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CONTEXTUAL STUDY ON THE ARTISANAL & SMALL-SCALE GOLD MINING SECTOR IN ZAMBIA

A contextual study of six ASGM sites.
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Executive Summary

Introduction

This study provides a comprehensive baseline assessment of six Artisanal and Small-Scale Gold Mining (ASGM) communities in Zambia, revealing the systemic challenges that undermine the sector's potential for sustainable and equitable development. The findings expose a series of critical paradoxes: a robust legislative framework coexists with widespread informality; intensive labour inputs result in alarmingly low productivity; and a severe dependency on mercury persists despite known health and environmental risks. Zambia's ASGM sector serves as a critical economic lifeline for approximately 1.4 million[1] people, contributing significantly to rural livelihoods and national gold production. The study, conducted in six key gold mining sites of the following Districts: Kabombo-Rufunsa; Sasare-Lusangazi;Chitumba-Vubwi; Luili/Matala-Mumbwa; Matipa-Chisamba; and Kanyelele-Mpika; and consequently, provides comprehensive empirical data on operational practices, gender dynamics, environmental impacts, and economic barriers found in these locations.

Key Findings

The assessment highlights profound structural weaknesses across the sector, framed by the following key statistics:

- **Gender Inequality:** The study reveals profound gender inequalities permeating Zambia's ASGM sector, with women comprising only **19%** of the total mining workforce. This aggregate figure masks extreme regional variations, ranging from a mere **2%** female participation in Kanyelele's male-dominated, high-risk environment, to near gender parity **(50%)** in Sasare and Chitumba, where cultural norms accommodate women's involvement, although this is in less physically demanding tasks like panning and ore sorting.
- **Formalisation Gap:** Despite progressive legislation (such as the MRC Act 2024 & GMD Act 2025), formalisation rates remain alarmingly low. Only **5.4%** of miners hold valid mining licenses, and **4.6%** are registered with PACRA, and a mere **1.0%** possess Environmental Compliance Certificates. Three structural barriers explain this compliance gap: prohibitive compliance costs that dwarf Artisanal and Small-Scale Miners' irregular incomes, bureaucratic complexities requiring multiple trips to urban centres, where the Ministry of Mines and Minerals Development offices are located, and knowledge gaps, where **84.0%** are aware of licensing requirements, but only **16.7%** are familiar with the process of applying. Women face additional hurdles, including limited mobility from their homes, due to care responsibilities and cultural biases.
- **Productivity Crisis:** Productivity analysis reveals severe inefficiencies constraining miners' earnings, with a stark difference between the **average** and the **typical** operation. (a) **Average Operation (Mean):** The mean operation processes a large volume of **0.543 tonnes of ore per cycle** but recovers only **6.7g of gold**, resulting in an extremely low yield rate of **approximately 0.0012%**. This average is heavily skewed upward by a small number of high-volume, mechanized operations. (b)

[1] World Bank (2021). *Zambia - Artisanal and Small-Scale Mining Gold: Potential, Challenges, and Opportunities*. Washington, D.C.: World Bank Group

Typical Operation (Median): The median which best represents a typical miner paints a more accurate and concerning picture. A typical Artisanal and Small-Scale Gold Mining operation processes **0.375 tonnes of ore per cycle** to recover just **3g of gold**.

This traps the majority of miners in a cycle of high physical effort for minimal returns**.** The poor gold recovery stems from compounded factors: reliance on inefficient manual crushing methods, inability to identify and target higher-grade ore, significant mercury losses during the amalgamation process, and limited mechanisation. The disparity between the average and median yields highlights the deep inefficiency at the core of typical Artisanal and Small-Scale Gold Mining operations and the concentrated productivity of a mechanized minority. Comparative data shows mechanized sites like Luili/Matala achieve **5x higher productivity (1-5 tonnes/day**), basic equipment like mechanical crushers, processing ore through wet pans unlike mortar and pestle demonstrating the potential gains from technology adoption. Women miners face additional productivity constraints, such as processing 30% less ore daily due to time allocated to domestic responsibilities. These findings highlight the potential for substantial economic gains through targeted technical interventions and gender-responsive support systems.

- **Mercury Dependency:** The study documents alarming mercury dependency across ASGM operations, with miners using an average of **2.56 grams of mercury per tonne of ore processed.** This practice results in a concerning 3:1 mercury-to-gold ratio, indicating significant chemical waste and environmental contamination. Gender-disaggregated data reveals that men predominantly handle mercury during gold amalgamation, while women face secondary exposure through contaminated water sources used for domestic purposes and panning activities. Site-specific analysis shows Rufunsa and Lusangazi as mercury hotspots, with 100% of processing still relying on this toxic substance. In contrast, Luili/Matala demonstrates marginally better **Extraction rates (5g gold per tonne)** due to **partial mechanization**, though mercury use remains prevalent.
- **Safety Failures:** The sector's safety record presents grave concerns, with **73.51%** of miners working without personal protective equipment (PPE) and 66.84% of pits lacking basic support structures that would make their mining activities safer. Environmental management is a concern, with 93.26% of sites operating without rehabilitation plans and 32.6% directly discharging waste into natural watercourses.

Recommendations

To address the systemic challenges in Zambia's ASGM sector, immediate and coordinated interventions should prioritize: (1) **gender equity** through targeted empowerment programmes for women in high-value mining roles, leadership quotas (30% in cooperatives by 2027), and childcare support to reduce their dual burden; (2) **mercury elimination** by banning imports by 2027, promoting affordable alternatives (e.g. centrifugal concentrators), and offering 10% price premiums for mercury-free gold, with strict enforcement in hotspots like Kabombo and Sasare; (3) **safety and environmental compliance** by mandating PPE provision, deploying occupational health officers to high-risk sites, and enforcing rehabilitation bonds to curb pollution; (4) **productivity enhancement** through mechanization leasing, cooperative mining models, and Zambia Gold Company expansion to ensure fair pricing via digital receipt systems; and (5) **streamlined formalisation** via mobile licensing units, reduced fees, and local-language training to bridge knowledge gaps (84% awareness vs. 17% understanding of procedures). These measures must be underpinned by community engagement, phased implementation starting with high-risk areas (Kanyelele, Kabombo), and robust monitoring to ensure compliance and adaptive learning.

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Abbreviations

ASM	Artisanal and Small-Scale Mining
ASGM	Artisanal and Small-Scale Gold Mining

ASGM	Artisanal and Small-Scale Miner
AGC	Artisanal Gold Council
AZWIM	Association of Zambian Women in Mining
CEJ	Centre for Environmental Justice
CDAs	Community Development Agreements
8NDP	Eighth National Development Plan
EIAs	Environmental Impact Assessments
EMA	Environmental Management Act
GEF	Global Environment Facility
GPS	Global Positioning System
GRZ	Government of the Republic of Zambia
IIED	International Institute for Environment and Development
KIIs	Key informant interviews
KIs	Key informants
MRC	Mineral Regulation Commission Act
MMDA	Mines and Minerals Development Act
MOH	Ministry of Health
MLNR	Ministry of lands and natural resources
MLGRD	Ministry of Local Government and Rural Development
MMMD	Ministry of Mines and Minerals Development
MSI	Multi-stakeholder initiatives
MSZ	Mwembeshi Shear Zone
NAP	National Action Plan
NMRDP	National Mineral Resources Development Policy
NGO	Non-Governmental Organizations
PACRA	Patents and Companies Registration Agency
PPE	Personal Protective Equipment
PMRC	Policy Monitoring and Research Centre
PPG	Project Preparation Grant
PPP	Public-Private Partnerships
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WHO	World Health Organization
ZDA	Zambia Development Agency
ZEMA	Zambia Environmental Management Agency
ZEITI	Zambia Extractive Industries Transparency Initiative
ZRA	Zambia Revenue Authority

1. Introduction

This chapter establishes the context for the baseline assessment of Zambia's Artisanal and Small-Scale Gold Mining (ASGM) sector. It begins by outlining the strategic importance of ASGM as a critical source of rural livelihood and its complex position within the national economy. The subsequent sections detail the rationale and objectives of this study, which was designed to fill critical knowledge gaps and inform evidence-based policy. Finally, the chapter describes the rigorous mixed-methods methodology employed to gather and analyse data from six key mining communities, ensuring a comprehensive and reliable foundation for the report's findings.

1.1 Background to the Artisanal and Small-ScaleGold Mining (ASGM) in Zambia

The Artisanal and Small-Scale Gold Mining (ASGM) sector is a significant economic lifeline in Zambia, particularly for rural populations where alternative employment opportunities are scarce. Historically, small-scale mining dates back to the pre-colonial era, when local communities extracted minerals for trade and ceremonial purposes. The sector's modern evolution began with economic liberalization in the 1990s and has been shaped by legislative reforms (such as the 2008 and 2015 Acts), culminating in the Mineral Regulation Commission Act (2024) and the Geological and Mines Development Act (2025), which aim to streamline regulation and promote formalisation.

Artisanal and Small-Scale Gold Mining (ASGM) in Zambia has a long history, deeply intertwined with the country's mining sector. It is worth noting that Zambia is traditionally known for its large-scale copper mining, but gold mining, particularly at the artisanal and small-scale level, has also played a significant role in the livelihoods of many Zambians, especially in rural areas where gold mining is taking place.

Today, ASGM activities are heavily concentrated along the Mwembeshi Shear Zone (MSZ), a check spanning several provinces. Despite its economic importance, the sector remains largely informal, operating outside established legal and regulatory frameworks. This informality creates numerous challenges, including economic leakages, severe health and environmental risks, and weak governance. A primary concern is the widespread use of mercury for gold extraction, a hazardous practice that contaminates soil, water, and air, posing significant risks to miners and surrounding communities.

The ASGM sector has evolved through various significant stages to its current state. Notably, the following historical phases have played a central role in shaping its development over time:

1. **Early Beginnings**: ASGM in Zambia can be traced back to the pre-colonial era when local communities engaged in the small-scale mining of gold and other minerals for trade and ceremonial purposes. However, the formal recognition of ASGM activities began during the colonial period in the early 1900s, when the British colonial administration began regulating mining activities, with 1930 being the landmark when the first mineral deposits were discovered in Ndola Rural[2].
2. **Post-Independence Era (1964 onwards)**: Following Zambia's attainment of Independence in 1964, the government nationalized the mining sector (even though nationalisation only happened much later, partially in 1969, and fully in 1974), focusing primarily on large-scale copper mining. ASGM activities, on the other hand, continued informally, often in remote areas, with limited government oversight. During this period, ASGM was largely seen as a subsistence activity, providing limited income mainly for rural populations[3].
3. **Economic Liberalization in the 1990s**: The economic reforms of the 1990s[4], which included the privatization of state-owned mines, led to increased interest in ASGM. The vast majority turned to small-scale mining as a livelihood due to job losses in the formal mining sector and economic hardships. Gold became a key mineral for ASGM due to its high value, ready market, and relatively low entry barriers.
4. **Recognition and Formalisation Efforts**: In the early 2000s, the Government of the Republic of Zambia began to recognize the economic importance of ASGM. The Mines and Minerals Development Act of 2008 provided a legal framework for the formalisation of ASGM, aiming to integrate small-scale miners into the formal economy, improve safety standards, and reduce environmental degradation.

Building upon these historical phases, the ASGM sector has subsequently experienced growth and entered several stages of formalisation, including the following:

a. Legal Framework*:* The Mines and Minerals Development Act of 2008 and its subsequent amendments (e.g., the 2015 Mines Act) established provisions for licensing ASGM operations, promoting safer mining practices, and encouraging the use of environmentally friendly technologies. The government also introduced the Mineral Rights Management System to streamline the licensing process. As of 2025, the government has enacted two new legislatures (Mineral Regulation Commission Act of 2024, and the Geological and Mineral Development Act of 2025) that are aimed at streamlining the mining sector in general, but also centred on formalising and fully recognising the existence of Artisanal and Small-Scale Mining, not only for gold but other minerals, such as development minerals and gemstones.
b. Support from International Organizations*:* Organizations such as the World Bank, United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP) have, over the years, supported Zambia's efforts to formalize ASGM. For example, the UNEP's Global

[2] Zambia handbook of Artisanal Mining 2018. (https://www.sgu.se/globalassets/itp308/presentations-msc/artisanal-and-small-scale-handbook-zambia.pdf)

[3] Zambia handbook of Artisanal Mining 2018.

