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DEPARTMENT OF ENVIRONMENTAL SCIENCE

**OCCUPATIONAL HEALTH AND SAFETY AS A DETERMINANT OF
ENVIRONMENTAL SUSTAINABILITY IN SMALL-SCALE MINING
COMMUNITIES: A CASE STUDY OF GADZEMA, CHEGUTU**



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the Bachelor of Science Honours Degree in Safety, Health, and
Environmental Management**

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DECLARATION

I, Memezi Nokutenda Shammah, declare that this dissertation is my original work and has not been submitted for any academic degree or other purposes. I confirm that the intellectual content of this dissertation is the result of my own efforts, and all assistance and sources used have been properly acknowledged.

Student Signature.....

Date.....

To be compiled by the supervisor

This dissertation is suitable for submission to the faculty and has been checked for conformity with the faculty guidelines.



Supervisor's Signature.

Date.....13/ 10/ 2025.....

DEDICATION

This dissertation is dedicated to my parents (David and Revai Memezi) and my siblings (Anotida, Akudzwe, and Anoziva), whose prayers, sacrifices, teachings, unwavering patience, and constant encouragement have been the driving force behind my aspirations for greater heights.

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ABSTRACT

The study investigated the function of occupational health and safety (OHS) as a factor of environmental sustainability in small-scale mining communities, utilizing Gadzema, Chegutu, as a case study. The study looked into how the application or neglect of OHS practices affects environmental outcomes in small-scale mining communities. A qualitative research design was used to gather data from 15 participants, comprising OHS Supervisors and environmental regulatory officers. Data Collection utilized a combination of email survey, WhatsApp survey, and field observations. Thematic analysis was used for data analysis. The findings showed that, while small-scale miners demonstrated commitment to OHS by using personal protective equipment (PPE), training workers, equipment inspection and hazard identification, and risk assessments (HIRA), implementation is inconsistent due to limited resources, weak enforcement, and lack of management commitment. These shortcomings frequently result in environmental damage, such as land degradation, water and soil pollution, deforestation, and waste mismanagement. The study established a clear relationship between strong OHS practices and better environmental results, concluding that incorporating OHS into environmental governance can greatly improve sustainability in small-scale mining communities. The research highlighted the need for collaborative enforcement efforts to promote both worker safety and environmental conservation.

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LIST OF ACRONYMS AND ABBREVIATIONS

HIRA.....Hazard Identification and Risk Management

OHSMS..... Occupational Health and Safety Management Systems

OHS..... Occupational Health and Safety

PPE..... Personal Protective Equipment

SDGs..... Sustainable Development Goals

SHE..... Safety, Health, and Environment

TBL..... Triple Bottom Line Theory

CHAPTER ONE: INTRODUCTION AND BACKGROUND OF THE STUDY

1.0 INTRODUCTION

The study investigates the relationship between Occupational Health and Safety (OHS) and Environmental Sustainability within Small Scale Mining Communities, with a case study focused on Gadzema, located in Chegutu. The researcher engaged with local traditional leaders, gaining insights into the area's history during the colonial era, the development of the small-scale mining sector, and the changes that have occurred alongside its growth. These interactions catalyzed the undertaking of this study.

The Zimbabwean Miners Federation in 2020 reported that approximately 50,000 small-scale miners were officially registered, each employing an average of 10 workers (Zimbabwe Environmental Law Association, 2020). Despite this, due to economic challenges and a surge in gold prices, especially in 2020, the number of small-scale miners has risen to over two million (Mwandiringana & Ye, 2023). This increase has led to the opening of more mining sites, both legal and illegal, in gold-rich areas, making it difficult to ascertain the true extent of the sector (Nyavada, 2022). However, these miners operate largely without clear regulatory frameworks or government support

The growth of small-scale mining in Zimbabwe can be attributed to several factors, including widespread poverty, limited employment opportunities due to economic difficulties, low agricultural productivity, and a lack of viable non-farming alternatives (Nyavada, 2022). In rural areas where mineral deposits are accessible, small-scale mining has become a crucial source of income and livelihoods (Mkodzongi, 2023). Additionally, crop failures during periods of drought have further driven the expansion of small-scale mining, as households seek alternative means of subsistence [Zimbabwe Economic Policy Analysis and Research Unit (ZEPARU), 2016].

Zimbabwe has a range of institutional platforms and programmes focused on environmental protection. Additionally, a well-established traditional leadership system exists, responsible for upholding and enforcing cultural norms and practices related to environmental stewardship. Despite these protective measures, however, the country continues to struggle with significant challenges in combating environmental degradation (Macheka et al., 2021).

1.2 BACKGROUND OF THE STUDY

Environmental sustainability remains a central focus of the global development agenda, as outlined in the United Nations' Sustainable Development Goals (SDGs) for 2030. Six out of the seventeen SDGs specifically aim to achieve environmental sustainability. These include SDGs 6, 7, 11, 12, 13, and 14, which focus on clean water and sanitation, affordable and clean energy, sustainable cities and communities, responsible consumption and production, climate action, and life below water. The activities of small-scale miners, along with their practices, are crucial to achieving these goals (Resolution, 2015).

Zimbabwe, as a nation, faces several significant environmental sustainability challenges, including water scarcity and pollution, land degradation, waste management issues, air pollution, deforestation, and biodiversity loss (Hove et al., 2020; Macheke et al., 2020). These challenges are particularly acute in areas where small-scale mining operations are prevalent. This is due to the direct impact that small-scale mining has on the environment, with miners extracting resources and carrying out production in ways that contribute to these environmental problems (Magidi & Hlungwani, 2023). As such, small-scale miners are intrinsically linked to the environmental challenges they help perpetuate.

The mining sector, especially small-scale mining, plays a vital role in the economies of developing countries like Zimbabwe. However, the dual function of small-scale mining - serving both as a livelihood strategy and an economic development activity - has often been overshadowed by negative perceptions, such as environmental degradation, social issues, and poor health and safety standards (Mkodzongi, 2023; Gukurume & Tombindo, 2023). These concerns highlight the potential for small-scale mining to cause severe environmental and health damage if not properly managed (Gumbo et al., 2024). OHS is a key aspect of mining operations, as it directly affects the well-being of miners and surrounding communities. Furthermore, sound OHS practices can have a significant influence on environmental sustainability in mining areas.

