices and explores potential opportunities and strategies for promoting sustainable mining. This research provided valuable insights and recommendations for stakeholders to enhance sustainable mining practices in the small-scale mining sector of Mazowe, Zimbabwe.

1.4 Research Objectives

The objectives of the study were as follows:

- a) To analyse the environmental and socio-economic impacts of small-scale mining in Mazowe.

- b) To investigate the challenges faced by small-scale miners in Mazowe in adopting sustainable mining practices.
- c) To explore the role of leadership and governance in shaping sustainable mining development among small-scale miners in Mazowe.
- d) To develop a framework towards sustainable small-scale mining development in Mazowe.

1.5 Research Questions

The study sought to answer the following research questions:

- a) What are the environmental and socio-economic impacts of small-scale mining in Mazowe?
- b) What are the challenges faced by small scale miners in Mazowe in adopting sustainable mining practices?
- c) In what ways does leadership and governance influence the sustainability of small-scale mining operations in Mazowe?
- d) What framework can be developed to promote sustainable small-scale mining development in Mazowe?

1.6 Research Justification

Various studies have focused on sustainable mining mainly in a broader perspective which is mainly applicable to large scale mining houses. Such studies include those conducted by Onifade, *et al* (2024), Maripa (2017), Hilson (2000), UNDP Bangkok Regional Hub Report (2018) which focused on mining mainly done at large scale level. The researchers considered sustainability in mining, its merits, challenges and consequences at large scale mining. When it comes to artisanal and small-scale mining, most researchers focused on their socioeconomic and environmental impact and challenges like those done by Bansah *et al* (2018), Dreschler (2001), and Zvarivadza (2018). This study mainly focused on establishing an understanding of the small-scale mining business environment in Mazowe, the operational challenges and opportunities and the possibilities and benefits of shifting towards sustainability in their mining operations with the aim of attaining sustainable mining in Zimbabwe.

1.7 Significance of the study

The research study will contribute to the existing body of knowledge on sustainable mining practices in Zimbabwe, particularly focusing on small scale mining sector in Mazowe. By

conducting a comprehensive assessment of the socio economic and environmental impacts of small-scale mining activities and identifying key challenges and opportunities for sustainable mining, this study will provide guidance for future research. The findings will have direct implications for policy makers and stakeholders involved in the mining sector in Zimbabwe. By identifying the specific challenges faced by small scale miners in implementing sustainable mining practices, and proposing actionable recommendations, this research can inform the development of targeted policies and interventions to enhance sustainability within small scale mining in Mazowe. Sustainable mining has positive benefits to the local community and this research will contribute immensely to the local community which depend on small scale mining activities within Mazowe. By assessing the environmental impacts of small-scale mining activities and benefits of sustainable mining to the environment, harm can be abated from reaching the environment.

1.8 Research Assumptions

Assumptions are drawn in this research that small scale miners in Mazowe have been operating for several years and are aware of the environmental and social impacts of their mining activities.

Again, it can be assumed that small scale miners are willing to develop their mining methods by adopting sustainable mining within their operations.

Another assumption is that the respondents to be engaged will provide honest and accurate information within the course of this research.

The implementation of sustainable mining methods will contribute to the socio-economic development and well-being of local communities around Mazowe.

Lessons and best practices from sustainable mining initiatives in other countries or large scale mines can be assumed to be fit and applicable to the context of small scale mining in Mazowe.

1.9 Delimitations of the study

This study focused specifically on small-scale mining activities in Mazowe which might not be the same case in other places within Zimbabwe.

Active small-scale mines around Mazowe mainly focused on gold mining which might differ with other mines like for instance small scale mines within the Great Dyke which mainly mine chrome and other base minerals.

The research may be limited in its ability to capture long term impacts and changes in the small-scale mining sector in Mazowe. The study focused on a specific time frame and could not account for potential future developments or changes in policies and regulations.

1.10 Limitations of the study

Challenges were encountered in data collection due to the informal nature of small-scale mining operators and potential reluctance among miners to disclose information. There were limitations in collecting reliable and comprehensive data on sustainable mining practices. To mitigate this challenge the researcher established trust and rapport with miners through community engagement and ensure confidentiality and anonymity. The researcher also used indirect data collection methods such as observations and triangulation to validate information. Also, the researcher incorporated multiple data sources, including field observations, expert interviews, and secondary data. The researcher also provided clear explanations and training on sustainability concepts to participants.

The findings and recommendations of this research may be specific to small scale mining activities within Mazowe and may not be directly applicable to other regions in Zimbabwe. To mitigate this challenge the researcher clearly delineated the scope of the study and recommended further research in other regions to compare findings and used detailed contextual descriptions to aid transferability.

The study may not extensively explore the influence of external factors such as global market dynamics, international sustainability standards on sustainable mining practices among small scale mining within Mazowe. To mitigate this challenge researcher the research acknowledged this limitation explicitly in the study and suggested future research to explore these influences comprehensively.

The study will be conducted in English posing a potential language barrier on technical mining terms to be communicated to participants due to their limited level of understanding and informal setup. To mitigate this challenge the researcher used simplified language, or bilingual interviewers to facilitate clearer communication and understanding.

The use of purposive sampling methods may introduce bias in the selection of participants, limiting the diversity of perspectives and experiences represented in the research. In order to mitigate on this challenge, the researcher complemented purposive sampling with other sampling techniques where feasible, and ensure transparent documentation of the selection process to acknowledge potential biases.

1.11 Chapter Summary

The chapter presented the background of the study and elaborated the problem statement, research objectives and questions, the significance of the study, the research assumptions, significance of the study and the justification of the study. It also highlighted the delimitations and the limitations of the study. This being the basis and guidance of the next chapter.

CHAPTER TWO

LITERATURE REVIEW

2.1 introduction

This chapter gave a critical review of the literature on how sustainable small-scale mining can be achieved and its impacts on the socio economic and environmental factors. Literature from different scholars was reviewed based on how small-scale mining is conducted, the mining methods and waste management practices, and the impacts on the environment and the surrounding society. The chapter firstly reviewed the theoretical theory surrounding sustainable mining and resource management and the conceptual theory as well. The chapter further looked at sustainable mining as a standalone topic and small-scale mining. It further reviewed literature on the environmental and socio-economic factors of small-scale mining and also the possible challenges faced by small scale miners in adopting sustainable mining practices.

2.2 Theoretical Framework

This section reviewed the theoretical framework of the study which relates to the existing theories that were used by the researcher to guide this study. Four theories were considered under review within this section namely the resource curse theory, the sustainability development theory, the Institutional theory and the resource-based view theory.

2.2.1 The Resource Curse Theory

In the resource curse theory, Fernando, (2022) asserted that the term resource curse refers to a paradoxical situation in which a country underperforms economically despite being home to valuable natural resources. John, (2010) highlighted that mineral abundance in less developed countries tends to generate negative developmental outcomes which includes poor economic performance, high levels of corruption, ineffective governance and greater political violence.

This phenomenon of worse economic performance by resource rich countries compared to countries with fewer natural resources gave rise to the concept of resource curse. This theory was first introduced by Richard Auty in 1993 and has since been used by some prominent scholars, (e.g. Jeffrey Sachs and Andrew Warner (1997, 2001), Philip Lane and Aaron Tornell (1999), Halvor Mehlun, Karl Moene and Torvik (2006)). However, the problem is that there is no universally accepted theory to explain the presence of resource curse in some countries and yet not in others. Norway is considered as one of the few countries which managed to utilise and turn natural resources as blessings rather than curses. Hence it has proved that it is possible

to increase the country's wealth and derive economic benefit from the natural resources as a country (Van de Ploeg, 2011).

Natural resources in most poor countries tend to be deemed a 'curse' more than a 'blessing' because of the outcome from exploiting the resources. For example, in Zimbabwe where there was a huge resource of iron ore, limestone and a stream of water nearby in Kwekwe and a rail network for the supply of coke once termed a blessed country due to the proximity of the natural resources which are required for steelmaking. In the resource curse theory, the availability of such resources ended up being useless and to some a 'curse' as the giant steel making company which was a major employer in Kwekwe failed to successfully utilise the readily available resources, and halted its operations in 2008 and the Government failed to resuscitate the operations (Business Weekly: online).

Another example of resource curse is of Zimbabwe's diamond reserves which have been linked to corruption, human rights abuses and economic instability. Zimbabwe's diamond revenues have been opaque, with estimates suggesting that \$2 billion USD in diamond revenues have been lost to corruption and smuggling (Global Witness, 2012). The diamond industry since the boom has also been linked to human rights abuses, forced labour, violence and displacement of local communities (Human Rights Watch, 2011). Furthermore, Moyo (2013), asserted that Zimbabwe's diamond industry did not contribute significantly to its economic development as a nation. Many small scale miners in Zimbabwe fail to grow despite having struck high grades of mineral resources mainly due to mismanagement (Maripa, 2017). The mining claims which belonged to Mazowe Mine were invaded by artisanal and small-scale miners since the company was placed under care and maintenance in 2018. The place has been a hive of activities but no meaningful revenue was received by the government of Zimbabwe from such activities since they were highly informal and mostly illegal.

2.2.2 The Sustainability Development Theory

The World Commission on Environment and Deelopment (WCED) published a report in 1987 sponsored by the United Nations (UN) and defined sustainable development as development that meets the needs of the present without compromising the ability of the future generations to meet their own needs. The report is also known as the Brundtland Report. It highlighted issues pertaining to international economy, population and human resources, food security, species and ecosystems, energy, industry and proposed principles for environmental protection. This theory provides a foundation in understanding the complexities of

sustainability in the context of small scale mining. Shi *et al*, (2019) asserted that culture, good governance, and the life support systems are important factors in promoting sustainable development.

Frankel (2012), said that countries like Venezuela, Angola, Democratic Republic of Congo and Zimbabwe host valuable mineral resources but with poor economies. The United Nations (UN) in 2015 adopted the 2030 Agenda for Sustainable Development and created 17 Sustainable Development Goals (SDG). The aim of these goals is peace and prosperity for people and the planet earth while tackling climate change and working to preserve our environment, planet earth. SDG 17 emphasises that there is need for mobilising resources, promoting investment, and sustainable development and fostering partnerships between governments and civil society and the private sector. To achieve sustainable mining development, governments should partner on a win-to-win situation to achieve economic development and promote environmentally friendly mining which yields socio economic development in the process. Collaboration and partnership between governments, civil societies and the private sector, small scale miners included, aids in the achievement of sustainable mining and economic development (UN, 2015). Neighbouring countries like Botswana and South Africa have managed to achieve economic development from mining by these collaborations for sustainability (Kabwe, 2013).