[4] Zambia handbook of Artisanal Mining 2018.

Environment Facility (GEF) funded projects aimed at reducing mercury use in ASGM, aligning with the Minamata Convention on Mercury, which Zambia ratified in 2016.

c. Challenges in Formalisation: Despite these efforts, formalisation has been slow due to several challenges, such as limited access to financing, lack of technical knowledge, and the informal nature of many ASGM operations. Consequently, many miners still operate without licenses, and illegal mining remains a significant issue.
d. Economic Contribution*:* ASGM has become an important source of income for thousands of Zambians, particularly in regions like Eastern Province, where gold deposits are abundant. According to a 2018 report by the International Institute for Environment and Development (IIED), ASGM contributes significantly to local economies, though much of this activity remains undocumented.
e. Environmental and Health Concerns*:* The use of mercury in gold extraction is a source of serious environmental and health concerns. Efforts to promote mercury-free technologies and better mining practices are ongoing, with support from both the government and international partners.

Despite its significance, ASGM in Zambia remains largely informal, and this has created numerous challenges in regulation, coordination, and governance. These challenges exacerbate environmental degradation and result in economic leakages that undermine the sector's potential contribution to national development.

Nonetheless, the ASGM continues to be a significant economic activity, directly engaging over 30,000 miners across Zambia[5] . The demographic profile of miners as of 2023 comprised 77% men, 18% women, and 5% children, many of whom rely on basic tools and unsafe practices and techniques for gold extraction according to the national action plan on mercury elimination[6]. One of the most widely used practices involves mercury, a hazardous substance that poses severe risks to both health and the environment. Mercury contamination affects soil, water, and air, as well as mining equipment, resulting in long-term health and environmental harm. These impacts extend beyond local communities, as mercury is released into the atmosphere can travel globally, affecting ecosystems far from its original source. Vulnerable groups, including children and pregnant women, face the greatest health risks from mercury exposure.

ASGM activities in Zambia are particularly concentrated along the Mwembeshi Shear Zone (MSZ), a region spanning the Central, Eastern, Lusaka, and North-Western Provinces. This area is central to gold mining operations and highlights the geographic importance of ASGM within Zambia. However, the lack of a formalized coordination mechanism continues to hinder the sector's development. Unlike other sectors such as water and health, which benefit from structured frameworks that cascade from national levels down to district and community structures, ASGM remains fragmented. The limited presence of organized governance structures constrains efforts to regulate and formalize the sector, leaving it vulnerable to exploitation, illegal trade, and further environmental harm.

[5] 10837- CEO Endorsement project document for the Global Opportunities for Long Term Development of the Artisanal and Small-Scale Gold Mining (ASGM) Sector planetGOLD in Zambia

[6] https://minamataconvention.org/sites/default/files/documents/national_action_plan/Zambia-NAP-2023-EN.pdf

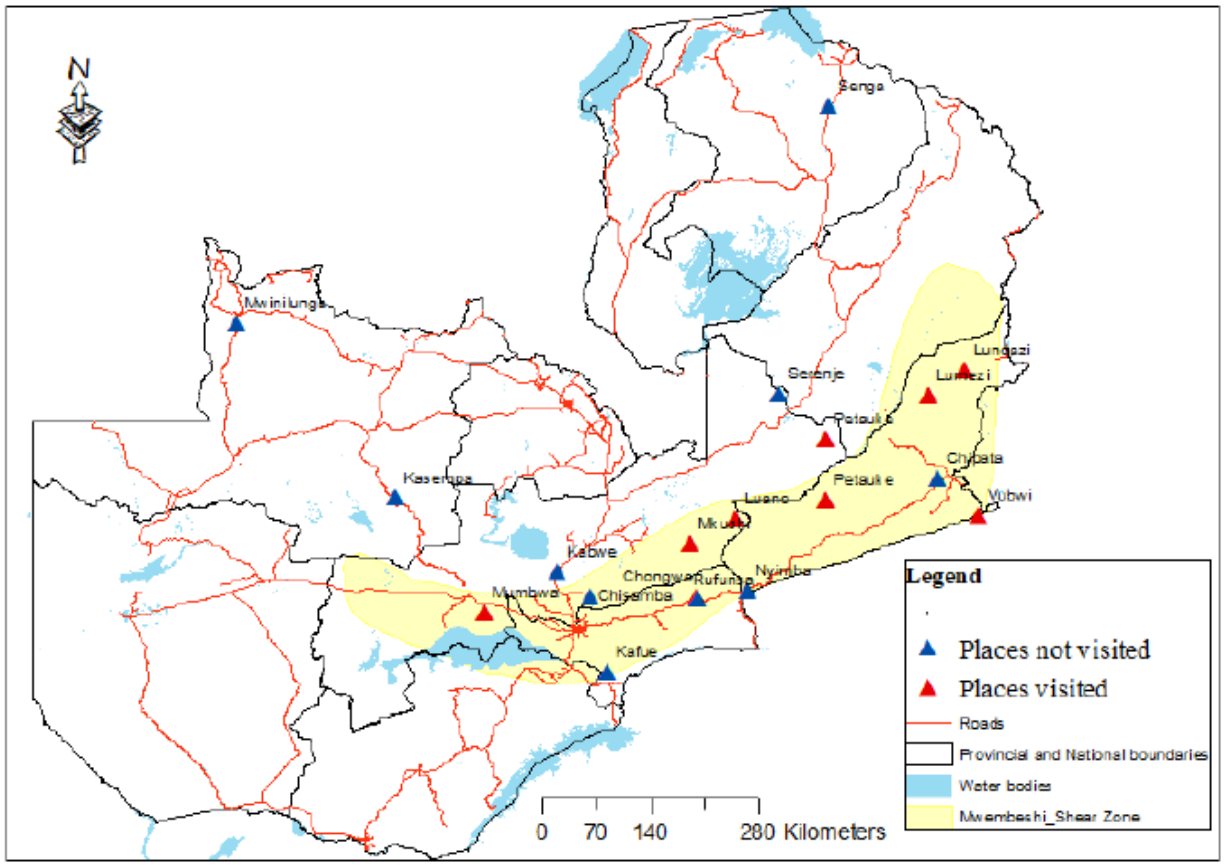

Figure 1: Locations of ASGM Activities in Zambia. Source: ZEMA (2021): NAP on ASGM

1.2 Study Relevance and Objectives

This contextual study was conducted under the ***planetGOLD Zambia Project***, a five-year initiative funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP), and executed by Artisanal Gold Council (AGC) in partnership with the government of the republic of Zambia through the Zambia Environmental Management Agency, with the aim of reducing mercury use in ASGM by promoting sustainable mining practices. This baseline study was designed to provide comprehensive data on Artisanal and Small-ScaleGold Mining (ASGM) activities across selected project sites in Zambia, filling critical knowledge gaps to inform targeted strategies for formalisation, mercury reduction, and environmental sustainability.

Previous assessments on the ASGM sector in Zambia such as those conducted during the Project Preparation Grant (PPG) phase and the development of Zambia's National Action Plan (NAP)[7] under the Minamata Convention highlighted key barriers to reducing mercury use, such as:

[7] Government of Zambia. (2018). National Action Plan for Artisanal and Small-Scale Gold Mining. Lusaka: Ministry of Mines and Minerals Development.

- Inadequate policy and regulatory frameworks,
- Weak multi-stakeholder coordination and planning,
- Limited organization of Artisanal miners,
- Insufficient data on gold extractive potential,
- Limited access to capital, and
- Lack of awareness about mercury's health and environmental impacts.

However, these studies were limited in scope, leaving gaps in critical areas such as multi-stakeholder coordination, formalisation processes, and gender dynamics within the ASGM sector. As a result, existing data remained insufficient to serve as a robust baseline for guiding project interventions.

Therefore, this baseline study addressed these gaps by systematically profiling ASGM activities across selected sites, generating representative data on site characteristics, environmental impacts, demographic trends, and key challenges faced by miners. This study provides a valuable resource for Zambia's Artisanal and Small-ScaleGold Mining (ASGM) sector. The findings also offer a clear roadmap for the planetGOLD Zambia Project's interventions, particularly in environmental management, formalisation, gender inclusion, and capacity building. This will help ensure that proposed interventions are evidence-based and tailored to the specific needs of target communities.

The main goal of this contextual study, in six target locations, was to conduct an analysis of the following components:

- Socioeconomic status: This component involved documenting the basic socioeconomic characteristics of Artisanal gold miners in the targeted sites, including demographic information such as population, age, gender, income, education levels.
- Formalisation Status: This component focused on identifying the challenges Artisanal gold miners face in complying with existing national legislation, regulations, standards, and local government policies. It also examined issues related to organizational affiliation in Artisanal mining in Zambia, including the extent to which miners are organized into cooperatives.
- Current Mining Practices: This component assessed the prevailing mining practices, an understanding of ore processing and gold extraction methods and the extent of legal compliance with technical mining practices, environmental practices, and occupational health and safety standards.
- Mercury Use: This component assessed the use of mercury, highlighting mercury handling and supply, annual mercury usage, and the potential for adopting mercury-free technologies.
- Knowledge and Awareness: This component evaluated the level of awareness among miners regarding mercury hazards, and mercury-free technologies. Also identified training needs and analysed the current use of different information channels.
- Gender Profile: This component focused on mapping the presence of women in gold mining and their roles. Also understanding of gender sector dynamics, and the status of other marginalised persons such as youth. The study also researched existence of child labour.
- Access to Financing and Gold Market: This component involved a rapid assessment of the gold supply chain, including the estimation of the ore extracted and volume of gold produced by Artisanal and Small-Scale Gold Miners.

The specific objectives were identified as follows:

1. To conduct detailed site profiling of ASGM activities across selected gold mining sites in Zambia, documenting site characteristics, and demographic information.
2. To gather baseline data on key thematic areas, including gold processing techniques, knowledge and awareness of mercury hazards, access to financing, and challenges faced by miners.
3. To provide actionable recommendations for project implementation, with a focus on formalisation, the adoption of mercury-free technologies, and environmental protection.

1.3 Study Design and Methods

For this baseline study a *mixed-methods research design*, integrating both quantitative and qualitative data collection techniques were utilised. This approach was selected to ensure a comprehensive understanding of the issues under investigation, capturing both the breadth and depth of the challenges and opportunities within the ASGM sector. Quantitative and qualitative data collection tools were designed to allow data triangulation between different stakeholder groups and research methods. Table 1 shows an overview of the data collection methods employed in the study. The table shows that some specific focus areas within components outlined, were only addressed in the specific research methods shown. The study methodology included primary data collection in the field, and a desk review of relevant secondary data.

a) Population and Sample Size

The study population primary target group was the ASGM Miners, while the local Communities, and various stakeholders were considered the secondary population to the study. These stakeholders are involved in or are affected by ASGM activities across gold mining sites along the MSZ[8], spanning Central, Eastern, Lusaka, Northern, and North-Western Provinces of Zambia. The study sites were chosen due to their prominence as hubs for ASGM activities.

b) Sampling Techniques

The study employed a *multi-stage, adaptive sampling strategy* designed to address the logistical and social challenges of studying Artisanal and Small-Scale Gold Mining (ASGM) communities. Given the absence of reliable population registries and the need to minimize disruption to miners' work, the approach prioritized flexibility, representativeness, and practical feasibility. By combining stratified

[8] Zambia handbook of Artisanal Mining 2018. (https://www.sgu.se/globalassets/itp308/presentations-msc/artisanal-and-small-scale-handbook-zambia.pdf)

geographic sampling with adaptive recruitment techniques, the methodology ensured robust participation across diverse mining roles, locations, and stakeholder perspectives.