The relationship between OHS and environmental and environmental sustainability is both complex and bidirectional. The environment is deeply interconnected with all human activities, and the survival of human societies is closely tied to the health of the environment (Buscardo et al., 2021). On one hand, poor OHS practices can lead to environmental degradation and pollution. On the other hand, environmental degradation can exacerbate OHS risks, increasing

the likelihood of accidents, illnesses, and injuries within mining communities (Matsa et al., 2020).

Despite the importance of this relationship, there is a notable gap in research examining the impact of OHS practices on environmental sustainability in small-scale mining communities. This gap is particularly concerning in developing countries, where small-scale mining is widespread and environmental regulations are often insufficient. This study aims to address this gap, contributing to the development of sustainable small-scale mining practices and improving the health, safety, and environmental outcomes for miners and their communities.

1.3 PROBLEM STATEMENT

Chegutu is very rich in many minerals, making it home to a huge population of small-scale miners. Small mining Communities in Chegutu, Zimbabwe, face considerable challenges in balancing OHS with environmental sustainability. Despite the critical importance of OHS practices in safeguarding the health and safety of miners, inadequate OHS standards are widespread in these areas, leading to environmental degradation and the depletion of natural resources. The absence of effective occupational health and safety management systems (OHSMS), coupled with weak regulatory frameworks and limited resources, exacerbates these issues. As a result, the environmental sustainability of these communities is undermined, threatening not only the health and well-being of miners and residents but also surrounding ecosystems. The situation is further complicated by a limited understanding of the interplay between OHS and environmental sustainability in small-scale mining communities. This knowledge gap makes it difficult to devise and implement strategies to address these interconnected challenges.

1.4 AIM OF THE STUDY

This study investigated the relationship between OHS practices and environmental sustainability outcomes in Gadzema, intending to provide actionable recommendations for improving both worker safety and environmental stewardship.

1.5 RESEARCH OBJECTIVES

- To assess the current occupational health and safety practices in Gadzema.
- To examine the environmental impacts associated with small-scale mining activities in Gadzema.

- To analyze how occupational health and safety practices contribute to environmental sustainability.

1.6 RESEARCH QUESTIONS

1. What are the current occupational health and safety practices implemented by small-scale miners in Gadzema?
2. What environmental challenges are associated with small-scale mining in Gadzema?
3. How do these occupational health and safety practices affect the environmental sustainability in Gadzema?

1.7 SIGNIFICANCE OF THE STUDY

The results of the study highlighted the critical link between OHS and environmental sustainability in small-scale mining, providing valuable insights for local communities, government authorities, mining companies, and regulatory bodies. The findings from this research can also be subjected to peer review and, as such, will be of great benefit for fellow scholars, as it will serve as a basis for further research. By bridging the gap between OHS and environmental sustainability, this study serves as a model for other rural mining communities in Zimbabwe and similar regions.

1.8 DEFINITION OF TERMS

Occupational Health and Safety (OHS): OHS is broadly defined as the science concerned with the anticipation, identification, assessment, and control of workplace hazards that could negatively impact the health and well-being of workers. It also considers the potential effects on surrounding communities and the wider environment (Alli, 2008, p. viii).

Small Scale Mine: According to the Mines and Minerals Act, Chapter 21:05, a small-scale mine is defined as a mining operation that employs a maximum of 50 workers and occupies an area not exceeding 100 hectares.

Environmental Sustainability: Environmental sustainability refers to a balanced, resilient, and interconnected state that allows human society to fulfil its needs without exceeding the capacity of the supporting ecosystem to regenerate the essential services, while also preserving biological diversity (Tennakoon et al., 2024).

Mining Communities: Setyadi (2024) defines a mining community as the people who live in locations that are significantly impacted by mining operations that take place nearby. These communities, which range greatly in size from a city to a village, are linked to the mining sector

either directly through employment or indirectly by the impact mining has on the local economy, society, and environment (Viega et al., 2001).

1.9 LIMITATIONS

The study faced several challenges that were beyond the researcher's control, which affected the findings. One such limitation was the sample size. Due to time and resource constraints, the study relied on a small sample drawn from the target population. While this allows for in-depth analysis, it may limit the generalizability of the findings to other small-scale mining communities in Zimbabwe. The research relied on self-reported data through surveys, which subjected responses from participants to exaggeration and errors. This influenced the accuracy of the findings; moreover, secondary data was scarce, limiting the ability to cross-check findings with existing literature.

1.10 DELIMITATIONS

The geographic Scope of the study was one of its primary delimitations because it was limited to Gadzema. The choice to concentrate on Gadzema ensured a more thorough and contextualized analysis of the unique circumstances and difficulties encountered in that community. The study primarily targeted two groups: OHS supervisors from small-scale mining companies and regulatory officers responsible for environmental monitoring. Other stakeholders, such as community members and other mine workers, were not included in the study. This focus allowed for a more direct assessment of the perspectives of those directly responsible for implementing and regulating OHS practices in the mining sector. The study employed a qualitative approach, utilizing email and WhatsApp surveys and field observations for data collection. By focusing on qualitative methods, this research aimed to capture the complexities and nuances of OHS and environmental sustainability in this context.

1.11 ASSUMPTION

The researcher assumed that there was a significant positive relationship between effective OHS practices and environmental sustainability in small-scale mining communities, such that improved OHS led to better environmental sustainability outcomes.

1.12 ORGANISATION OF THE REMAINDER OF THE STUDY

Chapter 2: This chapter reviewed the existing literature on the impacts of OHS in the small-scale mining sector and its relationship with environmental sustainability.

Chapter 3: This chapter outlined the research methodology employed in the study, including details on the population and sample, research instruments, data collection methods, and data analysis.

Chapter 4: This chapter presents the findings from the study, focusing on the role of OHS as a determinant of environmental sustainability in the Gadzema area.

Chapter 5: In this chapter, the researcher interpreted the results and related them to the objectives of the study, as well as comparing them with findings from other relevant studies in the literature.

Chapter 6: This chapter provided a summary of the study, followed by the conclusions and recommendations. The conclusions and recommendations were drawn from the analysis of the data and were aimed at addressing the study's research questions.