Small scale miners are well known for their wasteful mining methods, poor chemical usage, unprofessional mining management and environmentally unsafe practices (Dreschler 2001 and Zvarivadza 2024). Sustainable mining however, promotes for efficient utilisation of resources, economically and environmentally friendly mining methods and reduction of waste generation during the mining operations (Moshood et al 2024). This is in line with SDG 12 which focuses on ensuring sustainable consumption and production patterns by promoting resource and energy efficiency, sustainable infrastructure and environmentally sound management of chemicals and waste. It encourages countries and industries to adopt sustainable practices, reduce waste generation and minimize the environmental impact of production and consumption activities. It also highlights the importance of raising awareness and sustainable lifestyle and promoting sustainable public procurement practices (UN, 2015).

In Zimbabwe there is the Mines and Minerals Act (Chapter 21:05), Forest Act (Chapter 19:05) and the Environmental Management Act (Chapter 20:27) among other regulations which were placed to govern mining operations but however despite their presence there seems to exist rampant and unethical illegal mining, and unsustainable small-scale mining (Maripa, 2017).

This indicates lack in the enforcement of such regulations amongst other things like corruption within the mining sector (Tanda, 2024). The small-scale gold mining industry is known for high usage of mercury, a highly toxic chemical with adverse effects on the environment, which is used in an unsafe manner and poor disposal methods (Zvarivadza, 2019). Despite the country of Zimbabwe having ratified the Minamata Convention on Mercury in 2021, the only liquid metal in existence is still highly and widely used within the small scale gold mining sector in Zimbabwe mainly because of its high availability within the small scale and artisanal mining sector and its strong ability to recover ‘free gold’ in a very simple process of engulfing the yellow metal and also the simplicity method of recovering gold from the gold mercury compound (Mkodzongi, 2023). The miners therefore go for mercury because its readily availability, cheap to buy, simple to use and effective in the recovery of free gold which is targeted by most small-scale gold miners.

There appears to be a lack in the governance of the operations of small-scale miners within the region of Mazowe (Mkodzongi, 2020). Most of the operations are managed by incompetent personnel who lack the requisite knowledge and skill in sustainable mining. At the back drop there is a lot of loss in the process with the community losing a lot due to environmental degradation. The Environmental Management Act requires that every mine should obtain an Environmental Impact Assessment Certificate before commencement of mining operations but this is not the case on the ground (Spiegel, 2017). Most mines operate without EIA certification and even those who are certified do not have any environmental mitigation measures and mine closure plans in order to safeguard the environment after exhaustion of life of mine. Enforcement of regulations needs to be increased to improve the preservation of the environment and miners also need to be educated to incorporate social responsibilities within their plans in the mining business.

2.2.3 Institutional Theory

Institutional theory is a social science theory or framework that explains how institutions shape individual and organisational behaviour, social structures and economic outcomes in various circumstances. Institutions are defined as the rules, norms and values that govern human interaction and organise social life. According to Scott (2014), organisations are influenced by the broader institutional environment in which they operate within which includes government regulations, industry norms, cultural values and societal expectations. DiMaggio and Powell (1983) asserts that the institutional theory explains how pressures from an organisations

external environment can influence the adoption of certain practices and actions. Organisations therefore influence the environment in which they operate in and again are also influenced by the external environment in which they operate in.

Bethord (2018), explained that institutionalism goes further than just access to resources, rather relying on institutions is a means for organisations to reduce uncertainty and increase predictability and intelligibility of their actions to their environment. Thus, organisational decisions are thus influenced by institutions in according to this theory.

When applying institutional theory to sustainable small scale mining, several key considerations emerge. One of these several key considerations is the regulatory environment which focuses on the importance of formal regulations and informal norms that shapes the behaviour of organizations including small scale mining operations. Sustainable small scale mining requires a supportive regulatory environment that promotes responsible mining practices, environmental protection and social inclusions.

In the context of small-scale mining in Mazowe, institutional theory provides valuable insights into the factors that influence the behaviour of small-scale miners and dynamics towards sustainability within the mining sector. Regulations such as the Mines and Minerals Act, the Environmental Management Act, Parks and Wildlife Act and the Forest Act play a crucial role in shaping the behaviour of small-scale miners and determining their compliance with environmental and social standards.

Sometimes small-scale miners fail to get support from legal institutions and also in the right implementations of regulatory framework. In the case of Kuruneri vs Mining Commissioner Mashonaland Central, Case number HC8577/19 it was ordered by the High Court

Any mining licenses, permits or certificates which were issued in respect of such claims by the 1st and 2nd respondents without an Environmental Impact Assessment (EIA) certificate having first been issued shall be null and void and of no force and effect.

Apparently, this court order only affected small scale miners as they were the ones with certificates within Ascotvale farm in Mazowe. The decision by the high court however only affected miners within Ascotvale farm, but the same was not applied to small scale miners outside of Ascotvale farm as the Ministry of Mines and Mining Development does not require any person to produce an EIA certificate before being granted mining rights. Moreso during the process of being certified with an EIA certificate, many a times officials from the

Environmental Management Agency (EMA) request for anyone willing to engage in a mining project to be granted mining rights by the Ministry of Mines and Mining Development before being certified with an EIA certificate. Such misalignment in implementation of regulations have a negative effect on the behaviour of small-scale miners.

Institutional theory recognizes the role of institutional entrepreneurs who drive change by challenging existing norms and advocating for new practises. Moreover, sustainable small-scale mining can benefit from institutional entrepreneurs who promote responsible mining practises, engage with stakeholders and advocate for policy reforms, they provide them with mining equipment for sustainable mining, these equipment helps them to work safely within the environment of their mine. Institutional theory also highlights the role of norms and values within a society or community that shape the behaviour of organizations including small scale mining. According to Jefferis (2003), institutional theory emphasises the importance of formal regulations and informal norms that leads to sustainable small scale mining operations. Amakwa and Lozada (2015) explained that unsustainable mining within small scale and artisanal miners is linked to lack of support from financial institutions which do not recognize their operations as viable investment opportunities. By applying institutional theory to the context of small scale mining in Mazowe, a deeper understanding can be construed from the institutional factors that influence the industry and identify opportunities for promoting sustainable mining practices.

2.2.4 Resource Based View Theory

The Resource Based View (RBV) theory is a strategic management theory which is widely used as a managerial framework to determine how an organisation's resources can be utilised to achieve a sustainable competitive advantage. It mainly focuses on the internal resources and the organisation's capabilities to utilise those resources (Barney, 2001). The uniqueness thus gives the firm a competitive advantage in achieving its organisational goals. The key components of the resource based view theory are the resources: which refers to both tangible and intangible assets that an organisation possesses, capabilities: which refers to the ability of an organisation to utilise its resources effectively and efficiently, and core competences: which refers to the unique valuable capabilities that distinguish an organisation from its competitors (Grant, 1991). This theory is relevant to small scale mining in Mazowe, where miners can utilize their unique resources and capabilities to gain a sustainable competitive advantage in their operations.

The Resource Based View is based on two assumptions. One of the assumptions is that of the heterogeneity of resources within a population of companies. This assumes that a company possesses unique resources which it can utilise and gain a competitive advantage over its rivals. Such resources can be physical, for example machinery and equipment, or human capital resources which can be intelligence, experience, training, relationships and insights from employees or organisational capital resources which can be relationships within a company and its business environment (Utami & Alamanos, 2023).

The second assumption is that the complexities of trading resources across firms may create persistence in differences in resources. This is the assumption of immobility. The Resource Based View theory assumes that if valuable resources, which are costly and difficult to imitate, are owned by few companies, and they control them, such will possess a competitive advantage over rivals in the same industry (Helfat & Peteraf, 2003). Small scale miners utilise various tools in their mining activities depending mainly on their financial capabilities. Some use rudimentary tools like picks and shovels only with demolition hammers for breaking of rocks and a rope and bucket system for haulage of ore from underground to the surface. Others use compressors, jack hammers and explosives in their mining operations. In processing of ores some small scale miners utilise hammer mills with a low milling capacity of at most 1tph. Others utilise Chelian mills with a relatively higher milling capacity of about 3 to 4tph while others go for ball mills with a varying capacity from 5tph to 60tph. The higher the size and efficiency of the tools and machinery used, the greater the competitive advantage over rivals in the industry like in custom milling and custom vat leaching businesses. The following figure shows a framework of resource-based view to generate a sustained competitive advantage:

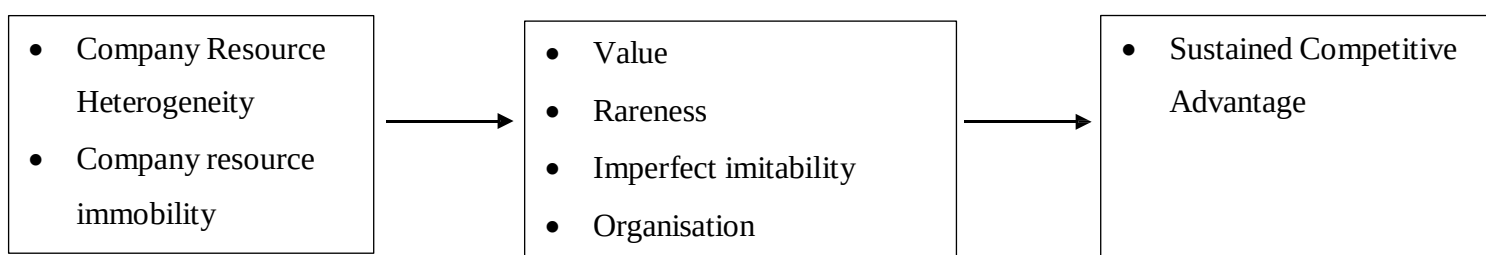


Fig 2.1: Resource Based View Framework

The Resource Based View framework shown in Fig. 2.1 includes four conditions to assess whether a resource has the potential to become and generate a sustained competitive advantage.

The four conditions are (1) Value, (2) being rare, (3) immobility and (4) organisational embeddedness of a resource (VRIO) (Barney, 2007). The framework proposes that the importance of an organisation is in such a way as to exploit the resource. This is known as the VRIO model in Resource Based View. The organisation must manage valuable, rare, imperfectly imitable resources in order to obtain and leverage competitive advantage. In the small scale mining industry there are custom milling plants which provide milling services for small scale miners without milling plants. Such millers compete for customers in order to survive and grow in the business. Again, there are also small scale miners who provide leaching services to other small scale miners without leaching plants. The same also compete for customers by utilising the resource based view theory, maximising their resources to gain sustainable competitive advantage.