The study targeted a total *sample size* of 440 participants, with the sample size of the miners as the main participants determined based on statistical principles for unknown population sizes, practical feasibility, and the need for representativeness. The sample size calculation for miners assumed a 95% confidence level and a 5% margin of error to obtain a sample of 384 miners.
The sample of 440 participants were distributed as follow:

Miners: 384,
Community Leader: 46, and
National Stakeholders: 10

Table 1: Overview of methods employed for data collection

Research Method Deployed	Actual sample	Study Focus Areas
Quantitative Research Methods **(Miners' Survey)**	390 Artisanal and Small-Scale Gold Miners in 6 selected study sites	• Socioeconomic information • Legal framework • Ore extraction, transportation and processing • Gold production, trade and supply chain • Occupational and technical safety • Environmental practices • Capacity building and information sources • Work roles and decision making • Mercury use and trade
Qualitative Research Methods **(Key Informant Interviews)**	66 key informant interviews with national and subnational stakeholders, who included: ▪ Traditional Leaders ▪ Mine leaders ▪ Community leaders ▪ Academia ▪ Government leaders	• Legal frameworks • Gold production, trade and supply chain • Environmental practices • Capacity building and information sources • Work roles and decision making • Mercury use and trade • Community effects due to mining practices • Social effects such as GBV and child pregnancies

	▪ NGOs and CSOs	
Desk Review	Grey literature	• Legal and policy framework • Gender related challenges and mainstreaming • Environmental practices • Mercury use and side effects • socio-economic dimensions

The actual sample size for this baseline did not differ substantially from the sample embedded in the design as it overachieved with a surplus of 18 more study participants. The gender distribution for the participants also was within the estimated range of 22.3% compared to 77.7% of males across all study sites**.** Table 2 shows the gender distribution of the study respondents.

Table 2: Survey participation by gender by site

MINING SITE (DISTRICT)	FEMALE	MALE	TOTAL
CHITUMBA (VUBWI DISTRICT)	18 (28.6%)	45 (71.4%)	63 (100%)
KABOMBO (RUFUNSA DISTRICT)	9 (13.0%)	60 (87.0%)	69 (100%)
KANYELELE (MPIKA DISTRICT)	15 (16.7%)	75 (83.3%)	90 (100%)
LUILI/MATALA (MUMBWA DISTRICT)	16 (22.5%)	55 (77.5%)	71 (100%)
MATIPA (CHISAMBA DISTRICT)	15 (41.7%)	21 (58.3%)	36 (100%)
SASARE (LUSANGAZI DISTRICT)	14 (23.0%)	47 (77.0%)	61 (100%)
TOTAL	87	303	390

c) Study Sites

This study focused on six gold mining sites located along Zambia's Mwembeshi Shear Zone (MSZ), each situated in a different district. The selected sites include:

- Luili/Matala in Mumbwa District of Central Province
- Matipa in Chisamba District of Central Province
- Kanyelele in Mpika District of Muchinga Province
- Kabombo in Rufunsa District of Lusaka Province
- Sasare in Lusangazi District of Eastern Province
- Chitumba in Vubwi District of Eastern Province

These sites represent a cross-section of the broader gold mining landscape within the MSZ corridor. The locations of these study sites are given in Figure 2 below.

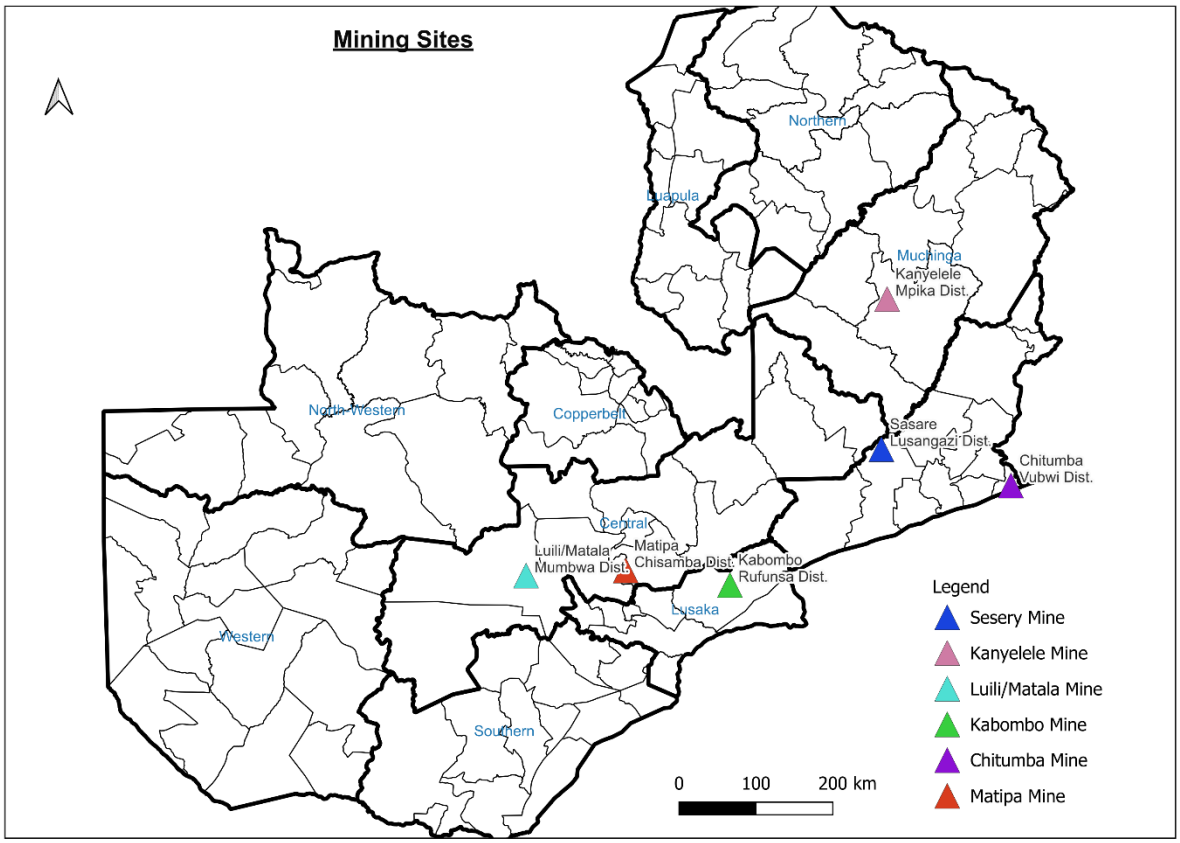

Figure 2: Map of Study Sites

2. Socio-economic Aspects of the Study Areas

Chapter 2: Summary

This chapter examined the socio-economic dynamics of Zambia's artisanal gold mining sub-sector using data collected by this study from across six sites. The data revealed a complex interplay of gender, education, income, and social protection. Key findings include a stark gender gap **(81% male, 19% female miners),** with women facing systemic barriers to entry and advancement. Educational attainment is moderate **(49.7% secondary school completion)** but its economic returns, against education levels, vary widely by site, with Kanyelele's higher-educated miners earning more than those in Chitumba, where primary education predominates. Income disparities are also pronounced, with Luili/Matala exhibiting extreme inequality per month (~63 USD to ~8,333+ USD) and Sasare's miners largely trapped in poverty. Social protection coverage registration is nearly absent **(1.3% NAPSA, 2.3% NHIMA)**, exacerbating vulnerabilities for women and older miners.

The study underscores the fact that *no single intervention can address these challenges*. Education alone is insufficient without local economic opportunities; gender parity requires site-specific strategies; and social protections must be expanded through cooperative and government collaboration. The sector's youth dominance **(66.5% aged 18–35)** presents an opportunity for targeted skills development, while middle-aged women (36–45) urgently need tailored support. Moving forward, policies must balance *human capital investment* (education, health) with *structural reforms* (fair wages, social safety nets) to create a more inclusive and resilient artisanal mining economy. This evidence-based approach is critical for breaking intergenerational poverty cycles and achieving sustainable development in Zambia's mining communities.

2.1Artisanal Gold Miner Population, Gender and Age Profile

2.1.1 Gender Distribution in Artisanal Gold Mining Sites

The baseline study surveyed *Artisanal miners* across six gold mining sites in Zambia, revealing a *significant gender disparity* in the sector; Overall, *81% of miners were male*, while *only 19%* were female, reinforcing the male-dominated nature of Artisanal mining, as revealed in figure 3 below. This finding aligns with Zambia's National Action Plan on the Elimination of Mercury (2023)[9], which reported a similar gender split of 77% men and 18% women in Artisanal gold mining.

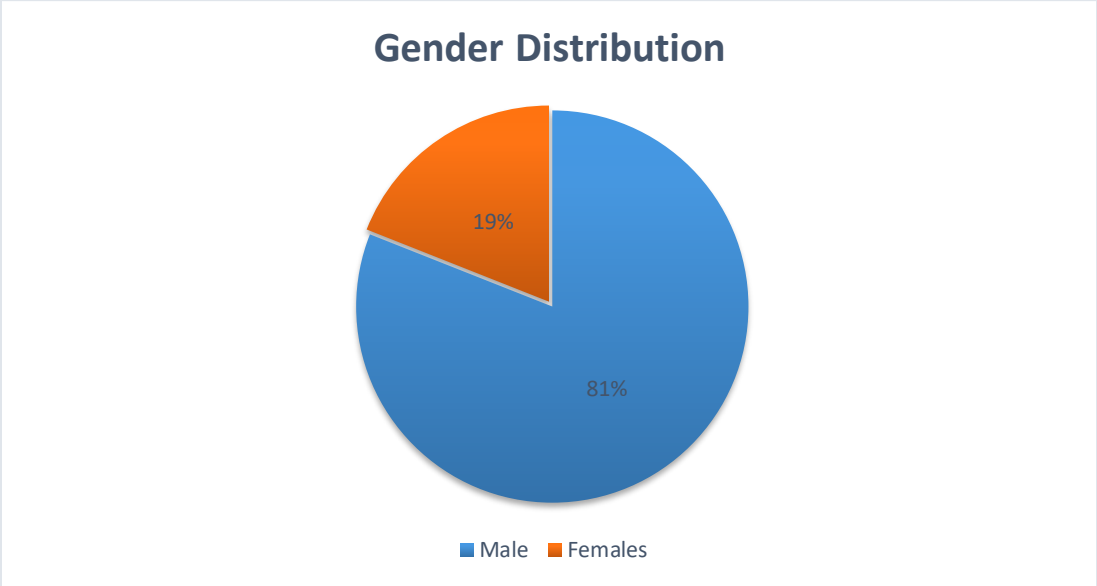

Figure 3: Gender distribution of miners across mining sites

a) Site-Specific Gender Disparities

The gender distribution varied considerably across mining sites, and table 4 indicates that:

- **Kanyelele (Mpika District)** recorded the greatest gender disparity, with **98% male** and **2% female** miners, the lowest female participation rate among all the sites. This is largely attributed to Bemba traditional beliefs in Muchinga Province, where mining pits are regarded as sacred burial sites for chiefs. Consequently, women are not allowed to own pits or actively mine, as they are believed to desecrate the sacred land. It is also believed that if a woman who is menstruating is unclean and if she passes through the pits, the gold will disappear.
- Luili/Matala (Mumbwa District) followed closely with 90% male and 10% female miners.
- Matipa (Chisamba District) and Kabombo (Rufunsa District) showed relatively higher (though still low) female representation at 24% and 20%, respectively. For Kabombo, women have secured tents where they process their own ore, others are paid to crush the ore using a metal mortar and pestle, however, the study found that there is a continuous decline in such activities as simple mechanization keeps increasing with simple machines like crushers, ball mills etc. This may eventually replace womens designated roles and reduce the percentage.
- Sasare (Lusangazi District) and Chitumba (Vubwi District) stood out as exceptions, with 47% and 40% female miners, suggesting that certain sites may offer more accessible opportunities for

[9] https://minamataconvention.org/sites/default/files/documents/national_action_plan/Zambia-NAP-2023-EN.pdf

women in Artisanal mining. There is good participation of women because, in both places, miners work together as families. The findings revealed that in Chitumba families, father, mother, and children mine within their farms, hence, the increased participation of women.

b) Implications and Further Analysis

The extreme underrepresentation of women in most sites (particularly Kanyelele and Luili/Matala) points to structural barriers, including sociocultural norms, safety concerns, finance, training opportunities and other challenges that limit access to mining resources for women. The higher female participation in Sasare and Chitumba warrants further investigation to identify enabling factors, such as more supportive community structures, access to finance and less physically demanding mining methods, that could be replicated elsewhere. These findings highlight the need for gender-sensitive policies to promote women's inclusion in Zambia's Artisanal mining sector, particularly through training, access to financing, and safer working conditions. Further discussion on these barriers and potential interventions is explored in the last section of this study.