1.13 CHAPTER SUMMARY

Chapter one described the background of the study, problem statement, aim, research objectives and questions, significance, definition of terms, limitations, delimitations, assumptions, as well as the organisation of the remainder of the study. The next chapter presents a review of related literature.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

Research on occupational health and safety (OHS) in small-scale mining communities in Africa reveals crucial insights into the complex relationship between worker safety, environmental sustainability, and community welfare. Studies have increasingly focused on the evolution of OHS practices and their implications for environmental management, particularly within industries marked by informal operations and limited regulatory oversight. This chapter examines OHS practices implemented by small-scale miners, their impacts on worker health, and their broader implications for environmental sustainability.

2.2 THEORETICAL FRAMEWORK

The study is informed by the Triple Bottom Line theory by John Elkington in 1994, which argues that organisational success should not be evaluated solely on financial returns but rather on the combined performance in three critical dimensions: People, Planet, and Profit. The TBL approach offers a comprehensive lens through which complex sustainability issues can be examined, making it particularly relevant for understanding the intersection of OHS and environmental sustainability within small-scale mining communities (Pasamar et al., 2023).

The "People" dimension of the TBL theory centres on the social impacts of economic activities, with a particular focus on the health, well-being, and rights of individuals and communities (Nogueira et al., 2023). In the context of small-scale mining, this dimension is most visibly expressed through the quality of occupational health and safety. Unsafe mining environments (characterised by inadequate protective equipment, poor sanitation, lack of knowledge, and exposure to toxic substances) pose serious threats to workers' health and well-being (Quiroz et al., 2023). Moreover, such conditions often extend their impacts beyond the mine sites, affecting the local communities through injury, disease, or even loss of life (Gukurume & Tombindo, 2023). By foregrounding OHS as a core element of the "People" pillar, the TBL theory underscores the notion that ensuring worker safety is not just a legal obligation but a key pillar of sustainable social development. In many small-scale mining regions, addressing OHS is an essential step toward protecting vulnerable populations and promoting community resilience.

The second dimension, "Planet", emphasises the ecological consequences of human and industrial activity. It advocates for environmental stewardship through practices that prevent

pollution, conserve biodiversity, and promote sustainable use of natural resources (Nogueira et al., 2023). In small-scale mining, environmental degradation is a prevalent and pressing concern and pressing concern (Mensah-Abludo et al., 2023). Activities such as deforestation, open pit mining, mercury and cyanide pollution, and water contamination are often the results of unregulated or unsafe mining operations. These environmental hazards are not isolated from human activity since they are frequently a direct consequence of poor OHS practices (Matsa et al., 2020). TBL theory enables a deeper understanding of how unsafe occupational practices contribute directly to environmental degradation (Nogueira et al., 2023). It highlights that improving OHS is not merely about protecting workers but also about reducing the environmental footprint of mining activities, thereby linking the "People" and "Planet" dimensions in a mutually reinforcing way.

The "Profit" component of the TBL theory extends beyond conventional notions of business profitability to include broader economic sustainability. It addresses how economic activities support long-term livelihoods, job creation, and equitable development (Nogueira et al., 2023). In the case of small-scale mining, economic viability is often undermined by the absence of safe workplaces (Nogueira et al., 2023). Accidents and injuries reduce workforce productivity, increase medical costs, and can lead to mine closures or legal penalties (Kim & Park, 2021). Conversely, adopting safe and environmentally responsible practices can improve operational efficiency, ensure continuity, and foster greater acceptance within local communities. Therefore, economic sustainability is inextricably tied to both social and environmental performance (Nogueira et al., 2025). From the TBL perspective, investments in OHS and environmental management are not costs to be minimized, but strategic actions that enhance long-term economic resilience.

Applied to this research, the TBL theory provides a robust conceptual foundation for examining the link between OHS and environmental sustainability in small-scale mining communities. It frames OHS not as an isolated labour issue but as a critical enabler of broader sustainability outcomes (Pasamar et al., 2023). By integrating the dimensions of people, planet, and profit, the TBL approach allows for a holistic assessment of mining practices and their implications. Importantly, it supports the central thesis that improving OHS can simultaneously safeguard worker welfare, reduce environmental harm, and contribute to sustainable economic development.



Figure 1 The connection of the elements of the Triple Bottom Line Theory

2.3 OVERVIEW OF SMALL-SCALE MINING

Small-scale mining refers to mineral extraction activities that are labor-intensive, use rudimentary technologies, and operate on a relatively small capital base. The sector plays a critical role in the economies of many developing countries, offering employment to millions and serving as a vital source of income for rural populations. Despite its economic significance, small-scale mining is often characterised by informality, poor regulation, and inadequate oversight (Hlungwani et al., 2021). These features contribute to unsafe working conditions, unreported environmental damage, and tax revenue losses. The informal nature of small-scale mining operations means they frequently operate outside the purview of national labour, health, and environmental laws. This regulatory gap creates a dual burden, which exposes the miners to occupational risks and the ecosystem to suffer from unmitigated degradation (Singo et al., 2022).

Structurally, small-scale mining differs from large-scale mining in key ways: the absence of standardised operational procedures, minimal use of advanced safety equipment, and limited access to environmental management expertise. These differences have profound implications for both worker welfare and environmental outcomes. Recognizing these distinct

characteristics is essential in designing targeted interventions that address the unique challenges faced by small-scale mining communities (Ofosu et al., 2025).

2.4 OHS IN THE SMALL-SCALE MINING SECTOR

The mining industry is notably vulnerable to poor OHS standards, which have led to frequent reports of occupational accidents (Quiroz et al., 2023). According to Matemera (2021), miners are at constant risk from hazards such as dust, excessive noise, heat, insufficient oxygen, poor lighting, and machinery-related injuries. In developing countries, including Zimbabwe, small-scale miners face heightened risks. Workplace hazards can be categorised into five main types: chemical (e.g., mercury, lead), biological (e.g., diseases like malaria), physical (e.g., noise, vibration), biomechanical (e.g., musculoskeletal strain), and psychosocial (e.g., stress fatigue) (Baghaei Naeini & Badri, 2024). Kwesi et al. (2024) observed that small scale mining sites present several specific hazards, including physical risks like inadequate PPE use, dust exposure, and high noise levels; biological hazards from unsanitary conditions and insect presence; psychosocial risks such as workplace violence and long shifts; and ergonomic issues related to repetitive tasks and awkward postures. Moyo et al. (2021) similarly highlighted the high prevalence of silicosis among workers exposed to silica dust, even over short periods.