2.3 Conceptual Framework

Sustainable mining in Zimbabwe requires a lot of considerations to be achieved. In the case of small scale miners there stands out more to what is required in large scale mining sector due to the informal nature of the business. Independent variables towards sustainable mining includes Government policies, regulations and enforcement mechanism, environmental management practices and social sustainability considerations which include community engagement. Dependant variables include economic, social and environmental sustainability outcomes amongst small scale miners. Next is a graphical presentation of the conceptual framework:

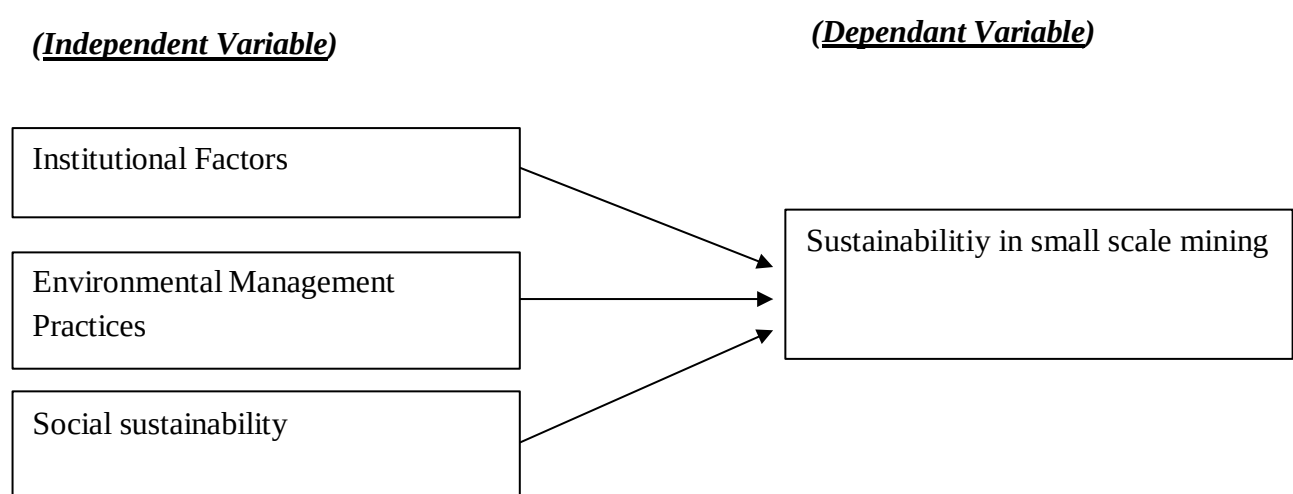


Fig 2.2: Conceptual framework on sustainability in small scale mining.

2.3.1 Sustainable Mining

According to the UN (2015), sustainable development is development that meets the needs of the present without compromising the ability of the future generations to meet their own needs. Sustainable mining refers to the extraction and utilisation of mineral resources in a way that minimises the negative environmental, social and economic impacts and promotes long term sustainable development (Ofinade, 2024). It considers the well being of local communities where mining will be carried out and engages strategies that allow for responsible use of natural resources. Governments can promote sustainable mining practices through partnerships with miners by encouraging the incorporation of the strategies listed below:

Shutting Down Illegal Mining

High unemployment rates and increased poverty can cause an increase in illegal mining activities in both unused mining shafts and registered mining sites. In Mashonaland Central areas regarded as high zones of illegal mining activities by the Ministry of Mines and Mining Development includes Phoenix Prince mining claims which belongs to Fredda Rebecca Gold Mine popularly known as Kitsi, RAN mine area also known as Garati area and Mazowe Jumbo Mine unused mining shafts after the closure of Goldfields of Mazowe mine. Illegal mining is also common at Shamva Mine where illegal miners sneak into the mine through old unused shafts (Ministry of Mines and Mining Development Report, 2024). The groups usually associated with these illegal activities have little or no regard for the environment and even their own safety which results in resource and land degradation, high source of gold smuggling, and higher chances of mine accidents. Such activities disrupt mining operations and by eliminating illegal mining, governments can put stringent measures to promote sustainability in mining.

Rehabilitating Mining Sites

Mining by nature involves the disruption and destruction of the environment on which operation are being carried out. Such activities results in air pollution, soil erosion, and deforestation. However, companies nowadays are now adopting green mining which involves the revegetation of the mining site in order to combat some of the effects of mining. Some companies now utilises dust suppression technologies to reduce to the point of eliminating air pollution by dust (Ofinade et al 2024). Mine closure plans mostly incorporate mechanisms and plans of leaving the mining site in an environmentally friendly state.

Utilisation of enviro-friendly operations, machinery and techniques.

Operations at mines utilise heavy machinery which consume a lot of fuel and emit a lot of gases into the environment. Some utilise chemicals which are harmful to the environment. Other mineral and mine operations have a high demand of water and electricity. Sustainability can be achieved by utilising eco-friendly machinery like electric-powered trucks, loaders and excavators which leads to reduction in air pollution in and around mining sites. Adopting water recycling and retreatment systems aids in water conservation and minimizes water pollution from mining activities. Implementing new technologies which recycle waste materials from the mine, minimizes environmental impact.

Social Corporate Responsibility

Mines sometimes stand out as the largest source of employment within other communities. In Zimbabwe, communities are developed around mining sites and mines end up being the highest form of formal employment within such communities. Such examples include communities around Shamva Mine, Mazowe mine, Ngezi Mine, Renco Mine, and Mimosa mine just to mention a few which were formed out of mining activities. Since minerals are finite resources, mining companies cannot continue to offer employment benefits indefinitely. Therefore, it is crucial to diversify economic activities within such communities and create commercially viable options that are not directly reliant on mining. Mines can therefore take leading plans in promoting the initiation of community based commercial enterprises. Mining companies can develop infrastructure to accommodate such investments and hand the control of such infrastructure to local authorities as part of their corporate social responsibilities.

2.3.2 Small scale Mining

Small scale mining is the practice of extracting minerals done by individuals or groups of people using basic tools with small and limited working capital. Dreschler (2001) asserted that there is some debate about the contribution of small-scale mining to sustainable development. Just like large scale mining, small scale mining is a commercial venture that aims at achieving production following normal business principles. However, the widely semi-legal and informal character of the sector mainly due to limited resources, leads to the adoption of casual business principles within the sector (Ngwenya, et al 2024). In order to achieve sustainable mining status, small scale miners need to improve on mining methods, business management, mineral processing techniques and environmental management. They also must incorporate social

responsibility within their operational communities in order to develop and support the local communities they operate within.

Sustainable mining development is mostly associated with large scale miners by various scholars mainly because of their capacity financially to incorporate new technologies and their ability to acquire and retain skilled human resources to manage their resources. However, when supported, educated and under professional guidance, there is a possibility that small scale miners can adopt sustainable mining route within their business modules (Hentschel 2003).

2.4 Environmental and socio-economic factors of small-scale mining

Small scale mining in Zimbabwe with high unemployment rate, stands out as a significant source of livelihood for many families and communities (Bansah et al 2018). Its operations are however, associated with environmental and socioeconomic factors.

Environmental Factors

Small scale mining, like other businesses, operates within an environment and has some influence over the same environment. The mining processes due to the informal nature of operations results in deforestation as trees are cut down mainly in an unordered manner resulting in loss of biodiversity and disruption in ecosystem. This is mainly done in ground clearance for shaft sinking or pit development as part of mining or setting up of mineral processing plant and sometimes for firewood. There is also a lot of land degradation in the quest of extracting the targeted valuable mineral from the ground. Gold panning on river banks results in water pollution with the usage of mercury posing a greater risk to both people and the environment. Most small-scale miners recover gold from the mercury amalgam by burning the mercury off the compound into the environment causing air pollution. Despite regulations which restricted the burning of mercury to be done in a retort, most small-scale miners don't possess such and they don't even have the knowledge of such equipment. Small scale mining also destroys habitats which leads to the destruction of flora and fauna within the environment and most small-scale miners do not revegetate their areas of operations.

Socioeconomic factors

The activities carried out by small scale miners cannot be separated from the environment in which they operate in. The socioeconomic effects of small-scale mining have been discussed by many authors. Small scale mining is known for providing employment of local communities (Hilson, 2016). It stands as a 'lucrative' form of support to poor rural communities and

contributes which attracts people of a mixed age groups from both sexes. However, small scale mining is also known for causing disputes amongst miners, villagers and farmers over various issues which includes dispute and conflicts of boundaries and fights over ores with high grades. Nwenya, et al (2024) asserted that due to poor mine planning and management which leads to negligent of the environment, the gains of small-scale mining can be overturned by the degradation of the environment due to mining operations which possess as potential deathtraps to locals and their livestock. Small scale mining is also known for creation of market places which support other businesses and become a source of revenue for other businesses which are not directly linked to mining. Villagers and other business personnel can open businesses in fast moving consumer goods (FMCG), clothing, and mining consumables business which is applicable to small scale miners. However, within such market places and the small mines there seems to be a rise in theft and robberies since within such environments there exist a sense of lack of law enforcement. This poses a security threat to such people within the community and vicinity of the mining site.

2.5 Challenges faced by small scale mining in adopting sustainable mining methods

Despite their small operations which demand little working capital and simple machinery, small scale mining have their own share of challenges. Chief among them is financial challenges. Most small-scale miners face financial challenges in funding their operations. They need finance to buy their simple mining machinery, personal protective equipment, mining consumables like diesel, explosives, mineral processing chemicals and food for the employees. Money is needed to enable and maintain a smooth running of operations. As the rock becomes more competent down underground, the more expensive it is to mine (Ngwenya et al, 2024).

Another challenge is that of lack of requisite skills. Most small-scale mines are operated by unskilled personnel, who lack the requisite skills for the trade. Most of them can't afford to employ people with professional skills needed for the job like mine surveyors, geologist and engineers. In the process small scale miners lose on their production due to their inefficient mining methods and poor recoveries during mineral processing, thus they target high grade ore reserves to counter their losses. In order to adopt sustainable mining methods, it requires the leadership to be handed to competent and well knowledgeable personnel to lead the mining operations of small-scale miners. However, training can also be done to these miners to combat this knowledge gap. It then requires for governments to conduct awareness campaigns to educate small scale miners on sustainable mining methods.