2.1.2 Youth Distribution Analysis Across Zambian Mining Sites

The study establishes that the majority (72%) of surveyed miners are between 26 and 45 years old. Younger miners (18-25 years) constitute 20% of the sample, while older miners (46 years and above) account for only 8%, as depicted in Figure 4 below.

To specifically assess youth engagement, the analysis applies the official Zambian definition of youth (individuals aged 19 to 35 years) as per the 2024 Youth Policy and Article 266 of the Constitution. Within the surveyed population, 66.49% fall within the broader 18-35 age range. When applying the precise policy definition, 46.13% are in the core 26-35 category. A further 20.36% are aged 18-25; however, 18-year-olds are technically excluded from the official youth category. Within this 18-25 bracket, 18-year-olds specifically constituted 3.08% of the total surveyed population**.** This minor exclusion does not materially change the conclusion that the Artisanal and Small-Scale Gold Mining (ASGM) sector is a significant employer for Zambia's youth, though notable variations exist across sites.

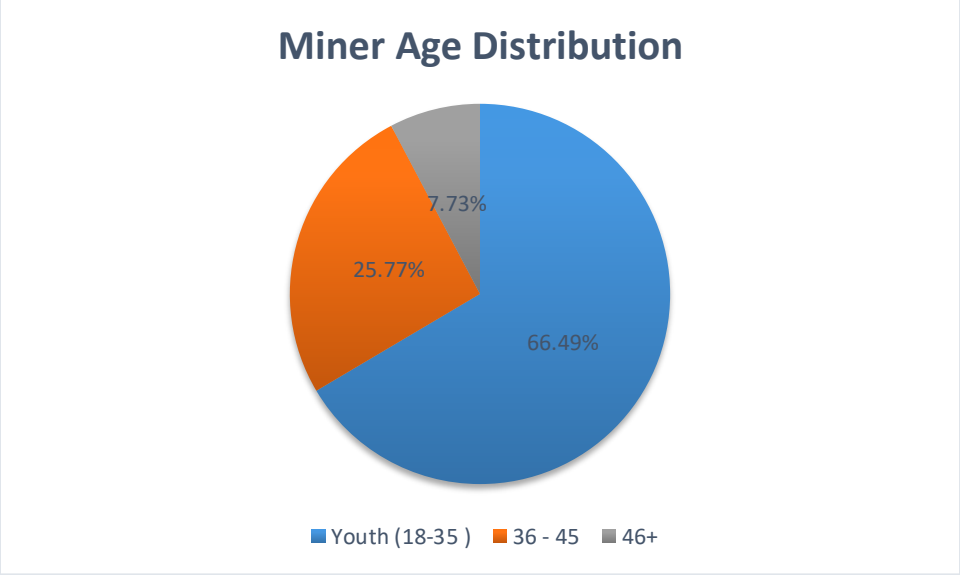

Figure 4: Miner Age Distribution

a) Site-Specific Youth Representation Patterns

Analysis of the 26–35-year cohort—the core of the youth demographic—reveals distinct patterns:

- Kanyelele emerges with the highest concentration, where 56.67% of its surveyed miners are in this group, suggesting the site offers conditions favourable to youth employment.
- Kabombo maintains a strong representation at 47.83%.
- Luili/Matala shows a different demographic profile, with a lower share in the 26-35 group (38.03%) but the highest proportion of younger miners in the 18-25 bracket (30.99%), indicating it may attract entry-level workers.
- Chitumba aligns closely with the survey average (47.62%).

These variations suggest that local socio-economic factors, the maturity of mining operations, or access pathways differ significantly by location, influencing the age structure of the workforce.

b) Notable Exceptions and Policy Implications

Two sites present notable exceptions to the dominant youth trend:

- Sasare has a comparatively low youth (26-35 years) representation at 28.33% and a high proportion of older workers (36-45 years: 33.33%). This could indicate an aging workforce, the presence of more established, skilled miners, or potential barriers to youth entry at this location.
- Matipa, while still having 52.78% youth representation, also shows a significant share of workers aged 36-45 (27.78%).

These findings have direct implications for youth empowerment initiatives. Targeted interventions may be needed at sites like Sasare to understand and address factors limiting youth participation. Conversely, the models in Kanyelele and Kabombo could inform strategies to enhance youth engagement elsewhere. **Recommendation for Further Analysis:** To contextualize these findings, a valuable next step would be to compare the site-specific age profiles against the background age distributions in their host Districts using national census data. This would help determine if the observed miner demographics reflect the local population structure or indicate a specific attraction or barrier for certain age groups into ASGM.

2.1.2 Site-Specific Mining Profiles

Matipa (Chisamba District) Gold Mining Site; is located approximately 30 kilometres from Chisamba and combines Artisanal and Small-Scale Gold Mining operations. It has the smallest estimated population of all study sites, with 45 miners (23.6% female, 76.4% male). While it has a substantial youth presence (63.9% aged 18-35), Table 5 reveals Matipa has the highest concentration of middle-aged miners among all sites, with 33.3% of its workforce aged 36–45. This suggests a more experienced or stable workforce demographic compared to other locations.

Luili/Matala (Mumbwa District) Gold Mining Site located in the Nangoma Constituency of Mumbwa district, approximately 150 kilometers west of Zambia's capital, Lusaka. The Luili and Matala sites are approximately 10 kilometers apart which are predominantly dominated by the Somalians who operate gold processing plants on a Small to Medium Scale. It is estimated that there are over 45 gold processing plants in this location, which utilise wet-pan technology. Each processing plant has a minimum of 40 wet pans. These processing plants serve the majority of the Artisanal gold miners in and around Luili/Matala area who use these plants. However, there are a few Artisanal miners who process their own ore without taking the ore to the wet pans. An estimated 600 Artisanal miners operate in the area, with a stark gender disparity (90.0% male, 10.0% female). According to Table 5, this site has a high youth (18-35) population at 70.0%. Notably, it has the second-highest share of miners aged 36-45 (27.1%) and the lowest

proportion of miners aged 46+ (2.9%), indicating a workforce concentrated in prime working ages with very few older participants.

Kanyelele (Mpika District) Gold Mining Site located in the Muchinga constituency of Mpika District, approximately 90 kilometers from Mpika town. The site contains several mining pits with a renowned established cooperative called "Learn to Share" among other cooperatives in the area. It is the largest site in the study, with an estimated 1,300 Artisanal miners, and shows the most extreme gender imbalance (97.7% male, 2.3% female). Table 5 data underscore its status as a youth-centric site, with 70.0% of miners aged 18-35. More specifically, it has the highest concentration of miners in the core 26-35 bracket (56.7%) across all sites, coupled with low participation from older miners (6.7% aged 46+), highlighting its appeal to younger workers.

Kabombo (Rufunsa District) Gold Mining Sites located approximately 165km from Lusaka in Rufunsa district. Within the district are other well-known gold mine sites, just like in other districts. But the study included this site, since the study sampling plan that needed one site per selected sample district, where active mining is taking place and where a potential use of mercury during gold processing was expected. Kabombo has a good number of cooperatives working as Artisanal miners. It has an estimated population of 1,000 Artisanal miners, with a gender distribution of 80.0% male and 20.0% female. Table 5 shows that 72.5% of its miners are youths (18-35), with nearly half (47.8%) specifically in the 26-35 category. It maintains a balanced age structure, with 21.7% aged 36-45 and a small segment of older miners (5.8% aged 46+), presenting a profile similar to the study's overall average.

Sasare (Lusangazi District) Gold Mining Site; located in Lusangazi district about 524km east of Lusaka. The mine has about 5 active cooperatives with Jungle Lion cooperative being the largest and largest cooperative with about 147 members. With an estimated 600 Artisanal and Small-Scale Gold Miners, it stands out for having the most equitable gender distribution (53.0% male, 47.0% female) among all sites. Table 5 reveals that Sasare's age distribution is exceptional. It has the lowest youth (18-35) representation at 50.0% and the highest share of older miners, with 16.7% aged 46+. Furthermore, it ties with Matipa for the highest proportion of miners aged 36-45 (33.3%). This profile indicates a significantly older workforce compared to other sites.

Chitumba (Vubwi District) Gold Mining Site; located in Vubwi district situated approximately 631 kilometers east of Lusaka, the district is characterized by dispersed Artisanal and Small-Scalegold mining activities, rather than a single dominant mining operation. Most of the miners carry out mining on their farmland. The study estimates 500 Artisanal miners with a relatively fair gender split (60.0% male, 40.0% female). As shown in Table 5, Chitumba has a strong youth presence (68.3% aged 18-35), with nearly half (47.6%) in the 26-35 bracket. It also shows an above-average proportion of older miners (11.1% aged 46+), second only to Sasare, suggesting a wider age spread within its mining community.

Table 3: Artisanal Miner Population Age Distribution by Site

MINING SITE	AGE (PERCENTAGE)			
	Youth (18-35)	**36 - 45**	**46+**	**Total**
Chitumba (Vubwi District)	68.3%	20.6%	11.1%	100%
Kabombo (Rufunsa District	72.5%	21.7%	5.8%	100%
Kanyelele (Mpika District)	70.0%	23.3%	6.7%	100%
Luili/Matala (Mumbwa District)	70.0%	27.1%	2.9%	100%
Matipa (Chisamba District)	63.9%	33.3%	2.8%	100%
Sasare (Lusangazi District)	50.0%	33.3%	16.7%	100%
Total	66.5%	25.8%	7.7%	100%

2.2 Education Levels, Marital Status, Employment and Income Status

2.2.1 Overall findings

The baseline study reveals a complex socioeconomic profile for Zambia's Artisanal and Small-Scale Gold Miners, characterized by moderate educational attainment, stable family structures, an overwhelming and direct reliance on mining for income, and a wide range of gross revenue that presents modest earning potential when considered net of operational expenses.

The workforce shows a relatively strong level of basic education, with **49.7%** having reached secondary school (see Figure 5). Tertiary education, however, remains rare at just **2.8%**.