The small-scale mining sector often faces financial limitations that hinder the implementation of effective OHS practices. As noted by Kwesi et al. (2024), safety training, provision of PPE, regular monitoring, and incident reporting are among the most common safety practices adopted by small-scale mining companies. Kwesi et al. (2022) also emphasized the importance of adhering to OHS regulations to prevent occupational hazards, with respondents identifying compliance as a crucial measure in promoting safety within the industry. A study by Siabi et al. (2022) further found that site managers have a primary responsibility to ensure workers are properly trained, machinery is regularly inspected, and safety measures such as PPE use are enforced. This usually reduces the effects of the OHS practices since the site manager will be swamped with many tasks. According to Siabi et al (2022), there is a need for clear safety policies and clearly defined roles and responsibilities to foster a strong safety culture within organisations.

Implementing OHS in the small-scale mining sector is fraught with challenges. The informal status of many operations means that regulatory agencies struggle to enforce safety standards. Financial constraints limit miners' ability to purchase PPE or invest in safer equipment (Qiao et al., 2022). Furthermore, low levels of literacy and technical knowledge hinder the

dissemination and uptake of OHS training. Cultural factors, such as fatalism and reliance on traditional knowledge, can also reduce compliance with modern safety practices, even when resources are available (Singo et al., 2022).

2.5 ENVIRONMENTAL IMPACTS OF SMALL-SCALE MINING

Environmental concerns are also prominent in small-scale mining, as many mining activities lead to significant ecological damage. According to Githiria & Onifade (2020) and Ofosu et al. (2020), mining activities produce various waste products, including tailings, overburden, and waste rock, which contribute to environmental degradation. Acid drainage, one of the most serious environmental impacts, results from mining operations and requires costly water treatment solutions. Improper waste management can release metal-laden pollutants into ecosystems, harming aquatic life and reducing biodiversity (Ofosu et al., 2020). Macheka et al. (2021) reported that unregulated mining activities in Zimbabwe's Chivi district have led to severe land degradation, with miners leaving open shafts that pose hazards to people and animals. Magidi & Hlungwani (2022) confirmed similar findings at Connemara Gold mine, where vegetation loss and soil erosion have been exacerbated by mining activities, while dust, noise, and air pollution have negatively impacted nearby communities.

According to Matsa et al. (2020), small-scale mining is a significant driver of environmental degradation in many resource-rich developing countries, with the most visible consequence being land degradation, resulting from excavation pits and tunnels which have not been rehabilitated. These impacts have lasting ecological consequences that undermine sustainable development. Magenge & Mapira (2023) indicated that small-scale mining also leads to deforestation, which disrupts ecosystems associated with carbon sequestration. Additionally, air pollution from burning waste or processing materials in poorly ventilated areas contributes to climate change (Magenge & Mapira 2023). These impacts reflect a general trend: where environmental regulations are weak or unenforced, mining activities can wreak extensive ecological harm, often with little accountability.

2.6 ENVIRONMENTAL POLICIES AND COMMUNITY ENGAGEMENT

In the context of Ghana's gold mining industry, Toukuu (2019) analysed the complexities of environmental policies and their limited enforcement, which has exacerbated environmental issues like mercury pollution. Toukuu (2019) emphasised the need for education and community engagement to address the misuse of mercury, advocating for community-centered

approaches that align with local needs. The study showed that, despite fair-trade initiatives that have improved workplace safety, the socio-economic benefits of mining have not been equitably distributed. Toukuu (2019) called for a governance framework that involves all stakeholders to ensure that mining operations contribute positively to community welfare.

Osei et al. (2022) observed that miners may continue unsafe practices in the absence of community pressure to improve conditions. This study suggested that educating communities on the long-term effects of irresponsible mining could help foster greater accountability. The study concluded that there is limited environmental awareness among youth and local leaders, recommending educational programs to address the negative impacts of mining on the environment.

2.4 CHAPTER SUMMARY

In summary, the literature highlights the critical importance of OHS practices within small-scale mining, as well as the complex environmental impacts that arise from these operations. A strong safety culture, adequate training, and clear policies are essential to reducing occupational hazards. However, the success of these practices is often constrained by economic limitations, lack of regulatory enforcement, and insufficient community awareness. Addressing these challenges requires not only the implementation of sound safety policies but also efforts to raise awareness about the environmental risks associated with mining. By fostering a culture of safety and sustainability, small-scale miners can work on minimising their environmental footprint while ensuring the well-being of their workers.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter outlined the research methodology that was employed to investigate "Occupational Health and Safety as a Determinant of Environmental Sustainability in Gadzema, Chegutu". Specifically, the research sought to answer the following questions using a qualitative approach:

1. What are the current occupational health and safety practices implemented by small-scale miners in Gadzema?
2. What environmental challenges are associated with small-scale mining in Gadzema?
3. How do these occupational health and safety practices affect the environmental sustainability in Gadzema?

A qualitative approach was chosen for this study, as it focuses on phenomena within their natural context and seeks to capture and understand the complexity of these phenomena. This research utilised a qualitative case study design (Nasri, 2023). The chapter also explained the population and sample, research instruments, data collection methods, and data analysis techniques that will be used in the study.

3.2 STUDY AREA

The study was conducted in Gadzema. Gadzema is a rural area in Zimbabwe's Mashonaland West province, under the Chegutu district. It is located around 110 kilometers south-west of the Harare-Bulawayo railway line. The land reform operation in 2000, as well as the present land distribution under the indigenization and empowerment program, boosted agriculture. Droughts and rainfall shortages prompted the populace to turn to gold mining as a source of income. The formation of the cooperative signaled the rise of gold mining as the primary economic activity, followed by agriculture (Zimbabwe Vulnerable Assessment Committee, 2009).