Since most formal small-scale miners target high grade ore reserves, this then attract another challenge of disputes and theft. Due to their limited operational capital, most small-scale miners find it difficult to properly secure their work places. Thus, in the event of striking a jackpot in their endeavours, they suffer from disputes and invasion of their operations by illegal miners. This in turn affects most miners on focusing on sustainable development as they will be fighting for the protection of their mine (Zvarivadza, 2024).

2.6 Chapter summary

This chapter focused on the literature review of sustainable mining development within the small-scale mining industry. The review focused on studies conducted within the field and exploring the gap that this study intends to research upon. Sustainable development is now the new direction in most large-scale mining ventures. The basis of this chapter was then used in the next chapter of research methodology.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology used in the quest towards achieving sustainable mining in Zimbabwe focusing on a case of small-scale miners in Mazowe. The chapter discussed the research philosophy, research design, population and sampling methods utilised, data collection methods, and ethical considerations throughout the research.

3.2 Research Philosophy

Research philosophy refers to the underlying beliefs, values and assumptions that guide the overall approach to knowledge generation in research and research methodology (Saunders, Lewis, and Thornhill, 2019). It shapes the researchers ontological and epistemological assumptions influencing their perception of reality, the nature of knowledge and the appropriate research methods to be utilised. There are various research philosophies or paradigms that the researcher had to choose from. The research philosophies or paradigms considered in this research are Positivism, Interpretivism, Pragmatism and Realism.

Positivism paradigm is a research philosophy that assumes an object reality, emphasising empirical observation and seeks to identify causal relationship (Kuhn, 1970). It emphasises the use of scientific methods to study social phenomena. Positivism research paradigm is based on the idea that social reality can be measured and quantified, and that objective knowledge can be obtained through systematic observation, experimentation and logical reasoning. It is commonly associated with studies in disciplines such as sociology, psychology and economics. Positivists commonly employ quantitative research methods such as surveys which utilises questionnaires, experiments to test hypotheses and establish the cause and effects relationships and statistical analysis. Its limitations include neglecting power dynamics and social inequalities.

An interpretivism philosophy is a research paradigm that emphasises the subjective meanings and interpretations that individuals assign to social realities. Emphasis is placed on the importance of context, culture and personal perspective in shaping the understanding of reality. The ontology is that reality is socially constructed across individuals and contexts. Interpretivism predominantly employs qualitative research methods such as interviews,

observations, focus groups and textual analysis. It advocates for the analysis of the broader socio-cultural factors that shape individual behaviour and beliefs, as well as the influence of historical, political and economic factors. This is the research philosophy utilised by the researcher in this study because it relies on the rich interpretations of individuals on social realities.

Pragmatism research paradigm is a philosophy which emphasises practicality, action and the pursuit of knowledge as a means to solve problems (Dewey, 1938). It emphasises the practical consequences and application of ideas as the primary basis for their truth and meaning. Pragmatism as a research paradigm is based on the proposition that researchers should use the philosophical and methodological approach that works best for the particular research problem that is being investigated (Kaushik and Walsh, 2019). It is often associated with mixed approach methods where the focus is on the consequence of the research and on the research questions rather than on the methods. The approach may employ both formal and informal rhetoric (Creswell and Clark 2011). Pragmatism accepts that there can be single or multiple realities that are open to empirical inquiry, but the reality is grounded in the environment and can only be encountered through human experiences. Pragmatism epistemology is that knowledge is always based on experience. The perception of the world is influenced by our social experiences and this knowledge is socially shared because it is based from socially shared experiences.

Realism research paradigm is a philosophy which assumes a real world exists independently or out of our perceptions, but acknowledges the limitations of our knowledge (Bhaskar, 1975). This is a research paradigm that focuses on understanding social phenomena by examining the underlying structures and mechanism that produces them. In the context of research, realism seeks to unveil knowledge by asking questions such as how social structures and mechanisms shape individuals' behaviours and actions. Acher, (1995) in Realistic Social Theory emphasised that there is need to analyse the social structures, and mechanism that shape individuals' behaviour and proposed the morphogenesis which refers to the process of change and transformation in social structures over time. By employing the realist research paradigm in this study, the goal will be to uncover the underlying social structures and mechanisms that shape the mining industry which most probably would not cover the much anticipated results of this study.

3.3 Description of study area

The research was conducted in Mazowe which is approximately 37km north of Harare. The place is well known for its farming activities with various citrus fields and also host the once famous mine in Mashonaland Central Province, Mazowe Mine, which was placed under care and maintenance in 2018. The place is also known for its famous gold deposits with various small-scale mines registered and mining the yellow metal. The town now hosts main businesses of both mining and farming amongst other businesses. Most small-scale miners within Mazowe deal mostly in gold mining.

3.4 Research Design

According to Neil (2006), research design is a systematic strategy to examining a subject of concern testing a hypothesis in a research project. It is the overall structure and orientation of an investigation. The study primarily acts as a guide while collecting, inspecting, assessing and interpreting observations from the research region. There are various research designs and the researcher took a review of them to decide on the one that suits this research. The first one is experimental research design. Like the name implies, it is a research strategy that allows a researcher to make strong claims about causality; to investigate a phenomenon experimentally by holding one parameter constant so as to deduce the cause-and-effect relationship in a field of study (Bryman, 1989). The researcher has to have some control aspects on subjects in the research hypothesis. This type of research design works well within an organisation where the researcher is involved in. In this scenario, experimental research design is not the one that best suit the requirements of this research.

Quantitative research design is a systematic approach that involves the collection and analysing numerical data to answer research questions and test hypothesis. This type of research focuses on measuring variables and relationships in a systematic and structured manner utilising statistical methods to analyse data and deduce conclusions (Creswell, 2014). It is often used to establish patterns, test hypotheses, make predictions and is widely used in fields of psychology, sociology, economics, health science and education. Quantitative research design is characterised by its objectivity in the sense that it aims to minimize researcher bias and subjectivity; standardisation, it involves large sample sizes to ensure reliable, generalisable and standardised results for consistency; numerical data, quantitative research involves collection

of numerical data which can be analysed statistically; hypotheses testing, it focuses on testing hypotheses through statistical analysis.

Another research design is qualitative research method. This method focuses on gathering and analysing non numerical data to gain a deeper understanding of a research phenomenon. The emphasis tends to be on individuals' interpretations of their environments, behaviours and that of others. Understanding is deduced from the perspectives of the respondents and not of the researcher. In this study, the researcher was on a quest to establish sustainable mining by focusing on small scale miners in Mazowe. Qualitative research methods are flexible and adaptive allowing for changes in research approaches and often involves an indepth analysis of data (Creswell, 2014). This research approach typically involves small, purposefully selected sample sizes for analysis and acknowledges the researcher's subjective interpretation of the data. In depth interviews and group discussions were used to collect information on the experiences and challenges of small-scale miners and establishing their position and perception in regards to sustainable mining development and the relevant stakeholders within the mining industry. and in the interest of effectiveness, it is the one that was used by the researcher. The justification of the use of qualitative over quantitative or mixed methods is that qualitative approaches align closely with the study's objectives of gaining rich and contextual understanding of the issues being investigated.

3.5 Research Population

Research population refers to the entire group of individuals or objects that the researcher is interested in studying (Cresswell, 2014). It is a broader group from which a sample may be drawn for research. In this study, the population consist of various stakeholders that include policymakers, government officials, environmentalist, community members, experts in the field of mining and development and small-scale miners. Choosing this population is justified by the need to capture the diverse perspectives and expertise related to small scale mining. By including individuals from different backgrounds, a comprehensive understanding of small-scale mining can be obtained. The insights and opinions of these stakeholders can contribute to a well rounded analysis and provide valuable insights for policy recommendations. Research population helps in finding problems and the solution to obtain the main goal for the project. The target population in this research are miners which can further be classified or categorised as comprising of artisanal miners, small scale miners (both formal and informal or licenced and unlicenced) and large scale mining houses (the ones with higher mining capacity). The miners in question will be bound by the geographical boundaries of Mazowe.

3.6 Sampling Methods

Sampling methods refers to procedures used to select a subset of individuals or cases from a larger population with the goal of making inferences about the population in question based on the sample (Creswell, 2014). This research mainly focused on registered small-scale miners within Mazowe, Zimbabwe. Sampling methods can be classified into two categories namely probability sampling and non-probability sampling. Probability sampling is a sampling method that assigns each member of a population a known and equal chance of being selected. It ensures that the sample is a representative of the population and allows researchers to make statistical inferences about the population. The main characteristics of probability sampling are that it involves random sampling or selection, deals with a known probability which can be calculated and that the sample selected is a representative of the population. Types of probability sampling includes simple random sampling, stratified random sampling, cluster sampling and systematic sampling.

Non probability sampling is a sampling method in which the selection of participants is based on non-random criteria such as convenience, expertise or availability. This method provides no guarantee that the sample selected is a representative of the population and it limits the ability to make inferences about the population. The main characteristics of non-probability sampling method, like the name entails, the probability of the sample selected is unknown and cannot be calculated, utilises non-random selection and the sample may not be a representative of the population. Types of non-probability sampling includes convenience sampling, purposive sampling, snowball sampling and quota sampling. In this study, the researcher adopted qualitative research methods, hence non probability sampling methods were utilised in choosing small scale miners.

3.7 Research Sample

A research sample is a subset of the research population selected to represent the larger group, enabling researchers to draw valid and generalizable conclusions (Creswell, 2014). In this study, the sample size was determined based on principles of representativeness and adequacy, ensuring that the findings would be reliable and meaningful. The total number of participants was influenced by factors such as the research design, data collection methods, and available resources. To facilitate robust analysis and minimize sampling error, a sample of 40 participants was selected. Given the specific focus of the study and the need to gather insights from knowledgeable stakeholders, a purposive sampling technique was employed. Participants were

chosen from a sampling frame of 150 registered and operational small-scale miners in Mazowe, obtained from the Ministry of Mines and Mining Development Mashonaland Central Provincial Office. This approach ensured that those included possessed the relevant knowledge, expertise, and experience pertinent to sustainable small-scale mining practices.

3.8 Ethical Considerations

The study adhered to ethical standards in social research. Informed consent was obtained from all participants after providing clear explanations on the study's purpose, procedures, and expected outcomes. Participation was voluntary, with the right to withdraw at any stage without consequences (Saunders, Lewis, and Thornhill, 2019). Confidentiality and anonymity were strictly by assigning codes instead of names and securely storing data. Sensitive information regarding illegal or environmentally harmful activities was handled with care, ensuring no participant is placed at risk. Ethical approval was sought from the Ethics Committee at Bindura University of Science Education before fieldwork. Additionally, relevant local government authorities were consulted for permission to access mining sites and official data. Adhering to these principles ensured compliance with both academic and professional ethical guidelines (Bryman, 2016).