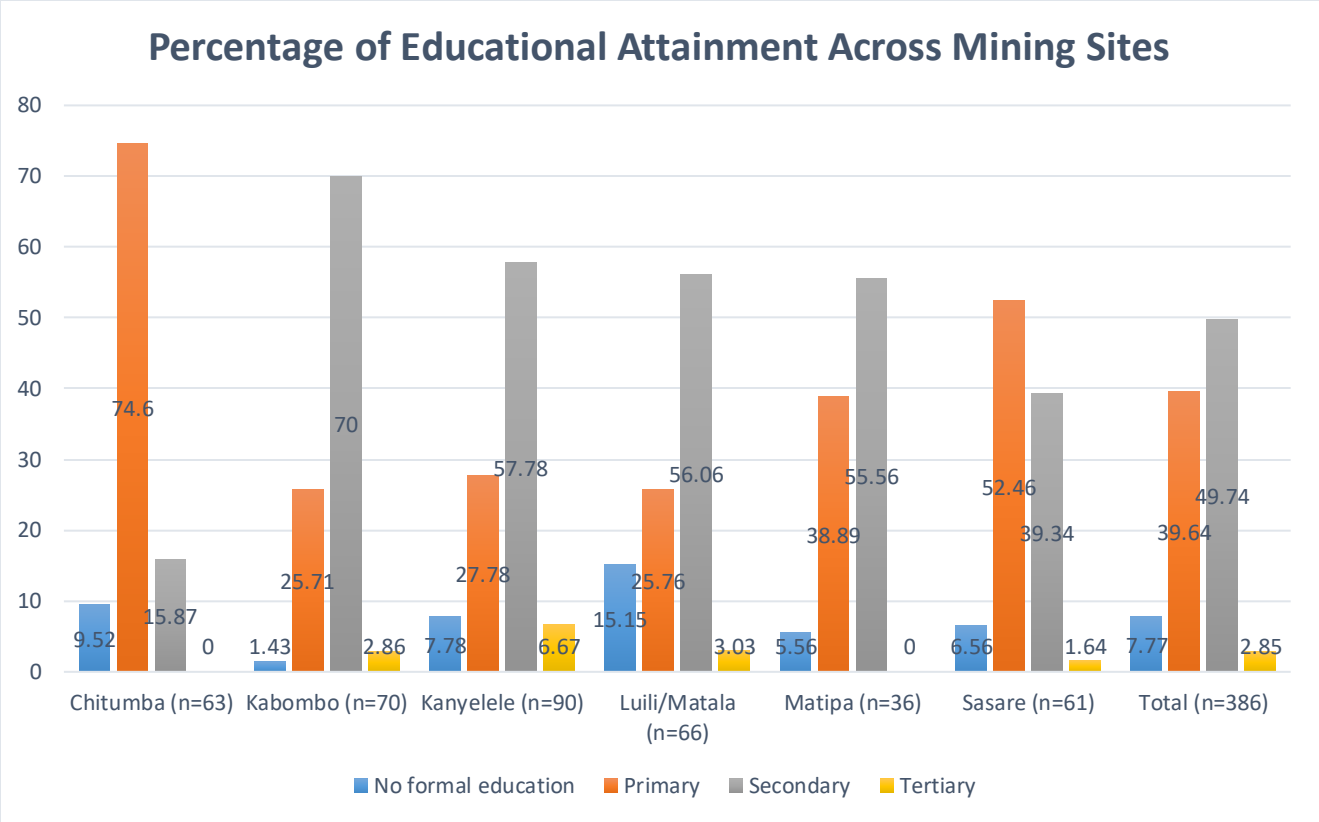

Figure 5: Percentage of Educational Attainment Across Mining Sites

Marital status data indicates strong family stability, with 64.8% of miners being married nationally. This stability is most pronounced in Chitumba, where 79.4% are married, as shown in Figure 6. Kabombo emerges as a clear outlier, with only 51.4% married miners and 47.1% single, suggesting a younger, more mobile workforce at that site. Widowhood is present at all sites except Kabombo but represents a small segment (2.3%) of the total.

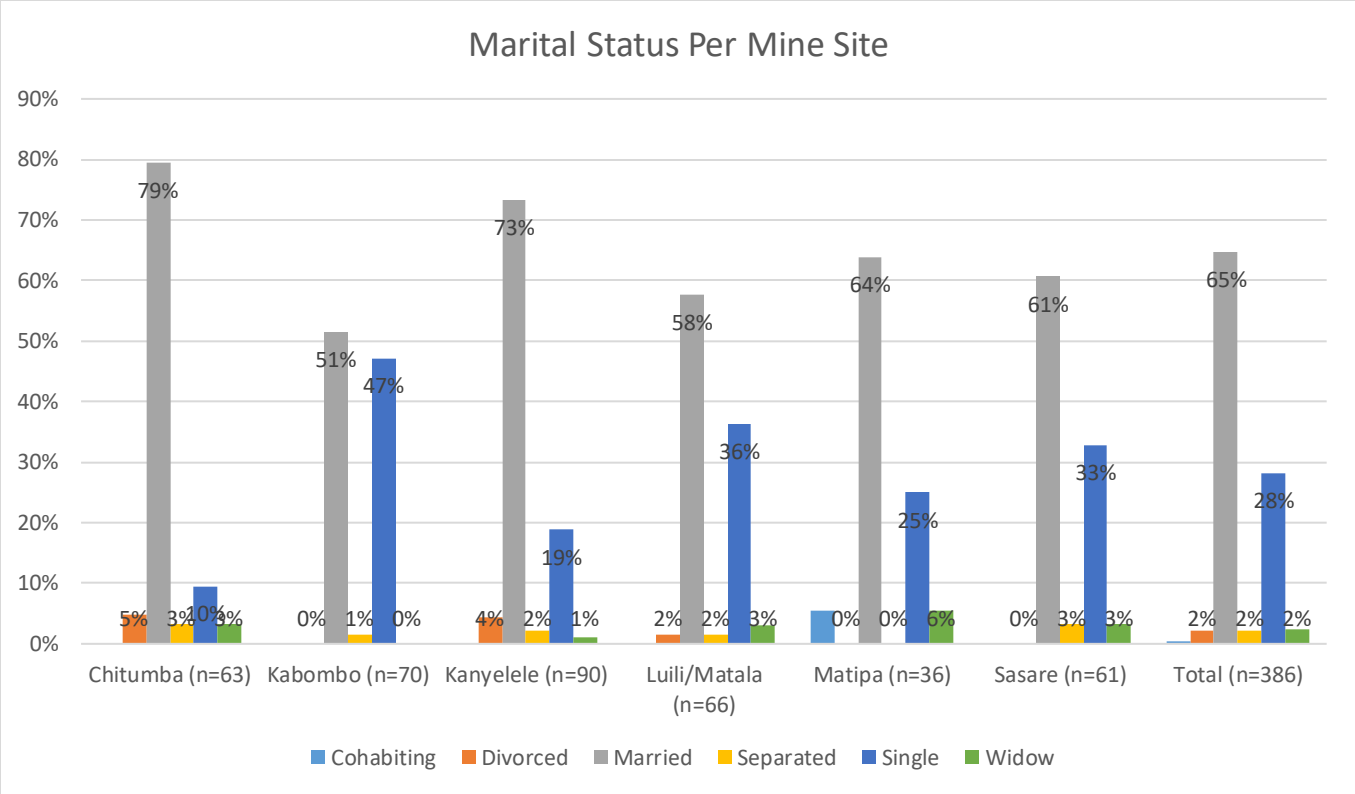

Figure 6: Marital Status per Mining Site

The mining workforce is predominantly local. As detailed in figure 7, a majority of miners at each site originate from the host district or a neighboring region. For example, 82.5% of Chitumba miners come from Vubwi District, and 57.1% of Luili/Matala miners are from Mumbwa. Cross-border migration is limited but notable, with 12.7% of Chitumba's miners coming from Malawi.

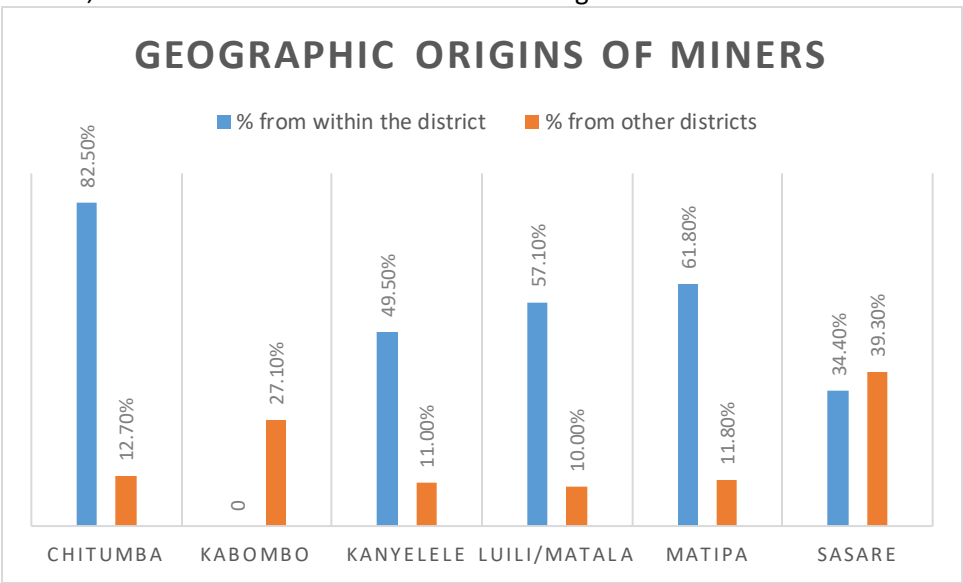

Figure 7: Geographic Origins of Miners

Income patterns reveal a three-tier structure for gross monthly revenue. Table 8 shows that a base tier (29.7% of all miners) reports revenue below USD 208, a dominant middle tier (50.5%) earns between USD 208 and USD 833, and a small upper tier (11.3%) reports revenue above USD 833. It is critical to note that these figures represent gross revenue before the deduction of significant operational costs (e.g., equipment, fuel, mercury, tribute payments). While the middle and upper tiers appear to earn more than Zambia's statutory minimum wage, net income is substantially lower, often leaving miners with precarious take-home pay.

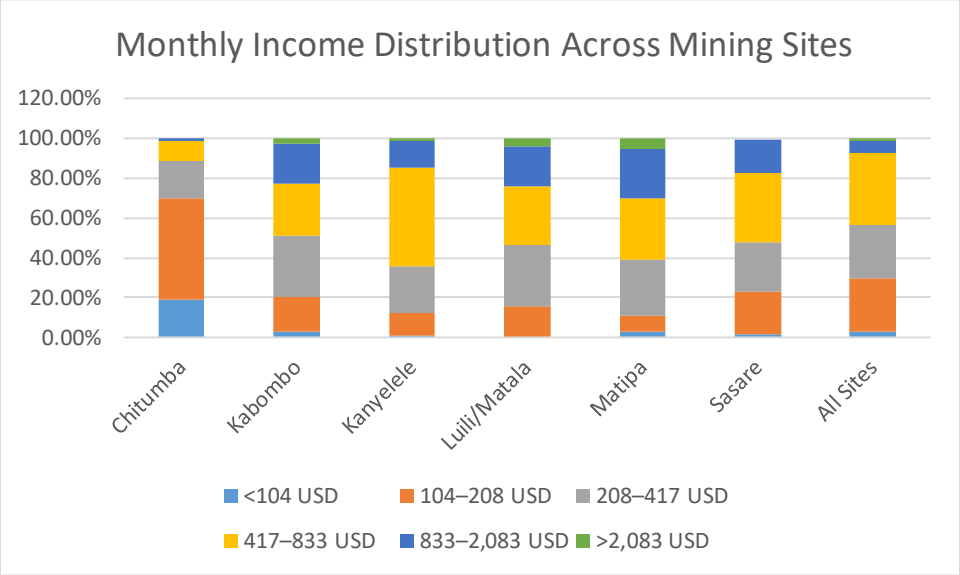

Figure 8: Monthly Income Distribution Across Mining Sites

Further, the study reveals an overwhelmingly mining-dependent workforce, with 82.4% of respondents relying primarily on gold mining for livelihood. Farming serves as the main alternative (7.7%). As detailed in figure 9, while mining dominates across all sites (exceeding 80% at each location), secondary income sources show meaningful variation. For example, farming supplements 14.3% of workers in Chitumba and 14.8% in Sasare, while business activities and other informal work are most common in Kanyelele (9.4%). This profile underscores both the sector's economic centrality and the limited livelihood diversification, with only 1.0% engaged in formal private business and 0.3% in wage employment, highlighting the highly informal nature of Artisanal mining economies.