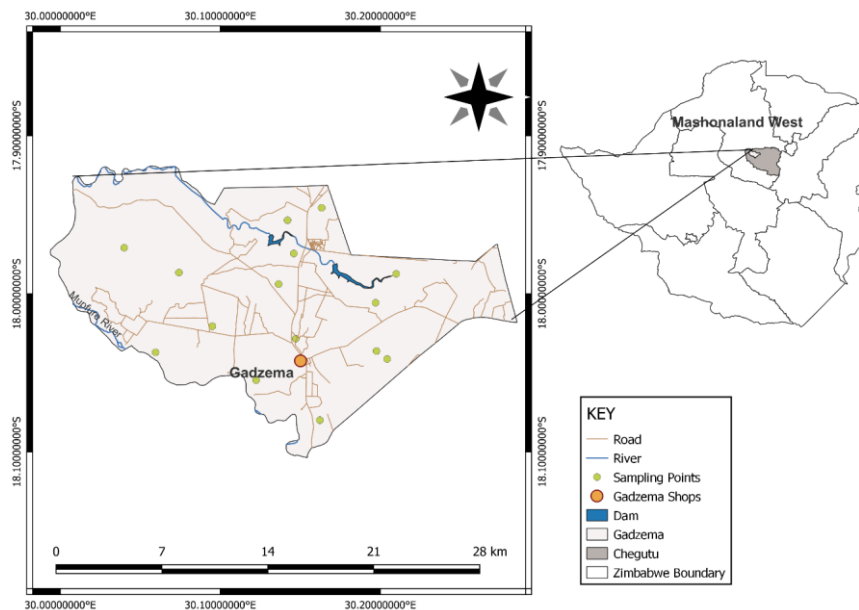


Figure 2 Map of the study area showing the location of Gadzema and the sampling points

3.3 POPULATION AND SAMPLE

3.4 DATA COLLECTION

The study titled "Occupational Health and Safety as a Determinant of Environmental Sustainability in Small-Scale Mining Communities" was conducted in Gadzema. Participants were selected using purposive sampling, primarily through the researcher's networks. Permission to conduct the research was sought and obtained from relevant organisations. Upon receiving the approval, the researcher asked the selected participants whether they wanted to do an online interview or an email survey. Half of the participants chose the email survey, and the other half chose the WhatsApp survey since both allowed them to complete the questionnaire at their convenience. The researcher then distributed email and WhatsApp survey invitations to the participants, each accompanied by a link to a semi-structured questionnaire.

The questionnaire employed a semi-structured format, incorporating both open-ended and closed questions. Open-ended questions are particularly valuable in qualitative research as they allow respondents to provide detailed, nuanced responses in their own words. This facilitates the exploration of underlying perceptions, experiences, and reasoning that may not be captured through closed questions. Two sets of questionnaires were developed for this study: one tailored for OHS supervisors and the other for environmental regulatory officers. However, within each group, all participants received the same set of questions to ensure consistency and

compatibility of responses. Follow-up reminders were sent to non-respondents one week after the initial distribution of the survey to improve participation.

In addition to the surveys, the researcher conducted field visits in Gadzema to gain a deeper understanding of the actual OHS practices and the prevailing environmental conditions. These observations were guided by a structured checklist, which allowed the researcher to systematically document findings. The information gathered through field observation served as a crucial means of validating the data obtained through the surveys.

3.5 RESEARCH INSTRUMENT

3.5.1 EMAIL SURVEY

The researcher used an email survey as a primary data collection instrument. The questionnaire consisted of semi-structured questions. Email surveys are cost-effective, and they allow participants to remain anonymous, which encourages honest and unbiased responses. The survey also allows the participants to complete the survey at their own time. Though known for a lower response rate as compared to face-to-face interviews, an email survey seeking to address a subject of interest or of relevance to the respondent and sent to known respondents is likely to generate a higher response rate (Spiegelman et al., 2023).

3.5.2 FIELD OBSERVATIONS

According to Leedy and Ormrod (2013), qualitative researchers may conduct observations either as relatively detached observers or, in the case of ethnography, as participant observers. Leedy and Ormrod (2013) further state that the primary advantage of field observation is its flexibility, enabling researchers to take advantage of unanticipated data sources as they arise. Field observations enabled the researcher to directly assess actual occupational health and safety practices, as well as the environmental conditions in the area. A checklist was used to systematically document observations.

3.6 VALIDITY AND RELIABILITY

Validity and reliability were ensured in this study as follows:

3.6.1 VALIDITY

The extent to which an instrument measures what it is supposed to measure is known as validity. It is essential for guaranteeing the accuracy and significance of the study findings (Karnia, 2024). This study used two types of validity, which are content validity and construct validity. The researcher developed the survey questionnaires to align with the study's objectives

and research questions. The questionnaires were examined by academic supervisors and subject matter experts to ensure they comprehensively cover all aspects. Triangulation of data sources (comparing responses from surveys and observations) was done, which further enhanced the study's construct validity by cross-verifying findings.

3.6.2 RELIABILITY

Karnia (2024) defined reliability as the ability of an instrument to produce the same results under consistent conditions. The same set of survey questionnaires was used across respondents within the same category (OHS Supervisors and environmental officers), which helped maintain uniformity in data collection. Before full deployment, a pilot test was conducted. This test helped identify ambiguous questions and allowed the researcher to adjust the language for improved responses. The researcher used a standardised checklist for field observations to document conditions methodically, minimising bias and enhancing inter-rater reliability.

3.7 DATA ANALYSIS

In this study, Thematic analysis was chosen to analyse the qualitative data. Microsoft Excel was used for coding and categorization of data, allowing the identification of patterns within the responses. According to Creswell and Poth (2024), case study data analysis typically involves five key steps: (1) organising details about the case, (2) categorising the data, (3) interpreting individual instances, (4) identifying patterns, and (5) synthesising and generalising findings.

3.8 ETHICAL CONSIDERATIONS

Research ethics are a set of principles that guide how studies are conducted by researchers (Arafat, 2024). In this study, research ethics were upheld by using principles that prevented any form of violation or infringement of participants' rights (Resnick, 2020). Below is a brief description of ethical issues for this study:

3.8.1 INFORMED CONSENT

Before conducting the research, the researcher asked for participants' informed consent. The researcher clearly explained the participants' rights (refer to Appendix 1) before they could proceed to answer the survey questionnaire. These rights included: withdrawal from participation at any moment throughout the research, participants' preference to be part of the research or not, and whether to complete the entire questionnaire or decline to answer some questions.