3.9 Chapter Summary

This chapter focused on research methodology outlining the research methods which were considered to be most appropriate with this study. Elaborations were placed on the research philosophy, research design, research population, research sample, sampling methods, research instruments and ethical considerations as outlined within this chapter. Data presentation and analysis was done in the next chapter.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, INTERPRETATION AND DISCUSSION

4.1 Introduction

This chapter focused on the presentation, analysis, interpretation and discussion of the collected data. Interviews were the main instrument used to collect data. The previous chapter focused on the methodology and procedures that the researcher used in sampling, collecting and analysing data. The data presented and analysed in this chapter provided a basis for answering the research questions appropriately, and assist the researcher in reaching to research conclusions. A total of 40 participants were scheduled for engagement in this research; 30 small-scale miners, 3 Ministry of Mines and Mining Development officials, 2 Environmental Management Agency officials, 5 community members within Mazowe. Data was collected through a mix of face to face and telephone semi-structured interviews, in line with Creswell and Poth's (2018) qualitative research design principles.

4.2 Response rate

Of the 40 scheduled interviews, there was an overall response rate of 37/40 (93%). Table 4.1 below shows the response rate amongst the various stakeholders engaged. The thematic analysis approach proposed by Braun and Clarke (2006) guided the process of coding, identifying, and interpreting patterns from participant responses. Participants were assigned pseudonyms such as Miner 1, MMMD Officer 1, EMA Officer 1, and Village Head / Community Member 1 to ensure confidentiality.

Table 4.1: Response Rate

Participants	Scheduled	Successful	Response rate
SSM	30	30	100%
MMMD	3	2	67%
EMA	2	1	50%
Community members	5	4	80%
Overall	40	37	93%

Source: Primary data (2025)

Thirty (30) small scale miners were interviewed, 2 MMMD officials, 1 EMA official and 4 community members were interviewed. Using the rule of the thumb, it was suggested by Creswell and Creswell, (2018), that a response rate of 60% or more is desirable. This means the responses in this study were quite good since it was 93% of the total respondents who participated in the field research.

4.3 Demographic Data of small-scale miners

4.3.1 Age and Gender Distribution

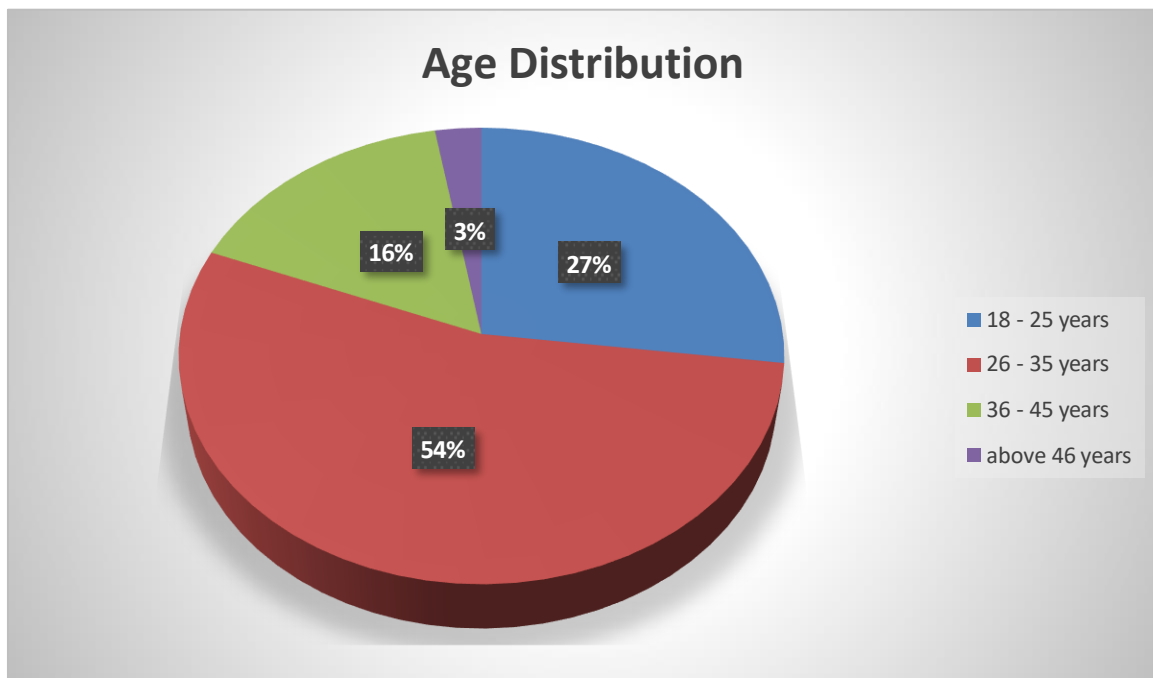


Fig 4.1: Age distribution (N=37)

The majority of respondents (54%) were aged between 26-35 years, followed by (27%) who were aged between 18 – 25 years, indicating a predominantly young workforce engaged in small-scale mining. Six (16%) were aged between 36 – 45 years and only 1 (3%) participant was above 45 years of age. This demographic suggests that the sector attracts young individuals who are likely to be energetic and physically capable of performing the demanding tasks associated with mining activities.

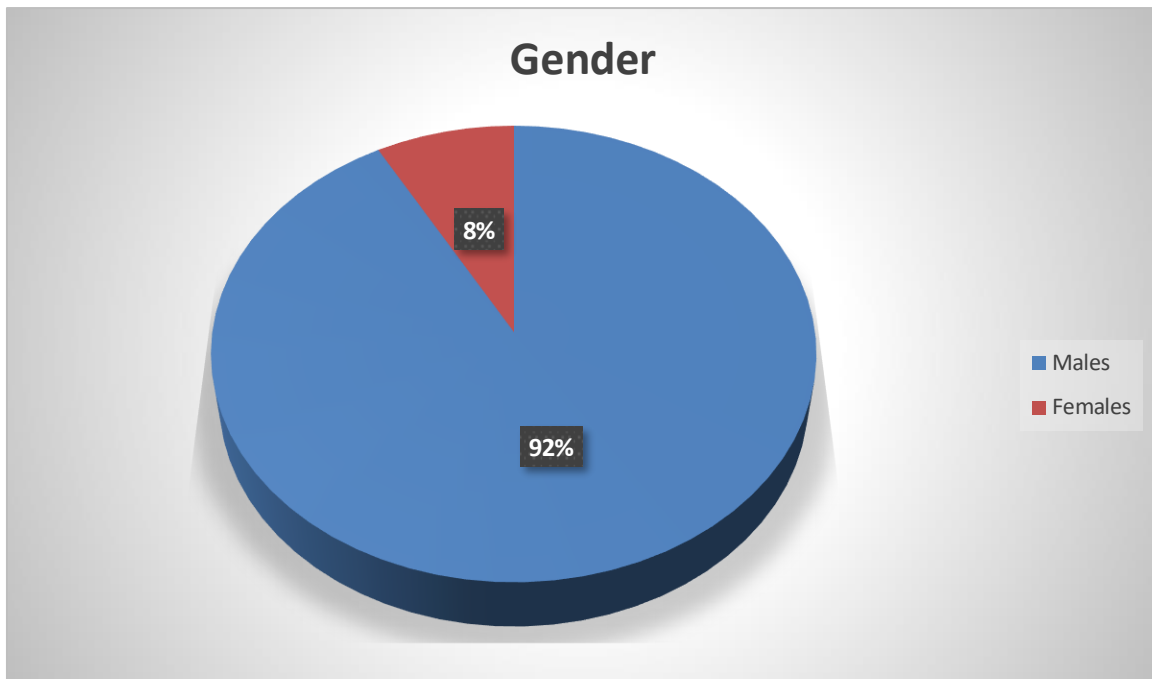


Fig 4.2: Gender (N=37)

Males constituted 92% of the respondents, reflecting a significant gender dominance in mining activities. This is not surprising, as mining has traditionally been a male-dominated profession, with men often holding more physically demanding roles such as heavy lifting, excavation, and equipment operation. The high percentage of males in the sample may also indicate that women are underrepresented in the sector, which could have implications for their safety, health, and overall well-being.

The gender imbalance in the sample may also have implications for the effectiveness of safety and health interventions in the sector. For example, if women are underrepresented in the workforce, they may not be fully accounted for in safety training programs, which could leave them more vulnerable to accidents and injuries.

In terms of the age distribution, the high percentage of young respondents (54%) may indicate that small-scale mining is an attractive career option for young people in the region. This could be due to a range of factors, including limited job opportunities elsewhere, a lack of education and training options, or a desire for riches, independence and self-employment. However, the young age of the respondents also raises concerns about their exposure to occupational hazards and the potential long-term effects of small-scale mining on their health and well-being.

4.3.2 Education Level and Experience

Table 4.2 below shows the educational level of representatives of small-scale miners interviewed during the research.

Table 4.2: Education Level (N=37)

Education Level	Participants	Percentage
Primary	9	24%
Secondary	22	59%
Tertiary	6	16%
Total	37	100%

Source: Primary Date (2025)

Most participants (59%) had completed both primary and secondary education. Only 16% of the participants attained tertiary education, of which the majority was government officials. This suggests that the sector may not be attracting a highly educated workforce, potentially limiting the miners' ability to apply more complex mining techniques or manage more sophisticated equipment. The lack of formal education may also contribute to a higher risk of accidents and injuries in the sector. One mine owner said that he prefers working with uneducated people because they are easier to manage than educated ones.

Experience varied, with 50% of the small scale miners interviewed having 2-3 years of mining experience, suggesting that many are relatively new entrants in the sector. This is a concerning trend, as inexperienced miners may be more prone to accidents and may not fully understand the risks associated with mining activities. The high turnover of miners may also contribute to a lack of institutional knowledge and expertise within the sector.

The limited education and experience of many miners may also contribute to the sector's reputation as a high-risk and low-skilled occupation. This could deter potential entrants and make it challenging to attract a more skilled and experienced workforce. Addressing these issues will be crucial to improving the safety and productivity of small-scale mining operations.

4.3.4 Type of Mining Operation and Mineral Mined

A significant proportion (75%) operated informally, highlighting the prevalence of unregulated mining activities. This lack of formalization and regulation can lead to a range of negative

consequences, including, increased risk of accidents and injuries for miners, environmental degradation and pollution, loss of revenue for the government due to unreported income and difficulty in enforcing labour rights and protections for miners.