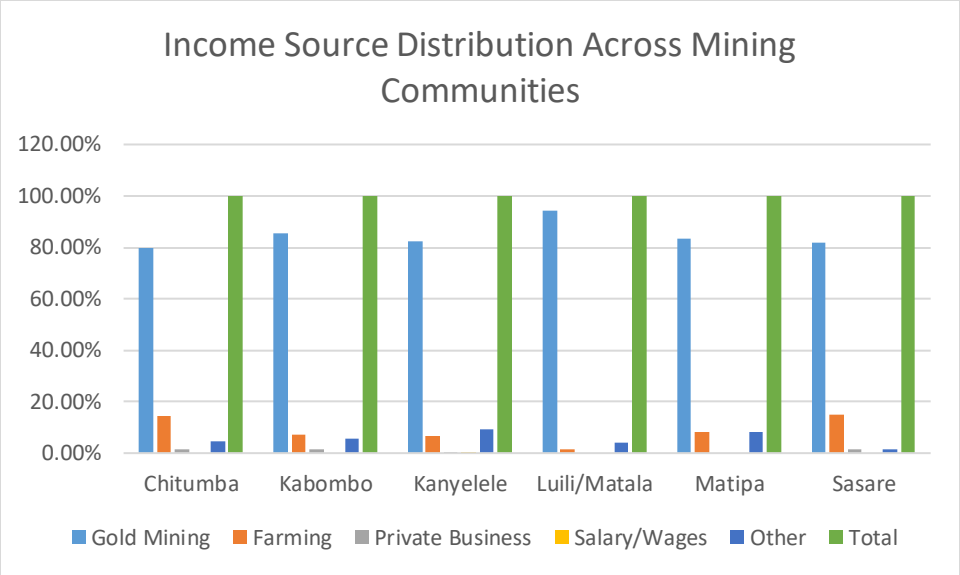

Figure 9: Income Source Distribution Across Mining Communities

2.2.2 Site-Specific Findings

a) Education and Income Patterns Among Female Artisanal Miners in Zambia

The intersection of educational attainment and monthly income reveals complex, site-specific relationships between human capital development and economic outcomes for female miners, with distinct generational patterns emerging across Zambia's mining regions. The detailed empirical data supporting the key findings in this section are consolidated in Table 9 below.

As shown in Table 4, **Matipa (Chisamba District)** demonstrates the clearest education-income correlation, where relatively strong educational outcomes (46.67% secondary attainment across age groups) correspond with diversified income streams. The site's middle-aged women (36-45) show both the highest educational variability (14.29% no schooling vs 42.86% secondary) and widest income range (63 to 2,083+ USD), suggesting education may enable income mobility for some while leaving others behind. Younger miners (18-25) with universal primary/secondary education earn consistently at 104 USD, indicating education provides floor protection against extreme poverty but does not guarantee advancement.

Table 4 reveals that **Chitumba (Vubwi District)** presents a crisis of compounded disadvantages, where poor educational outcomes (16.67% no formal schooling overall) align with dire economic circumstances. The 36-45 cohort shows particularly alarming overlap - 66.67% lack formal education while 66.67% earn below 63 USD monthly. Surprisingly, the oldest miners (46+) with 50% secondary attainment still earn modest incomes (104 USD or 208+ USD), suggesting even educational achievement struggles to overcome systemic barriers at this site. The universal primary education among 18–25-year-olds hasn't yet translated to income improvement, with 57.14% earning below 21 USD.

Sasare's (Lusangazi District) educational poverty, detailed in Table 4, mirrors its economic deprivation, creating a double bind for female miners. The 92.86% primary-only attainment corresponds with 46.15% earning just 63 USD monthly. Most alarmingly, all miners 46+ with only primary education are trapped in the lowest income bracket, showing how limited schooling perpetuates intergenerational poverty. Even the 33.33% of 18–25-year-olds with secondary education earn below 21 USD, indicating education alone cannot overcome the site's severe economic constraints.

The data in Table 4 for **Luili/Matala (Mumbwa District)** shows paradoxical patterns where educational advantages don't consistently deliver economic benefits. While 60% of 18–25-year-olds attain secondary

education (highest young cohort rate among sites), their incomes vary widely (63 to 21+ USD). Conversely, the uniformly educated 26-35 cohort (50% primary/50% secondary) shows better income concentration at 104–208 USD, suggesting older miners may convert education to income more effectively despite lower formal attainment than younger peers.

Kanyelele (Mpika District) stands out in Table 4 as an outlier case, where exceptional educational achievements (6.67% tertiary overall) coincide with relatively higher incomes. The 36-45 cohort's stark educational divide (50% no schooling vs 50% tertiary) mirrors their polarized incomes (417 or 833 USD), suggesting education may create ceiling effects rather than floor protection at this site. Younger miners' strong secondary attainment (57.14% for 18–25-year-olds) aligns with 42.86% reaching 417 USD, showing education's potential upside when combined with favourable site conditions.

Finally, Table 4 illustrates how **Kabombo's (Rufunsa District)** generational reversals defy conventional patterns, where the tertiary-educated 46+ cohort earns 417 USD while universally primary-educated 18–25-year-olds all earn below 63 USD. The site suggests education's value may be cohort-specific, with older women benefiting from unique historical opportunities that no longer exist for younger generations. The 26-35 cohort's universal secondary education (100%) only delivers 50% reaching 104 USD, showing credentials alone cannot overcome structural barriers.

Table 4: Education and Income Patterns of Female Artisanal Miners by Site and Age Cohort

Site	Age Cohort	Highest Education Level (%)	Monthly Income Range (USD)	Key Insight
Matipa	18-25	Primary/Secondary: 100%	~104	Education provides poverty but not advancement.
	36-45	No Schooling: 14.3% Secondary: 42.9%	63 – 2,083+	High variability suggests education enables mobility for some.
Chitumba	18-25	Primary: 100%	<21 (57.1%)	Universal primary education has not translated to income gain.
	36-45	No Formal Schooling: 66.7%	<63 (66.7%)	Alarming overlap of low education and extreme low income.
	46+	Secondary: 50.0%	~104 or ~21+	Educational achievement still yields only modest income.
Sasare	All Ages	Primary Only: 92.9%	~63 (46.2%)	Educational poverty mirrors economic deprivation.
	46+	Primary Only: 100%	Lowest Bracket	Limited schooling traps older miners in intergenerational poverty.
	18-25	Secondary: 33.3%	<21	Education alone cannot overcome

				site's economic constraints.
LUILI/MATALA	18-25	Secondary: 60.0%	63 – 21+	Educational advantage does not guarantee consistent income.
	26-35	Primary: 50% / Secondary: 50%	104 – 208	More concentrated income despite lower formal attainment.
KANYELELE	All Ages	Tertiary: 6.7%	Higher Overall	Exceptional education coincides with higher incomes.
	36-45	No Schooling: 50% / Tertiary: 50%	417 or 833	Polarized education mirrors polarized incomes (ceiling effect).
	18-25	Secondary: 57.1%	Reaching 417 (42.9%)	Strong secondary attainment aligns with income upside.
KABOMBO	46+	Tertiary: 100%	~417	Older cohort benefited from unique historical opportunities.
	18-25	Primary: 100%	<63	Younger generation is universally low-educated and low-earning.
	26-35	Secondary: 100%	Reaching 104 (50%)	Credentials alone cannot overcome structural barriers.

b) Education, Income, Location and Marital Status Among Artisanal Miners in Zambia

The integrated socioeconomic characteristics of each mining site reveal distinct community profiles, as synthesized in Table 5 below. The interplay between education, marital stability, income, and workforce origin underscores how local contexts shape the mining economy.

Kanyelele emerges as the most educationally advanced site, with 57.8% secondary and 6.7% tertiary education attainment, coupled with the highest proportion of married miners (73.3%). This stability correlates with the site's income profile, where 49.5% earn 417–833 USD monthly, representing the highest median earnings among all sites. The workforce primarily originates from within Mpika (49.5%) and the nearby Kasama (11.0%), suggesting established, minimal migration patterns.

Luili/Matala presents a contrasting case of income diversity, being the only site with miners in the 8,333+ USD bracket (1.4%), alongside 31.0% in the 208–417 USD range, as shown in Table 5. This spread reflects the site's specialized economy, where 94.3% rely on mining, supported by 45 processing plants. The marital status distribution (57.6% married, 36.4% single) and education levels (56.1% secondary) mirror this economic profile. The workforce originates primarily from within Mumbwa (57.1%) and Lusaka (10.0%).

Chitumba shows the most compressed socioeconomic characteristics, detailed in Table 5: 74.6% have only primary education, 80.9% are married, and incomes cluster tightly below 417 USD. This profile aligns with the site's labour origins (82.5% from within Vubwi district) and employment patterns, where 14.3% supplement mining with farming the highest such proportion among all sites.

Kabombo stands out for its educational achievement (70.0% secondary) but lower marriage rate (51.4%), suggesting an educated but more transient workforce. Table 5 shows its income distribution is remarkably broad, with 25.7% at 417–833 USD and 14.3% reaching 833–2,083 USD. The workforce comes predominantly from within Rufunsa (41.4%) and Lusaka (27.1%).

Sasare presents a unique case with near-equal gender distribution and balanced marital status (60.7% married, 32.8% single). Educationally, 39.3% have secondary education, while incomes peak at 208–417 USD (25.0%). The workforce originates mainly from within Lusangazi (34.4%) and the nearby Petauke (39.3%), indicating short-distance migration patterns.

Matipa completes the picture with moderate education levels (55.6% secondary) and incomes concentrated in the 417–833 USD bracket (30.6%). The local workforce (61.8% from Chisamba) reflects more settled community ties, with 8.3% combining mining with farming.

Table 5: Comparative Socioeconomic Profile of Mining Sites

Site	Education Profile (Secondary+)	Marital Status (Married)	Dominant Income Bracket (USD)	Primary Workforce Origin	Main Livelihood Dependency
Kanyelele	64.5% (Most Advanced) (Sec: 57.8%, Ter: 6.7%)	73.3% (Highest)	417–833 (49.5%)	Mpika (49.5%)	Mining: 82.2%
Luili/Matala	56.1% (Secondary)	57.6% (Married)	208–417 (31.0%) *Only site with 8,333+ earners*	Mumbwa (57.1%)	Mining: 94.3% (Highest)
Chitumba	25.4% (Lowest) (Primary: 74.6%)	80.9% (Married)	104–208 (50.8%) *Most compressed range*	Vubwi (82.5%) (Most Local)	Mining: 80.0% Farming: 14.3% (Highest)
Kabombo	70.0% (Secondary)	51.4% (Lowest)	417–833 (25.7%) *Broadest spread across brackets*	Rufunsa (41.4%) & Lusaka (27.1%)	Mining: 85.7%
Sasare	39.3% (Secondary)	60.7% (Married)	208–417 (25.0%)	Lusangazi (34.4%) & Petauke (39.3%) (Nearby)	Mining: 82.0% Farming: 14.8%

MATIPA	55.6% (Secondary)	Data not specified in text	417–833 (30.6%)	Chisamba (61.8%)	Mining: Farming: 8.3%	83.3%

c) Policy Insights

Overall, three critical policy insights emerge from the findings of the education, marital, income and geographical origins of miners:

1. Education functions as necessary but insufficient for income mobility, while sites with better schooling show higher earnings overall, individual miners frequently can't convert education to income without supportive site conditions.
2. Middle-aged women (36-45) face compounded vulnerabilities, this cohort shows the most extreme education-income variations, needing targeted upskilling and economic support.
3. Site characteristics mediate education's value, similar educational profiles yield different outcomes across locations, requiring place-based approaches combining education with local economic development.