3.8.2 CONFIDENTIALITY AND ANONYMITY

The researcher did not include sensitive information in the survey questionnaires, such as participants' names and the names of their organisations. This information was intentionally left out in order to retain anonymity. The participants were also informed that the information they were to provide was for academic purposes only.

3.9 CHAPTER SUMMARY

Chapter three focused on the research methods that were utilised to collect data for the study. The qualitative research design was identified and explained. The chapter covered population and sample, instrumentation, data collection, as well as data analysis. The validity and reliability of research instruments and research ethics were also discussed. The next chapter will present the results of the study.

CHAPTER FOUR: RESULTS

4.1 INTRODUCTION

This chapter presents the results of the data analysis. The responses were thematically analyzed to uncover common patterns, ideas, and concerns about OHS and environmental sustainability. Quantitative elements, such as frequency counts, were employed to supplement qualitative trends when appropriate. The chapter is structured according to the research objectives: (1) to assess the current occupational health and safety practices in Gadzema, (2) to examine the environmental impacts associated with small-scale mining activities in Gadzema, and (3) to analyze how occupational health and safety practices contribute to environmental sustainability.

4.2 OHS PRACTICES IMPLEMENTED IN GADZEMA

Participants were asked about the current OHS practices they were implementing at their workplaces. Four main themes emerged from the data: Personal Protective Equipment (PPE), training and education, equipment inspection, and hazard identification and risk assessment (HIRA). PPE use emerged as the most often implemented practice, followed by training and education, equipment inspection, and HIRA.

Table 2 Frequency of OHS practices stated by respondents

OHS Practice	Number of Respondents Mentioning	Percentage (%)
PPE use	13	100 %
Training and education	10	76%
Equipment inspection	8	61.5%
HIRA	5	38.5%

4.3 ENVIRONMENTAL CHALLENGES IN GADZEMA

The environmental impacts associated with small-scale mining activities in Gadzema were found to be substantial and varied. Data gathered through field observations and corroborated by responses from environmental regulatory officers revealed five major environmental

challenges: land degradation, deforestation, soil contamination, waste mismanagement, and water pollution. These issues were observed across multiple mining sites, with their severity differing depending on the size and management structure of each operation.

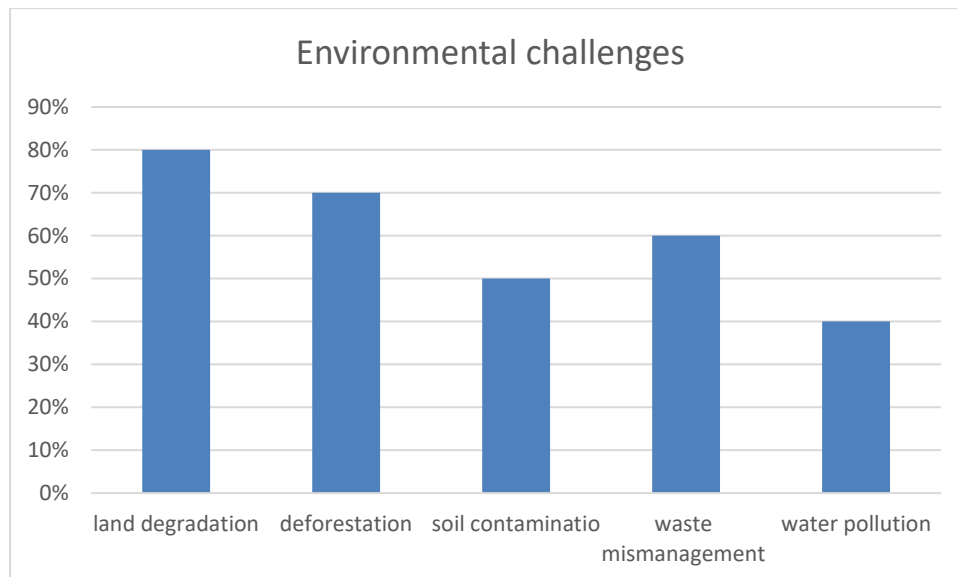


Figure 3 Frequency of environmental challenges

4.4 RELATIONSHIP BETWEEN OHS PRACTICES AND ENVIRONMENTAL SUSTAINABILITY

To examine the relationship between OHS practices and environmental sustainability, participants were asked two key questions: (1) whether they believed a relationship exists between OHS and environmental sustainability, and (2) in what ways OHS practices impact environmental sustainability. Respondents acknowledged a direct and significant relationship between OHS practices and environmental sustainability. Respondents emphasized that OHS practices, when implemented effectively, not only protect the workers but also foster environmental responsibility.

"Proper OHS practices often go hand in hand with environmental stewardship." (SHE Officer 1)

" When workers are educated in proper safety measures, they also become more responsible with how they treat the environment. Safer mining means less damage." (Site Manager 6)

This strong agreement among respondents suggests that fostering a safety-first culture in mining has wider implications for environmental protection and sustainable resource management.

4.4.1 HOW OHS PRACTICES IMPACT ENVIRONMENTAL SUSTAINABILITY

From the responses, several thematic areas emerged on how OHS practices influence environmental sustainability. These themes include safe handling of hazardous materials, structured waste management, responsible excavation, and behavioral change among workers due to safety training and education.

a) Safety Handling of Hazardous Substances

Respondents highlighted that when OHS practices are followed, especially in terms of hazardous materials handling, the risks of environmental contamination are significantly reduced.