Gold was the only mineral (100%) being mined. This suggests that the sector is heavily focused on gold production, with the majority of miners engaged in this activity. The informal nature of the sector and the dominance of gold production raise concerns about the sector's long-term sustainability and potential for environmental degradation.

4.4 Data Analysis Method

Data was analysed using thematic analysis, which is appropriate for qualitative inquiry that seeks to identify, analyse, and interpret patterns of meaning across a dataset (Braun and Clarke, 2006). After transcribing the interviews, the researcher coded data manually to identify recurrent ideas and grouped them into overarching themes that aligned with the research objectives. According to Bryman (2016), thematic analysis is well suited for exploratory studies because it allows researchers to capture both commonalities and differences in participants' views. In this study, the process involved six steps, namely: familiarisation with the data, generation of initial codes, searching for themes, reviewing themes, defining themes, and writing up findings.

4.5 Presentation and Discussion of Findings

Theme 1: Economic Significance of Small-Scale Mining

Participants overwhelmingly recognised small-scale mining as a vital source of income and employment in Mazowe. Most miners described the sector as their only viable livelihood option given the lack of formal job opportunities in the country. One miner noted that:

“Mining is how we survive. Without it, our families would have nothing to eat. There is nothing else meaningful to do which we can survive on.” Miner 2.

Similarly, village leaders noted that mining has brought income-generating opportunities for youths, women, and informal traders in the area. This finding resonates with Zvarivadza (2018) and Hilson and McQuilken (2014), who observed that ASM provides significant socio-economic benefits, particularly in rural African economies.

However, the benefits were described as short-term and unstable. Many miners complained about exploitative buyers, and lack of financial support from the government. EMA officials

also noted that economic benefits are often undermined by unregulated operations that deplete natural resources without long-term community development. This confirms Mhembwe et al. (2021)'s argument that while ASM contributes to livelihoods, it rarely leads to sustained local development due to weak governance and limited reinvestment in communities.

Theme 2: Environmental Degradation and Regulatory Challenges

Environmental degradation emerged as one of the most pressing concerns. EMA officials reported rampant deforestation, land degradation, and river siltation caused by alluvial gold mining in Mazowe. Only 35% of miners reported possessing an EIA certificate, indicating limited compliance with environmental regulations. It is a legal requirement that all mining activities should only be done after obtaining an EIA certificate from the Environmental Management Agency. The majority of miners cited that high fees that are charged during the process of EIA certification process discourage them from compliance with environmental regulations. These findings mirror Hilson (2017)'s assertion that overly complex formalisation frameworks discourage compliance among small miners.

Most miners employed rudimentary and environmentally unfriendly methods, with only a handful adopting environmentally friendly practices such as reforestation or controlled water use. Waste and tailings management were mostly inadequate, leading to land and water pollution. EMA officer noted that:

“We see rivers turning brown and farmland being destroyed every season. Most miners don’t rehabilitate sites, and are constantly in the habit of cutting down trees for firewood” EMA Officer 1.

Measures to prevent land degradation were minimal, with some miners indicating reliance on traditional methods that do not effectively prevent land degradation. This lack of proactive measures increases the risk of deforestation, soil erosion, and loss of biodiversity in mining areas. Without proper land rehabilitation strategies, such as reforestation, contouring, or the use of cover crops, the long-term productivity of the land is compromised, leading to reduced agricultural potential and ecological imbalance. Additionally, the absence of effective land management practices can result in the formation of hazardous waste piles, abandoned mining sites, and unstable ground conditions that threaten both environmental health and community safety. The limited adoption of sustainable land use practices underscores the urgent need for

targeted education, policy enforcement, and support for miners to implement environmentally responsible techniques that mitigate land degradation and promote land restoration. Miners acknowledged that their practices harm the environment but cited lack of technical knowledge and capital for rehabilitation. Village residents expressed frustration over the destruction of grazing lands and contamination of water sources, which threaten agriculture and livestock. One village head noted that:

“The water from Mazowe River is no longer safe for drinking or watering crops, we fear contamination from chemical like mercury which they use when processing their ores” Village Head 2.

These findings align with Spiegel (2015) and Hilson (2017), who noted that unregulated ASM leads to severe environmental damage, often due to inadequate policy enforcement and limited monitoring capacity. EMA officer attributed these challenges to insufficient manpower and poor inter-agency coordination. MMMD officials also noted that limited resources hinder them from effective monitoring of mining activities within communities. As Dube and Mudzonga (2018) note, enforcement agencies in Zimbabwe face resource constraints that limit their effectiveness in curbing illegal mining and environmental degradation.

Theme 3: Leadership and Institutional Coordination

Leadership weaknesses and poor coordination between institutions emerged as another dominant theme. Both Ministry and EMA officials highlighted the lack of collaboration between their agencies. EMA officer 1 alluded that:

“We operate in silos. Most of the times the Ministry of Mines and Mining Development gives out claims without consulting us about environmental suitability,”

Miners and village leaders echoed similar frustrations, stating that inconsistent leadership from local authorities leads to confusion and conflict. Some miners expressed distrust toward officials, accusing them of corruption and selective law enforcement. Miner 6 said that:

“Some miners get protected because they know people in power, while others are chased away. Sometimes your mine gets invaded by people who claim to know people in power and when you report the matter, no action is taken by authorities.”

This pattern of fragmented governance supports Spiegel (2015)’s findings that Zimbabwe’s ASM sector suffers from decentralized control and policy inconsistency. The absence of

transparent leadership structures undermines collective efforts toward sustainable mining. According to Hilson and Maconachie (2020), effective leadership and institutional collaboration are prerequisites for formalising ASM and aligning it with sustainable development goals (SDGs). In Mazowe, however, such leadership appears weak, reactive, and poorly coordinated.

Villagers also complained that they are rarely consulted on mining permits or environmental plans affecting their land, which undermines local governance. This reflects the governance gap identified by Zvarivadza (2018), who called for inclusive stakeholder participation.

Theme 4: Community Participation and Sustainable Future

Few miners reported involvement in community development activities, indicating limited corporate responsibility. The mining industry has long been a significant contributor to the global economy, providing essential minerals and metals that fuel industrial production and technological advancements. However, beyond its economic importance, mining also has a profound impact on local communities, supporting numerous dependents and injecting capital into the local economy. These results are in agreement with Dreschler (2001) who indicated that mines can take leading plans in promoting the initiation of community based commercial enterprises. Community perspectives revealed both conflict and optimism. While many villagers associated mining with land disputes, violence, and loss of agricultural land, others viewed it as an opportunity for empowerment if properly managed.

“If the government trains us and the miners on safe practices, we can all benefit. Mining is a source of employment for most of our young man.” Village Head 2.

Participants advocated for environmental education, technical training, and empowerment of local associations. They called for closer cooperation between miners, community leaders, and regulatory bodies to promote shared responsibility for sustainability. This finding is consistent with Mhembwe et al. (2021), who argue that sustainable ASM requires multi-stakeholder partnerships involving communities, government, and miners. Such collaboration aligns with the Brundtland Commission’s (1987) concept of sustainable development, which emphasises meeting present needs without compromising future generations’ welfare.

4.6 Challenges in adopting sustainable mining practices

Table 4.3 shows the major challenges cited by small scale miners in adopting sustainable mining practices.

Table 4.3: Challenges in adopting sustainable mining

Reason	Participants	Percentage
Lack of knowledge	12	40%
Lack of capital	15	50%
Inadequate technology	3	10%
Regulatory issues	0	0%

The most pressing challenge was lack of capital and knowledge about sustainable practices, followed by inadequate technology. The major challenge was raised by 50% of the respondents. These challenges agree with Ngwenya, et al (2024) who indicated that, the widely semi-legal and informal character of the sector mainly due to limited resources, leads to the adoption of casual business principles within the sector. It also agrees with Hilson & Muck (2000) who indicated that despite their small operations which demand little working capital and simple machinery, small scale mining have their own share of challenges, the chief among them being financial challenges.

4.7 Analysis and Discussion of Results

The findings on environmental impacts of small-scale mining in Mazowe revealed a disturbing trend as indicated in the results premeditation section. A small number of miners reported possessing an EIA certificate, indicating limited compliance with environmental regulations.

This low level of compliance is a cause for concern, as it suggests that many mining operations are not subject to the necessary environmental controls. The mining industry is a significant contributor to greenhouse gas emissions, and its operations often result in the degradation of natural habitats and ecosystems. The lack of EIA compliance can have far-reaching consequences, including the loss of biodiversity, water pollution, and soil degradation.

Several factors contribute to the low level of EIA compliance in the mining industry and one possible reason indicated is the lack of awareness among miners about the importance of environmental impact assessments. Many miners may be unaware of the requirements for obtaining an EIA certificate or the benefits of conducting such an assessment. This lack of awareness can be attributed to inadequate training and education programs, which are essential for ensuring that miners understand the environmental implications of their operations.

Another factor that contributes to the low level of EIA compliance is the lack of resources and infrastructure in some mining operations as indicated. Small-scale miners, in particular, may not have the necessary resources to conduct an EIA or to implement the measures required to minimize their environmental impact. This can be due to limited funding, inadequate equipment, or a lack of expertise. In such cases, the mining operation may not be able to comply with environmental regulations, leading to a failure to obtain an EIA certificate.

The consequences of non-compliance with environmental regulations in the mining industry are severe and far-reaching. In addition to the environmental damage caused by mining operations, non-compliance can also lead to financial losses and damage to a company's reputation. The mining industry is a critical sector that is subject to increasing scrutiny from regulatory bodies, NGOs, and the public.

The widespread use of hazardous substances poses serious risks not only to miners but also to surrounding communities and ecosystems. Mercury, in particular, is known for its detrimental effects on human health, including neurological damage, respiratory problems, and kidney failure. Chronic exposure to mercury vapor or contaminated water sources can have long-lasting impacts on individuals' well-being, especially for those working directly with the substance over extended periods. These results agree with Bansah et al (2024) who indicated that despite regulations which restricted the burning of mercury to be done in a retort, most small-scale miners do not possess such and they do not even have the knowledge of such equipment.

These substances besides affect human health, often contaminate soil, water bodies, and aquatic life, leading to bioaccumulation in fish and other aquatic organisms. As a result, local communities that rely on these water sources for drinking, fishing, and agriculture are exposed to harmful toxins, which can cause severe health issues and disrupt livelihoods. Moreover, the contamination of water resources can have devastating effects on biodiversity, harming aquatic ecosystems and reducing species diversity.