The baseline findings reveal a sector where female miners' economic fates depend on intersecting factors of age, education, and geographic location, with no single intervention sufficient to break cycles of disadvantage. Comprehensive strategies must address both human capital development and the structural barriers that prevent educated women from translating skills into sustainable livelihoods."

2.3 Social Protection Coverage Across Zambian Mining Sites Among Artisanal Miners

2.3.1 Overall Findings

The study reveals severe gaps in access to social services among Zambia's Artisanal miners, with particularly stark disparities in formal social protection coverage. Only 1.3% of miners contribute to the national pension scheme (NAPSA), with minimal gender variation of just about 1.2% of women and 1.3% of men participating, as illustrated in Figure 7: Miner NAPSA and NHIMA Contribution by Gender. Similarly, national health insurance (NHIMA) enrolment stands at a meagre 2.3% overall, though women show slightly better coverage at 3.5% compared to men's 2.0%. This marginal gender difference in NHIMA participation may reflect women's greater health-seeking behaviours, but the overall picture in Figure 10 remains one of near-total exclusion from formal safety nets for both genders, leaving miners dangerously vulnerable to financial shocks and health crises.

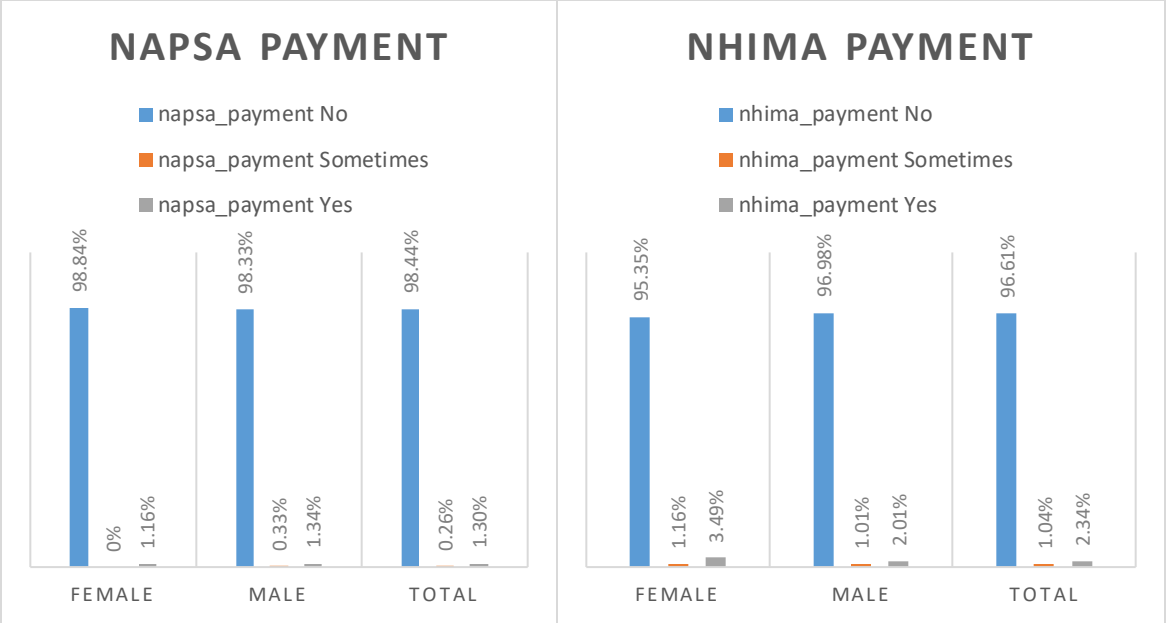

Figure 10: Miner NAPSA and NHIMA Contribution by Gender

Healthcare access presents another critical challenge, with 82.6% of miners lacking reliable medical services. As detailed in Figure 11 below: Miners' Medical Access by Site, where clinics exist, 43.3% require 30 minutes or more travel time, a barrier that disproportionately affects women miners who often bear additional caregiving responsibilities. Water access is equally precarious, with 55.6% relying on potentially contaminated rivers and 18.3% having no on-site water at all. These conditions create particular hardships for women miners, who typically shoulder water collection duties while facing greater health risks from poor sanitation, depriving them of a basic human right.

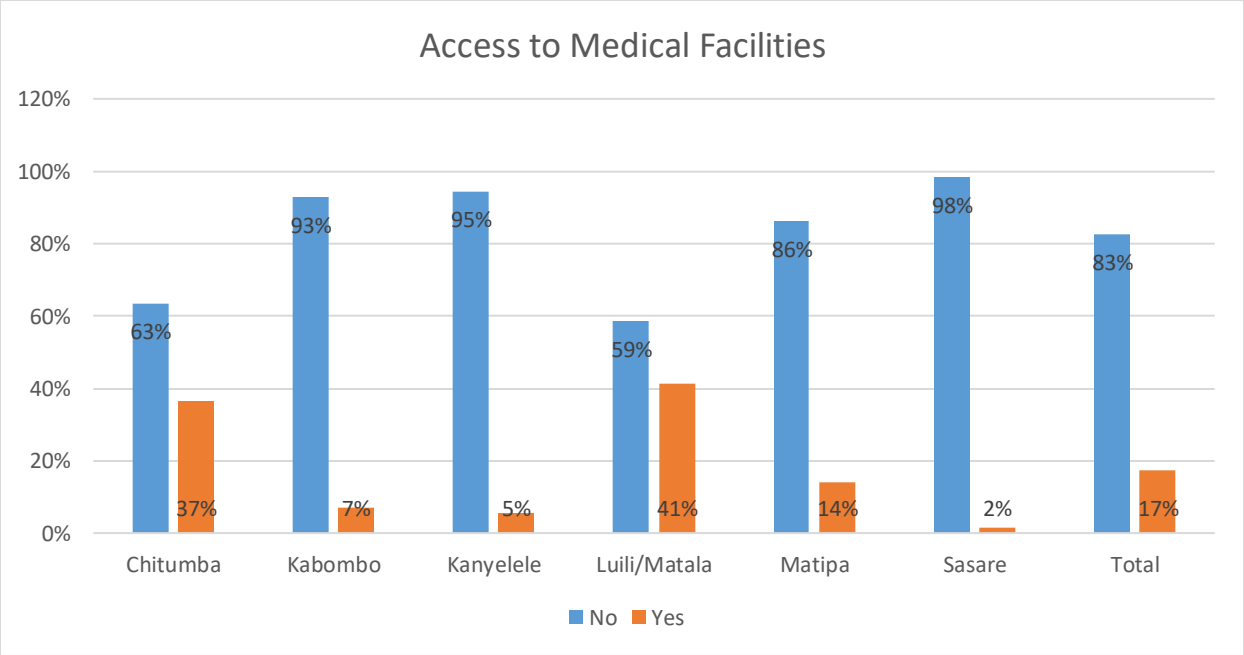

Figure 11: Miners Medical Access by Site

The findings reveal a system failing both male and female miners, but with distinct gendered impacts. While NHIMA enrolment shows slightly better inclusion of women, the near-absent pension coverage leaves female miners especially vulnerable in old age. The lack of nearby clinics and clean water creates additional burdens for women, who traditionally manage family health and household needs. These gendered disparities highlight the need for targeted interventions that address both universal service gaps and the specific vulnerabilities faced by women in Artisanal mining communities.

2.3.2 Site-Specific Findings

The site-specific findings reveal a crisis in social protection across Zambia's Artisanal mining sector, with significant disparities between sites and genders. While all miners face systemic exclusion, female miners experience compounded vulnerabilities that require urgent policy attention.

Chitumba (Vubwi District) emerges as one of the most disadvantaged sites, with near-total exclusion from social protection programmes, recording **0% NAPSA** and **2% NHIMA** enrolment among both men and women, as shown in Figures 12 and 13. The situation is particularly severe for women, who recorded **0% enrolment** in both programmes across all age groups. This complete exclusion is compounded by limited access to healthcare services, with **64%** of miners lacking healthcare access, and unsafe water conditions, with **95%** relying on river water. Together, these factors create overlapping vulnerabilities, leaving female miners especially exposed to health and financial risks.

Kabombo (Rufunsa District) shows marginally better but still inadequate protections (3% NAPSA, 3% NHIMA overall, see Figures 12 and 13), with women facing complete pension exclusion despite 11% intermittent NHIMA enrolment among 36–45-year-olds. The site's critical healthcare gap (92% lack access) and water insecurity (29% without on-site water) disproportionately affect women, who typically bear water collection duties and family health responsibilities. The few existing protections appear inaccessible to most female miners.

Kanyelele (Mpika District) demonstrates how local initiatives can create pockets of relative improvement, with its cooperative-led clinic and 3% NHIMA enrolment (including 7% for women aged 36-45). However, these remain exceptions in a landscape of systemic failure—95% still lack consistent healthcare and NAPSA coverage is minimal (1%,). The site's water mix (72% rivers, 24% boreholes) suggests partial solutions that could be expanded, particularly to benefit women miners who face total pension exclusion despite some health insurance access.

Luili/Matala (Mumbwa District) presents contradictions that highlight geographic disparities within sites. While 41% report medical access, the 45min-2hr travel time creates significant barriers, particularly for women with caregiving responsibilities. The complete NHIMA exclusion for women contrasts with the site's economic activity, revealing how mineral processing hasn't translated to worker protections. Severe water scarcity (46.3% lack on-site access) exacerbates these challenges.

Matipa (Chisamba District) stands as the relatively best-performing site (5.9% NAPSA, 8.3% NHIMA overall, see Figures 12 and 13), yet still fails most miners. For women, we see limited NHIMA enrolment (13.33%) concentrated among 26–35-year-olds and minimal NAPSA participation (6.67%). The site's water innovations (14.7% rainwater harvesting) suggest potential for scalable solutions, but 86.1% healthcare access gaps and persistent pension exclusions for younger/older women reveal systemic shortcomings.

Sasare (Lusangazi District) represents the most extreme case of institutional neglect—0% NAPSA/NHIMA coverage across all demographics, with near-total healthcare exclusion (98.3%) affecting its significant female miner population (47%) particularly hard. The complete absence of formal protections at this site demands immediate intervention.

The study reveals three critical patterns: First, even "better performing" sites like Matipa and Kanyelele still fail most miners, particularly women outside the 26-35 age range. Second, water and healthcare gaps

compound pension and insurance exclusions, creating layered vulnerabilities. Third, the total exclusion of younger and older miners from social protections across most sites suggests systemic age discrimination in program access. These findings underscore the need for comprehensive, site-specific interventions that address both universal protection gaps and the unique vulnerabilities of female miners across different age groups.