"Effective OHS practices directly contribute to environmental conservation. When miners prioritize safety and health, they are more likely to adopt practices that minimise environmental harm, such as proper waste management and safe handling of hazardous materials, preventing spillage." (Environment Officer 2)

Conversely, where safety standards are neglected, respondents reported direct environmental consequences:

"Poor OHS practices, such as inadequate training and education, and lack of PPE, often lead to careless handling of hazardous substances. For instance, at our workplace, oil spillage is a problem, and chemical containers are burnt, thereby releasing toxic gases into the atmosphere." (Site Manager 7)

These insights demonstrated that OHS is a gateway to environmental responsibility, especially in the management of chemicals, fuel, and industrial waste.

b) Waste Management Practices

Improved OHS measures often bring with them stricter and more organized waste management practices. This was confirmed by a respondent who noted the environmental improvements following the introduction of more serious SHE protocols:

"Ever since we started implementing safety, health, and environment measures seriously, there has been a reduction in a reduction in spillages as well as waste across the workplace." (Site Manager 4)

Respondents also pointed out that in the absence of formal procedures, mining operations often resort to unsafe disposal methods:

"Miners dump chemical containers in a pit and, when full, they burn the waste. This releases gases into the atmosphere, which contributes to global warming." (Environment Officer 1)

"When safety protocols are not followed, hazardous materials may be improperly discarded, leading to pollution." (Site Manager 1)

This illustrates how the lack of environmental training and safety oversight can lead to harmful waste practices, with long-term implications for air quality and climate.

c) Excavation Methods and Land Stability

Unsafe excavation methods are also both an OHS hazard and an environmental threat. Respondents indicated that reckless digging and tunneling not only jeopardize workers' safety but also damage land structures. Unsafe excavation methods cause destabilization of land, resulting in road collapse.

d) Training and Behavioral Change

Respondents repeatedly emphasized the role of safety training in cultivating environmental responsibility. Safety education was seen as a mechanism not only for preventing accidents but also for instilling broader awareness of how human actions impact the environment.

"When workers are trained in proper safety and health measures, they become more aware of their surroundings and more cautious about how they handle resources." (SHE Officer 2)

This shows that environmental sustainability can be achieved in part through behavioural changes driven by a robust OHS culture.

CHAPTER FIVE: DISCUSSION

5.1 INTRODUCTION

This chapter discusses the findings presented in the previous chapter. The discussion is structured around the three research questions: (1) the occupational safety and health practices implemented by small-scale miners in Gadzema, (2) the environmental impacts of small-scale mining operations, and (3) how occupational health and safety practices affect the sustainability of the environment.

5.2 OHS PRACTICES IMPLEMENTED IN GADZEMA

The findings show that OHS practices are unevenly implemented in Gadzema. While some mining companies have implemented formal safety measures, such as PPE, training and education, equipment inspection, and HIRA, others have uneven or limited compliance. The presence of structured policies in mines align with a study by Siabi et al (2022), which highlighted the importance of a written policy regarding the implementation of employee occupational health and safety. Siabi et al (2022) goes on and explain that the policy should be able to outline structures, procedures, and processes that can create a safe workplace.

The difference in implementing OHS seems to come down to varying levels of institutional capacity. The results relate to a study by Astutik et al (2024), which highlighted that OHS implementation is hindered by several challenges, including a lack of expert resources, low worker awareness of OHS, a lack of management leadership in implementing OHS, and inadequate regulatory enforcement.

Mines with engaged and safety-conscious management tended to create a more proactive OHS environment. In contrast, where OHS was viewed as a regulatory burden rather than an essential value, implementation was perfunctory or reactive. This validates Mandowa et al (2025), conclusions that strong leadership management commitment, support, and involvement are the driving force behind all other elements that improve OSHMS implementation. Furthermore, the absence of established safety departments in some mines indicated the need for policy Innovation suited to small-scale miners. Introducing cluster-based OHS support systems, which are shared by numerous small-scale miners, can overcome the resource gap and professional safety management across the industry.

5.3 ENVIRONMENTAL CHALLENGES IN GADZEMA

The study indicates that environmental deterioration is a widespread consequence of small-scale mining in Gadzema. The empirical evidence indicates that land degradation, water and soil contamination, deforestation, and improper waste management are the most pressing challenges. These findings are consistent with previous research (Magenge & Mapira, 2023) that related small-scale mining with various environmental difficulties, including river pollution, unsafe open pits, environmental degradation, and destruction of natural habitats, all of which affect the existence of wildlife.

This study makes an important contribution by demonstrating how environmental degradation is both a result and a reflection of small-scale mining's unregulated nature. For example, the expansion of unrehabilitated pits, deforestation for shaft timber, and uncontrolled waste disposal all demonstrate a lack of environmental accountability measures. The environmental governance gap is compounded by regulatory authorities' limited ability to oversee dispersed and mobile mining operations (Gumbo et al., 2024).

From a sustainability standpoint, these environmental consequences weaken the Triple Bottom Line approach (Nogueira et al, 2023), which positions that long-term development must balance economic, social, and environmental factors. In Gadzema, economic survival and profit maximization frequently trump environmental conservation, resulting in a distorted development trajectory. The frequency of behaviours like fuel spills and open burning of chemical containers endangers ecosystems while also contributing to global environmental issues like climate change.

5.4 IMPACT OF OHS PRACTICES ON ENVIRONMENTAL SUSTAINABILITY

This study makes an important contribution by demonstrating the relationship between OHS measures with environmental sustainability. Responses showed that OHS and environmental sustainability are interdependent, recognizing that enhanced safety practices frequently result in better environmental outcomes and vice versa. This supports the theoretical notion of integrated risk management in health, safety, and environment (HSE), which incorporates risk management practices across all business aspects (Habie, 2025).

The interdependence between OHS practices and environmental conservation appeared in various ways. Training on hazardous materials, for instance, not only reduced the likelihood of worker injury but also lowered improper waste disposal and chemical handling. Similarly, the

provision and enforcement of PPE indirectly influenced environmental behaviour; workers who were better protected and informed were more likely to engage in environmentally responsible practices. The study also revealed how poor OHS practices contribute to environmental degradation. Unsafe excavation methods exacerbate land destabilization, and insufficient training leads to careless handling of pollutants. This supports findings by Benson et al. (2024), who argue that OHS interventions in mining often yield co-benefits for environmental management.

The intersection of health and environmental risks also foregrounds the issue of cumulative vulnerability. In Gadzema, miners operate in conditions that simultaneously expose them to occupational hazards and environmental harm, such as contaminated water and degraded land. This dual exposure perpetuates cycles of risks and poverty, suggesting that interventions should not compartmentalize health and environment, but address them jointly through participatory, community-based risk governance. These findings acknowledge the importance of Environmental Health Literacy, which suggests that awareness and understanding of environmental health information can be used to make more informed decisions and reduce health risks (Moreno-Gomez-Toledano, 2024).