The prevalent use of mercury also indicates a lack of access to safer, more sustainable gold extraction technologies. Many miners continue to rely on traditional methods due to limited awareness of alternative techniques or the high costs associated with modern equipment. This reliance on hazardous chemicals underscores the urgent need for comprehensive education and training programs to promote safer practices. Additionally, regulatory gaps and weak enforcement often allow the continued use of toxic substances without adequate oversight.

The findings on socio-economic impacts of small-scale mining in Mazowe are substantial, with each miner supporting quite a number of dependents, highlighting the industry's vital role in sustaining livelihoods. Additionally, approximately half of miners employ community members, thereby contributing to local employment and economic stability. These findings underscore the importance of mining as a primary income source, especially in regions where alternative economic opportunities are limited, such as areas with challenging agricultural prospects. The positive ripple effects extend to local businesses and infrastructure development, fostering broader community benefits. However, despite these economic contributions, the level of corporate responsibility remains limited, with only about 5% of miners involved in community development initiatives. This gap indicates a need for enhanced community engagement and corporate social responsibility to ensure that mining activities translate into sustainable community development. Moreover, the social implications of mining are complex; while it can improve livelihoods and foster community participation, it also poses risks such as environmental degradation, displacement, and increased inequality, which can undermine long-term social stability.

The findings of challenges faced by small scale miners in adopting sustainable mining practices, as identified in the study, align with findings from previous research. Challenges included lack of knowledge, lack of capital, and inadequate technology. Notably, the most pressing challenges were lack of capital and limited knowledge about sustainable mining practices, with 90% of respondents highlighting these issues. These findings corroborate Ngwenya et al. (2024), who argue that the semi-legal and informal character of the sector primarily due to limited resources leads to the adoption of casual business principles, thereby hindering formalisation and sustainable development. These results are also consistent with Hilson and Muck (2000), who noted that despite their small scale and low operational costs, small-scale mining operations face significant financial challenges. This suggests that financial constraints and limited technical knowledge are persistent barriers across different contexts, emphasizing the need for targeted support to address these issues and promote more sustainable practices within small-scale mining sector.

The findings on leadership and governance highlight the critical role of effective policy implementation and community participation in achieving sustainable mining practices. The perspectives of key stakeholders underscore the need for stronger governance structures, improved regulatory enforcement, and more inclusive decision-making processes. This echoes

previous research by Ngwenya et al. (2024) that notes the sector's semi-legal and informal character hinders sustainable development.

The findings reveal a consensus among respondents regarding the critical components necessary for establishing an effective framework to promote sustainable small-scale mining in Mazowe. Notably, a majority emphasized the importance of developing clear, enforceable policies that regulate mining activities while ensuring adherence to environmental standards and social responsibilities. This underscores the need for a comprehensive legal and regulatory framework that provides clarity and accountability for miners, which is consistent with best practices in sustainable resource management.

Environmental management was identified as a key component, with respondents advocating for the implementation of guidelines to minimize environmental degradation. This includes water conservation, pollution control, and land rehabilitation, aligning with global sustainable mining principles that prioritize environmental preservation alongside economic gains. The emphasis on community involvement reflects the recognition that local stakeholders are vital to sustainable development; mechanisms for meaningful participation can foster social license to operate and equitable benefit-sharing, thereby reducing conflicts and promoting social cohesion.

Capacity building through training programs was highlighted as essential for equipping miners with sustainable techniques, health and safety awareness, and business skills. Providing access to affordable credit and technology was also deemed necessary to enable miners to adopt environmentally friendly practices, which could enhance productivity while reducing ecological impacts. The promotion of innovative, eco-friendly mining technologies further supports the transition toward sustainable practices, emphasizing the role of technological advancement in environmental conservation.

Furthermore, establishing robust oversight and compliance systems was seen as vital for monitoring adherence to sustainability standards. Regular inspections and impact assessments can serve as mechanisms for accountability and continuous improvement, ensuring that sustainability objectives are met over time.

Regarding policy improvements, the respondents' suggestions point to the need for strict enforcement of existing laws, transparency in licensing procedures, and the formalization of small-scale mining activities. These measures can curb illegal mining and promote responsible

practices. Incentives such as tax breaks and subsidies for environmentally friendly practices can motivate miners to adopt sustainable methods. The importance of stakeholder participation in policy development was also underscored, highlighting that inclusive, participatory approaches can enhance policy relevance, practicality, and acceptance.

These insights demonstrate a comprehensive understanding of the multifaceted approach required to foster sustainable small-scale mining in Mazowe. Implementing such a framework and policy enhancements can contribute to environmentally sound, socially equitable, and economically viable mining practices in the region.

4.8 Chapter Summary

The chapter focused on the presentation and analysis of the collected data. The analysed data was then interpreted and discussed. The chapter first of all gave the response rate of the study, of which the overall response rate was 93%. The background and the demographic information of the respondents, was also presented. The chapter then discussed the results in relation to the reviewed literature in the second chapter of this study.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the study, key findings, conclusions, and practical recommendations based on the research conducted on small-scale mining in Mazowe, Zimbabwe. The study aimed to explore the socio-economic and environmental impacts of small-scale mining, identify the challenges faced in adopting sustainable practices, and examine the influence of leadership and governance on promoting sustainability in the sector.

The importance of this study stems from the need to balance economic benefits derived from small-scale mining with environmental conservation and social responsibility, ensuring long-term sustainability for local communities and the nation at large. The research employed qualitative methods, including interviews and focus group discussions, targeting miners, government officials, and community leaders and members.

5.2 Summary of Findings

The study's key findings are summarized below, aligned with the research objectives:

Objective One: To analyse the environmental and socio-economic impacts of small-scale mining in Mazowe

A minority proportion of small-scale miners (only 35%) reported possessing Environmental Impact Assessment (EIA) certificates, indicating limited compliance with environmental regulations. Most miners employed rudimentary mining methods, with little or no land rehabilitation measures, leading to land degradation and deforestation. Use of toxic chemicals, especially mercury, was prevalent amongst all small-scale miners engaged, posing health and environmental hazards. Waste management practices were inadequate, contributing to water pollution and habitat destruction. EMA and the Ministry of Mines and Mining Development officials lack adequate resources, manpower, and coordination to enforce regulations effectively.

Each miner supported an average of 4-6 dependents, underscoring the sector's role in livelihood sustenance. Approximately 50% of miners employed community members, contributing to local employment. Few miners (about 5%) engaged in community development initiatives,

indicating limited corporate social responsibility. The sector provided economic opportunities but also fostered disputes over land, high-grade ore, and operational security.

Objective Two: To investigate challenges faced by small-scale miners in adopting sustainable mining practices

Major challenges included lack of capital, limited technical knowledge, and inadequate access to markets. Many miners were unaware of government policies on sustainable mining (only 30% awareness). Use of hazardous chemicals like mercury remains widespread due to limited access to safer techniques. Poor enforcement of environmental regulations and land use policies hampers sustainable practices.

Objective Three: To explore the role of leadership and governance in sustainable mining in Mazowe

Stakeholders highlighted weak governance, ineffective regulation enforcement, and limited community participation as barriers. There is a notable policy gap: the absence of targeted support programs and capacity-building initiatives for small-scale miners. Recommendations from stakeholders included strengthening regulatory frameworks, fostering stakeholder engagement, and establishing support centres for miners.

Objective Four: To develop a framework towards sustainable small-scale mining development in Mazowe

A proposed framework consists of four core pillars, each addressing a critical constraint identified in Mazowe. This framework presents a structured model for transforming small-scale mining in Mazowe from its current environmentally destructive state into a socially, economically and environmentally sustainable system. The diagram ahead is an illustration of the framework:

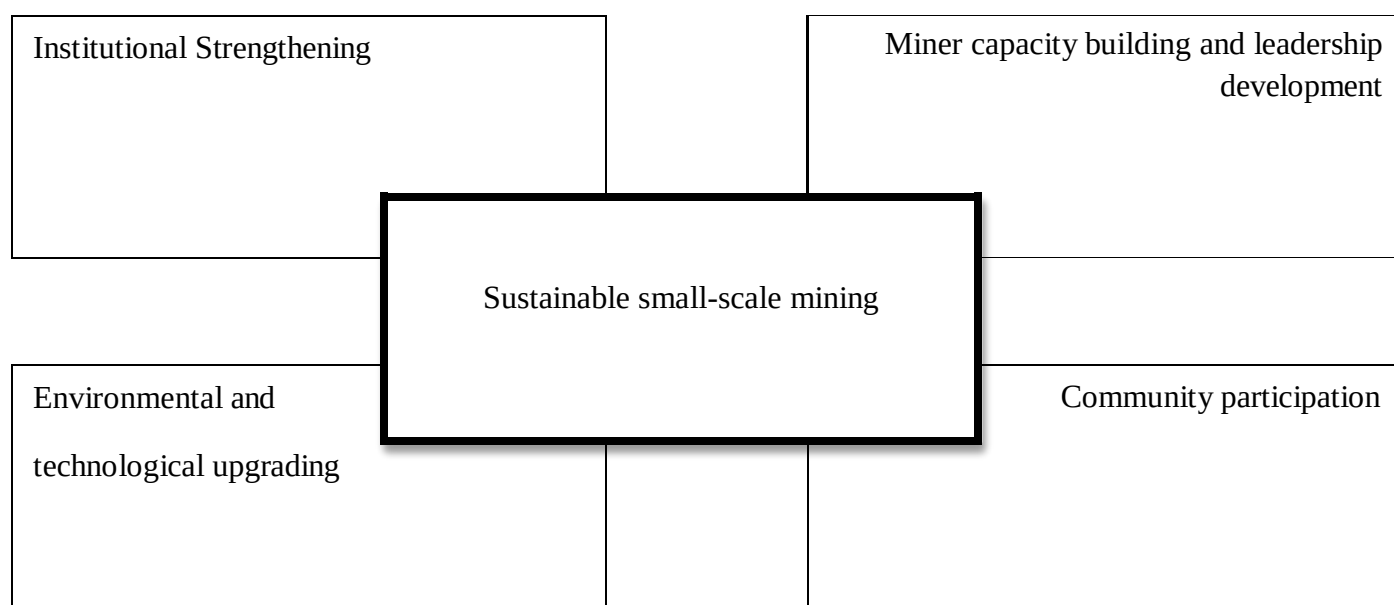


Fig 5.1 Proposed framework towards sustainable mining

The table below is a summary of the framework

Table 5.1 Summary of the Framework

Pillar	Focus	Primary Outcomes
Institutional Strengthening	Clear mandates and coordination amongst stakeholders	Improved governance and compliance Reduced illegal mining
Miner capacity and Leadership	Skills development, organisation management, leadership training	Professional, safer mining Improved self-regulation
Environmental and technological upgrade	Clean technologies, efficient mining methods, rehabilitation	Reduced environmental impact
Community participation	Inclusive governance, conflict mitigation, communities benefit from mining	Socially sustainable operations, reduced conflicts

This framework aligns with Sustainability Development Goals (SDG) 8, (Decent Work), SDG12 (Responsible Consumption and Production), and SDG15 (Life on Land). When these four pillars function interactively, they create a sustainable mining ecosystem that is

characterised by legal compliance, environmental protection, social legitimacy, and economic viability.

5.3 Conclusions

Based on the findings, the following conclusions are drawn:

Small-scale mining in Mazowe significantly impacts the environment, with widespread use of toxic chemicals and poor land management practices. However, compliance with environmental regulations remains low, necessitating urgent intervention.

The sector is vital for local livelihoods, providing employment and supporting dependents, yet it suffers from limited corporate social responsibility and community engagement.

Major operational challenges include lack of capital, limited technical knowledge, and weak policy enforcement, which hinder the adoption of sustainable mining practices.

Leadership and governance are crucial for advancing sustainable mining, but current regulatory frameworks are weakly implemented, and community participation is limited.

There is a pressing need for capacity-building, policy enforcement, and stakeholder collaboration to transition small-scale mining toward sustainability.

5.4 Recommendations

5.4.1 General Recommendations

The government, in partnership with development agencies, should develop and implement targeted capacity-building programs for small-scale miners, emphasizing environmental management and sustainable practices.

Strengthening regulatory enforcement, including regular inspections and penalties for non-compliance, is essential to mitigate environmental degradation.

Promoting access to affordable, eco-friendly mining technologies and safer chemical alternatives will reduce health and environmental risks.

Encouraging community participation and establishing multi-stakeholder platforms can foster inclusive decision-making and shared responsibility for sustainable mining.

5.4.2 Specific Recommendations

Establish a dedicated support centre similar to previous service centres established by the Ministry of Mines and Mining Development for small-scale miners to provide training, technical assistance, and access to financing and equipment for sustainable development.

Develop and promote land rehabilitation and reforestation programs for abandoned or degraded mining sites.

Enhance awareness campaigns about policies, environmental risks, and sustainable practices to improve compliance.

Facilitate formalization of artisanal and small-scale mining activities through licensing and regulation to improve accountability and environmental standards.

Foster partnerships between miners, government, NGOs, and private sector stakeholders to promote responsible mining and community development.

5.4.3 Recommendations for Further Studies

Future research should explore the long-term impacts of sustainable mining interventions on local socio-economic development.

Comparative studies across different regions in Zimbabwe can provide broader insights into best practices and challenges in small-scale mining.

Quantitative assessments of environmental recovery post-intervention would complement qualitative findings and inform policy formulation.

5.5 Chapter Summary

This chapter summarized the key findings, drew conclusions on the current state of small-scale mining in Mazowe, and proposed practical recommendations to promote sustainability. The study highlighted the urgent need for integrated approaches involving capacity-building, stakeholder engagement, and technological innovation to transform small-scale mining into a sustainable sector that benefits communities, the environment, and the economy of Zimbabwe.

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Appendix 1: Interview guide for Ministry of Mines officials

1. Could you please describe your role and responsibilities within the Ministry of Mines and Mining Development?
2. How long have you been involved in the small-scale mining sector, and what kind of interactions do you typically have with small-scale miners in Mazowe?
3. What key policies or regulations currently govern small-scale mining activities in Zimbabwe?
4. How effective do you think these policies have been in promoting sustainable mining practices among small-scale miners?
5. What challenges does the Ministry face in implementing and enforcing these regulations at the district level (e.g., Mazowe)?
6. How would you describe the Ministry's leadership approach in guiding the small-scale mining sector towards sustainability?
7. How does the Ministry collaborate with other agencies, such as the Environmental Management Agency (EMA) and local authorities, to ensure coordinated governance of small-scale mining?
8. What leadership gaps or institutional barriers do you think hinder effective management of small-scale miners in Zimbabwe?
9. What kind of technical or financial support does the Ministry provide to small-scale miners to help them adopt sustainable practices?
10. Are there any ongoing training, awareness, or formalization programs to encourage responsible environmental management among miners?
11. How does the Ministry monitor the environmental impacts of small-scale mining activities?
12. What strategies or partnerships are in place to mitigate environmental degradation (e.g., land rehabilitation, mercury reduction, water management)?
13. How does the Ministry balance economic objectives (e.g., revenue generation, employment) with the need for environmental protection and community health?
14. Any final thoughts or recommendations on how small-scale mining could better contribute to Zimbabwe's sustainable development agenda?

Appendix 2: Interview guide for EMA officers.

1. Could you please describe your current position and responsibilities within the Environmental Management Agency?
2. How long have you worked with issues related to small-scale or artisanal mining in Zimbabwe, particularly in the Mazowe District?
3. What has been EMA's general experience in regulating and monitoring small-scale mining operations in Mazowe?
4. What environmental regulations or standards govern small-scale mining in Zimbabwe?
5. How effective have these regulations been in ensuring environmentally responsible mining among small-scale operators?
6. What are the most common environmental violations or challenges you observe among miners in Mazowe (e.g., land degradation, siltation, use of mercury)?
7. How does EMA enforce compliance when miners breach environmental standards?
8. What systems or tools does EMA use to monitor environmental impacts caused by small-scale mining?
9. How does EMA collaborate with the Ministry of Mines and Mining Development in regulating small-scale miners?
10. Does EMA provide environmental awareness or training programmes for small-scale miners?
11. How effective are these training or outreach initiatives in changing miners' attitudes and behaviours toward environmental management?
12. What policy or leadership reforms would you recommend to strengthen environmental governance in SSM?
13. How can EMA support small-scale miners to adopt more sustainable technologies or environmentally friendly mining methods?
14. Any final thoughts on how small-scale mining in Mazowe could contribute to Zimbabwe's long-term sustainable development goals?

Appendix 3: Interview guide for small-scale miners

Age: Sex: Qualification:

1. Can you tell me about your mining activities (years in mining, type of mineral, scale of operations)?
2. How did you get involved in small-scale mining?
3. How important is mining for your household income and livelihood?
4. Are there any financial or operational challenges that limit your productivity?
5. Do you have an EIA certificate at your mine? How would you describe the environmental impact of your mining activities?
6. What environmental protection measures do you currently use (if any)?
7. Are you aware of EMA environmental requirements? If yes, how do they affect your operations?
8. What challenges do you face when trying to comply with mining and environmental regulations?
9. Do you think current policies support or hinder sustainable small-scale mining? How?
10. How would you describe your relationship with nearby communities?
11. What can be done to improve miner–community relations?
12. What are the major challenges you face in your daily mining operations?
13. What leadership or governance challenges do miners experience in adopting sustainable mining?
14. How can institutions (Ministry of Mines, EMA, local authorities) better support sustainable mining?

Appendix 4: Interview guide for villagers

1. How long have you lived in this area, and how would you describe your community?
2. How long have small-scale mining activities been taking place near your village?
3. In your view, what are the benefits of small-scale mining to the community?
4. What negative effects have you observed from the mining activities?
5. How have mining activities affected the local environment (land, water, forests, air)?
6. Has mining created any conflicts within the community or between miners and villagers?
7. Has the presence of miners affected social values or behaviour in the community?
8. Has small-scale mining brought any economic opportunities (e.g., jobs, trade, markets) for villagers?
9. Are there any health-related concerns associated with mining activities?
10. Do miners consult the community before operating in or around the village?
11. How effective are local leadership structures (village heads, councillors, traditional leaders) in managing mining-related issues?
12. Do you feel the government (Ministry of Mines, EMA, RDC) engages meaningfully with the community?
13. What type of support does the community need to co-exist with mining activities safely?
14. Is there anything you would like to add that we have not discussed?

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RESEARCH ETHICS COMMITTEE



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BINDURA UNIVERSITY OF SCIENCE EDUCATION [BUSE]

16 October 2025

John Kaphaizi
Bindura University of Science Education
Graduate School of Business
P. Bag 1020
Bindura

John Kaphaizi

**RE: INSTITUTIONAL RESEARCH COMMITTEE ETHICAL CLEARANCE-APPROVAL
NUMBER: BUSEREC/0101/2025**

Your application for research ethical clearance related to the topic '**Towards sustainable small-scale mining in Mazoe, Zimbabwe.**' has been approved and allocated approval Number: **BUSEREC/0101/2025**. You are to quote this approval number for all correspondences inclusive of consent forms and any other documents as and when appropriate. The approval period is as stated below:

Type of Meeting	:	18 th BUSEREC meeting
Approval Date	:	16/10/2025
Expiry date	:	15/10/2026

The project will automatically discontinue on the expiry date. You can apply for renewal three months before the expiry date. The renewal application should be accompanied by a progress report.

You are not expected to make any changes/adjustments to the protocol including the consent documents. Any trials involving drugs, devices and biologics require approval of the Medicines Control Authority of Zimbabwe before commencement. All problems to do with the safety of participants must be reported to BUSEREC (buserec2022@buse.ac.zw) within three (3) working days.

Upon termination of the study, a report has to be submitted to BUSEREC.

Yours sincerely

BUSEREC CHAIRPERSON



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GRADUATE SCHOOL OF BUSINESS

Where Great Minds Meet

22 August 2025

TO WHOM IT MAY CONCERN

**REF: REQUEST TO CARRY OUT RESEARCH: KAPHAIZI JOHN, REG. NO. B241143A:
MASTER OF BUSINESS LEADERSHIP (MBL), PART 2.2 STUDENT**

This letter serves to confirm that **Kaphaizi John, Reg. No. [B241143A]** is a Master of Business Leadership student in the Graduate School of Business at Bindura University of Science Education.

The student is in the final stage of study which requires him to carry out a research. His dissertation is titled **“TOWARDS SUSTAINABLE SMALL-SCALE MINING IN MAZOWE, ZIMBABWE.”**

We would be grateful if you could give him any assistance he may require.

For more details, please do not hesitate to contact us.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'J. Mwenje'.



Dr. J. Mwenje
Director, Graduate School of Business