CHAPTER SIX: SUMMARY, CONCLUSION, AND RECOMMENDATION

6.1 SUMMARY

The research study sought to investigate how occupational health and safety (OHS) can determine the environmental sustainability of small-scale mining communities. Gadzema in Chegutu was used as a case study. The study was motivated by the increasing environmental challenges and recognition that poor OHS practices not only affect workers but also the environment as well.

The research was guided by three objectives:

- To assess the current occupational health and safety practices in Gadzema.
- To examine the environmental impacts associated with small-scale mining activities in Gadzema
- To analyze how occupational health and safety practices contribute to environmental sustainability.

A qualitative research design was used, making use of semi-structured survey questionnaires distributed via email and WhatsApp to OHS supervisors and environmental regulatory officers. Field observations were also conducted by the researcher for data collection. Data was analysed thematically using Microsoft Excel and presented under structured headings aligned with the research objectives. The study findings indicated that OHS practices implementation in Gadzema varied significantly depending on the capacity and leadership of the company. The use of PPE, equipment inspection, training and education, and HIRA were the practices being implemented. This disparity also extended to environmental challenges, with more compliant mines showing fewer challenges as compared to non-compliant mines. Land degradation, deforestation, soil and water contamination, as well as waste mismanagement, emerged as the environmental challenges being faced. The study also showed that OHS practices can, to a large extent, impact the sustainability of the environment in an area, whilst environmental conditions also affect workers' health and safety.

6.2 CONCLUSION

The research findings revealed that while some small-scale mining companies have implemented basic OHS practices, there are barriers that make these efforts inconsistent. The research also discovered environmental issues caused by small-scale mining, such as

environmental degradation and pollution. A strong interdependence between OHS practices and environmental harm was discovered. Poor OHS causes environmental degradation, whereas effective OHS practices lead to environmental conservation. These data imply that improving OHS can be a successful method for decreasing the environmental impacts of small-scale mining. The study's main takeaway is that investing in OHS is not only a strategy to protect workers but also a path to sustainable environments in mining communities. Future research should investigate the role of legislation and community engagement in promoting this dual goal, as well as how measurable improvements in OHS can translate to concrete environmental benefits across varied mining contexts.

6.4 RECOMMENDATIONS

- Regulatory authorities must transition to integrated compliance models in which OHS and environmental obligations are monitored together.
- Shared OHS support services can be implemented to serve mines with limited capacity.
- Regulatory bodies must be adequately funded and resourced to conduct regular monitoring.

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APPENDICES:

APPENDIX 1: SURVEY INVITATION

From: nsmemezi@gmail.com

To:.....

Subject: Invitation to participate in a research survey

Dear Participant

I am a final-year B. Sc SHEM student at Bindura University of Science Education, and as part of the program, I am undertaking a research study. I am inviting you to take part in a short survey titled "Occupational Health and Safety as a determinant of environmental sustainability in small-scale mining communities: A Case study of Gadzema, Chegutu". The survey is intended to collect data that will aid in answering a series of predetermined research questions. Your views and experiences are significant and will help the study.

Participation in this study is completely voluntary and confidential, and you have the right to withdraw from participating at any moment throughout the process. The survey should take about thirty minutes to complete.

If you agree to participate, please click on the link below. If you have any questions or issues concerning the study, please let me know. Thank you.

Yours sincerely

Nokutenda Shammah Memezi

APPENDIX 2: SEMI-STRUCTURED QUESTIONNAIRE FOR OHS SUPERVISORS

Introduction

The purpose of this questionnaire is to determine whether there is a relationship between OHS and the sustainability of the environment, and to provide actionable recommendations that can improve worker safety and environmental stewardship. Please be reminded that all the information you will provide will be kept confidential and will be used for academic purposes only.

Section A: Background Information

1. What is your role and responsibility at work?
2. How long have you been working in your current position?

Section B: OHS Practices

3. Do you have any OHS policies and procedures in place at your workplace? Yes/No
4. Do you have any OHS practices being done at your company? Yes/No
 - b) If yes, may you explain in short how you implement the practices?
5. Has your organisation experienced major accidents? Yes/No
 - b) If yes, when and what nature were they?
 - c) If no, what do you think is the reason for this?

Section C: Relationship between OHS and environmental sustainability

6. What is your impression of the relationship between OHS and environmental sustainability?
 - b) Do you believe the current OHS practices (in general) contribute to the sustainability of the environment? If yes, how?
7. Have there been any incidents where unsafe mining practices led to environmental damage? Yes/No

Section D: Challenges and Recommendations

8. What challenges do you face during the enforcement of OHS measures?
9. What improvements would you recommend for better integration of OHS and environmental sustainability practices?

APPENDIX 3: SEMI-STRUCTURED QUESTIONNAIRE FOR REGULATORY OFFICERS

Introduction

The purpose of this questionnaire is to determine whether there is a relationship between OHS and the sustainability of the environment, and to provide actionable recommendations that can improve worker safety and environmental stewardship. Please be reminded that all the information you will provide will be kept confidential and will be used for academic purposes only.

Section A: Background Information

1. What is your role and responsibility at work?
2. How long have you been working in this position?

Section B: Impacts of mining on the environment

3. What environmental impacts have you observed and documented in Gadzema as a result of small-scale mining?
4. Can you provide specific examples of how small-scale mining has affected local ecosystems?

Section C: Relationship between OHS and the environment

5. What is your impression of the relationship between OHS and environmental sustainability?
6. Have you observed any link between poor OHS practices and environmental harm in the area? Yes/No
 - b) If yes, how do poor OHS practices lead to environmental challenges?

Section D: Recommendations

7. How can collaboration between regulatory agencies, mining companies, and local communities be improved?
8. What Recommendations would you suggest to improve both OHS and environmental sustainability in Gadzema?

APPENDIX 4: OBSERVATION CHECKLIST

Location of observation:

Date of observation:

Category	Yes	No	Notes
OHS practices			
Do miners use personal protective equipment (PPE)?			
Is there evidence of safety training sessions (posters, schedules)?			
Are safety signs visible and understandable?			
Is the working area clean and well organized?			
Do workers have access to on-site first aid kits?			
Environmental aspects			
Is there evidence of land degradation on-site and in the surrounding areas?			
Are there any signs of water pollution (discoloration, odor)?			
Is waste segregation being done?			
Is there evidence of air pollution (e.g., dust)?			