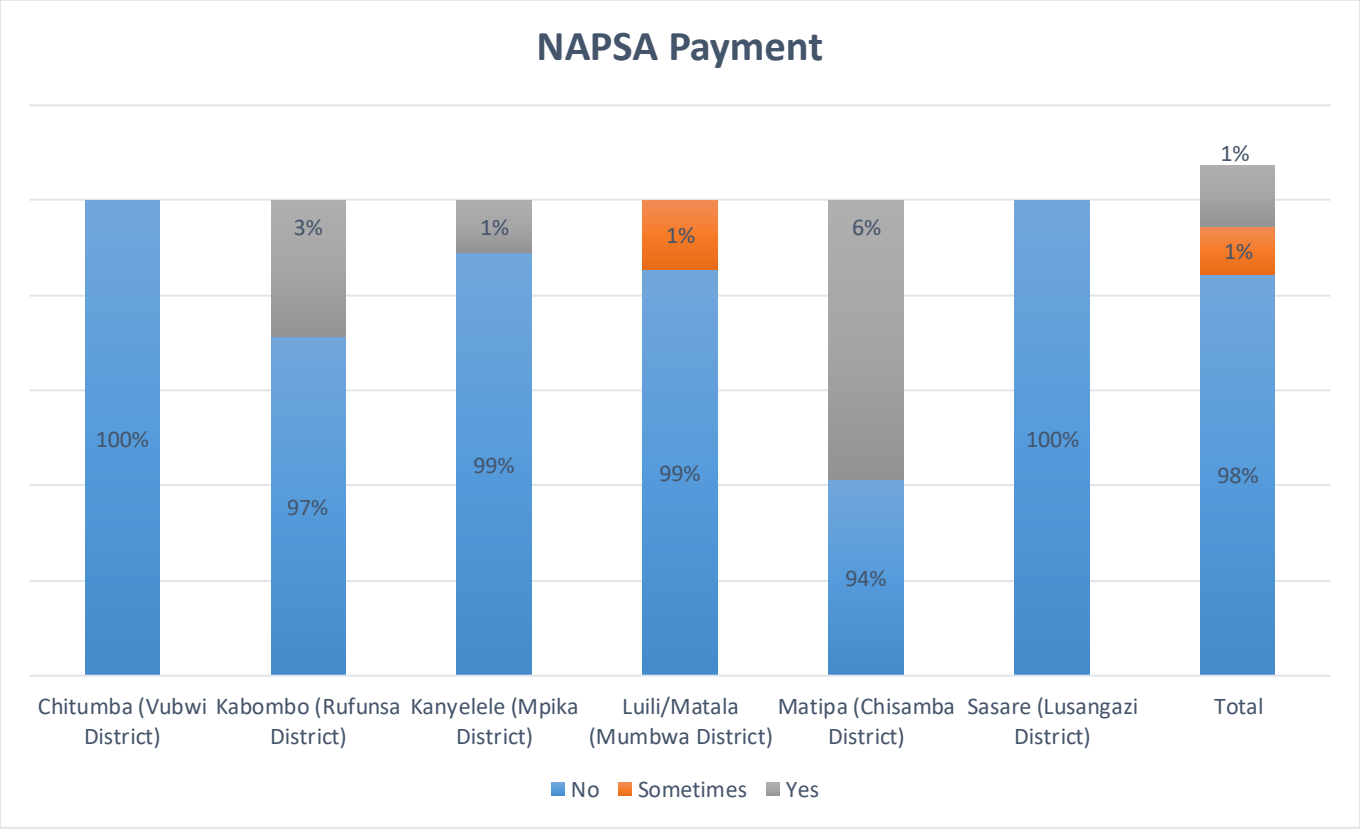

Figure 12: Miner NAPSA Contribution by Site

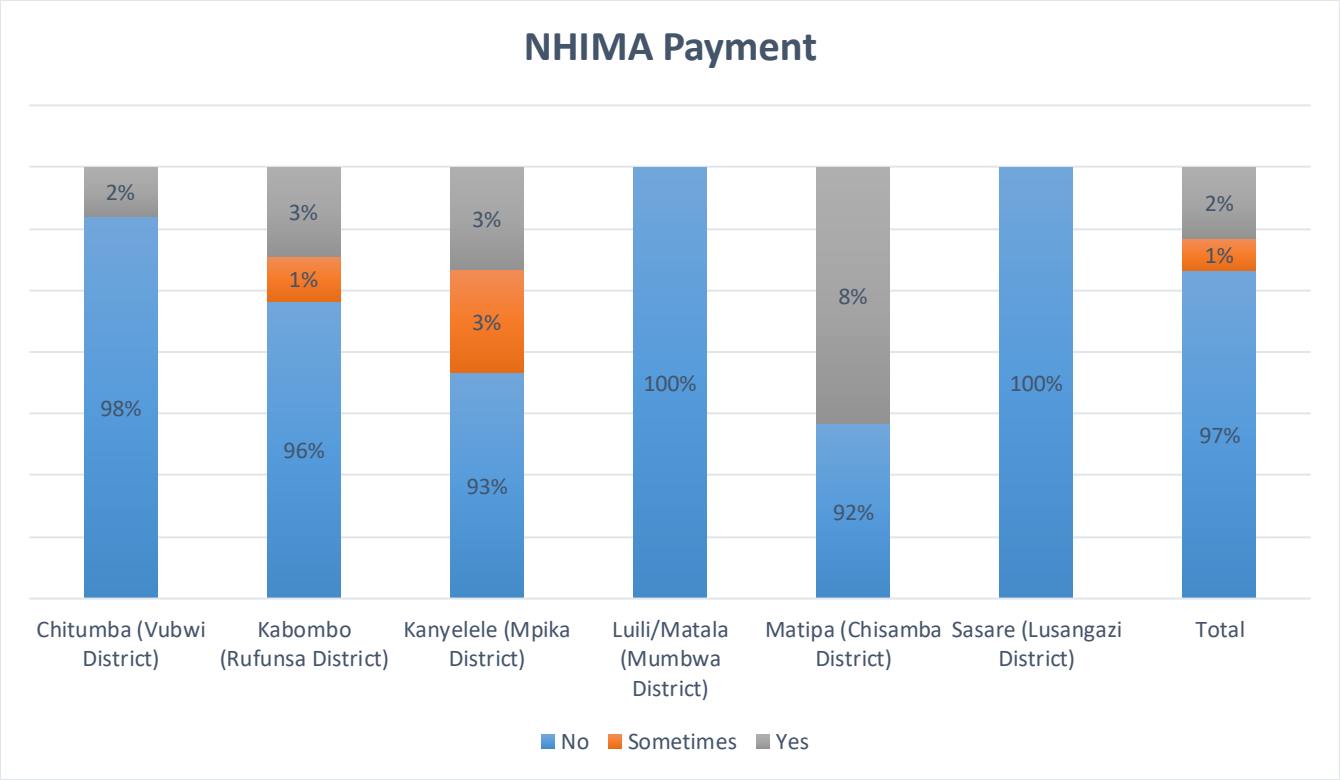

Figure 13: Miner NHIMA Contribution by Site

2.4 Chapter Conclusion

This chapter has provided a comprehensive socio-economic profile of Zambia's Artisanal mining sector, revealing significant disparities in gender representation, education, income, and social protection across six key mining sites. The findings highlight a male-dominated industry, with women constituting only 19% of miners a figure that varies drastically by location, from as low as 2% in Kanyelele to nearly half in Sasare and Chitumba. Education levels, while moderately encouraging (49.7% secondary attainment), do not uniformly translate into higher earnings, particularly for women, who face compounded vulnerabilities due to limited access to formal safety nets, healthcare, and clean water. The sector's youth engagement is notable, with 66.49% of miners aged 18–35, yet income mobility remains constrained by structural barriers, especially for middle-aged women (36–45 years) who experience the most extreme education-income disparities.

The analysis underscores the urgent need for targeted interventions that address site-specific challenges while recognizing the intersecting influences of gender, age, and geography. While education is a critical lever for economic mobility, its impact is mediated by local conditions ranging from cooperative support in Kanyelele to systemic neglect in Sasare. The near-total exclusion from social protections (1.3% NAPSA enrolment, 2.3% NHIMA coverage) exacerbates vulnerabilities, leaving miners, particularly women, exposed to health and financial shocks. These findings challenge policymakers to move beyond one-size-fits-all solutions, advocating instead for integrated strategies that combine education, livelihood

diversification, and place-based social safeguards to break cycles of disadvantage in Zambia's Artisanal mining communities.

2.5 Chapter Recommendations

To address the disparities identified, policymakers and stakeholders should prioritize gender-sensitive interventions that enhance women's participation and economic mobility. This includes targeted training programs, access to financing, and safer working conditions, particularly in male-dominated sites like Kanyelele and Luili/Matala. Successful models from Sasare and Chitumba, where female participation is higher, should be studied and replicated, emphasizing less physically demanding mining methods, such as ore processing (crushing, grinding, sluicing), panning, amalgamation, and gold trading, as opposed to hard-rock excavation and deep-pit digging**.** These roles are more accessible and can be structured into community-based support systems like women's cooperatives. Additionally, *youth-focused initiatives* are critical, leveraging the sector's role as a major employer for young Zambians (66.5% aged 18–35). Vocational training and cooperative-based enterprises could bridge the gap between education and income, especially in sites like Kabombo, where generational reversals in earning potential persist.

Structural barriers require comprehensive social protection reforms. Expanding NHIMA and NAPSA enrolment through mobile registration units and cooperative partnerships would help reduce financial and health risks. Site-specific investments in healthcare infrastructure, such as establishing clinics within a 30-minute travel distance, and improving access to clean water through initiatives such as rainwater harvesting in Matipa, are essential to reducing gender-related burdens. Finally, local economic development programmes should promote livelihood diversification beyond mining by supporting farming and small businesses, particularly in sites such as Chitumba, where alternative income-generating activities are already emerging. By adopting a multi-pronged approach tailored to the geographic and demographic realities of each site, Zambia can transform Artisanal mining into a more equitable and sustainable sector.

Table 6: Findings, Conclusions, and Recommendations for Artisanal Miner Population, Gender and Age Profile

Findings	Conclusions	Recommendations
The sector exhibits extreme gender disparities, with women constituting only 19% of miners overall, though this masks dramatic site-specific variations ranging from a mere 2% participation in Kanyelele's male-dominated, high-risk environment to near-parity in Sasare and Chitumba where cultural norms and less physically demanding tasks enable greater inclusion. Notably, middle-aged women (36-45 years) face compounded disadvantages, experiencing the most severe education-income gaps despite 49.7% of miners having secondary education, revealing how structural barriers prevent human capital from translating to economic mobility.	These patterns demonstrate that gender representation is deeply mediated by local cultural contexts, task allocation practices, and physical demands of mining work, creating a paradox where education fails to empower women miners due to occupational segregation and caregiving burdens. The sector's heavy reliance on youth labour (66.49% aged 18-35) further complicates this dynamic, as young miners - particularly women - lack pathways to advance beyond manual roles despite their education, while systemic neglect of social protections (1.3% NAPSA enrolment, 2.3% NHIMA coverage) leaves all miners vulnerable to health and financial shocks.	To transform these conditions, a three-pronged approach should be implemented: 1) Gender-responsive interventions including task rebalancing to move women into higher-value roles like ore grading, childcare subsidies to reduce care burdens, and leadership quotas in cooperatives. 2) Youth upskilling through vocational training hubs that bridge education-to-employment gaps in mechanized mining and jewellery production; 3) Expanded social protections via mobile enrolment units targeting mining communities, with customized NHIMA packages covering occupational injuries and community health posts to reduce women's caregiving burdens.

3. ASGM Legislation and Formalisation in the Study Areas

Chapter 3: Summary

This chapter examined the legislative framework governing ASGM in Zambia and assessed formalisation progress across six study sites. The findings reveal that despite comprehensive laws including the Mineral Regulation Commission Act (2024), Geological and Mines Development Act (2025), and Environmental Management Act (2011) among others, compliance remains critically low. *Only 5.4%* of miners hold valid mining licenses, 4.6% are PACRA-registered, and 1.0% have environmental permits, indicating widespread informality. The primary barriers include high costs, complex procedures, lack of awareness, and logistical challenges, with significant disparities between sites. Cooperatives show the highest compliance (65.2% licensed), *suggesting they are a viable model for scaling formalisation efforts*.

The study underscores the need for practical interventions to complement Zambia's strong legal framework. Decentralized licensing services, financial support, cooperative development, and gender-inclusive policies are essential to improving formalisation rates. Without addressing these systemic barriers, *the gap between policy and on-the-ground realities will persist*, limiting the sector's potential to contribute to sustainable development and economic growth. Moving forward, a multi-stakeholder approach involving government agencies, traditional leaders, miners' associations, and development partners is crucial to ensuring that formalisation efforts translate into tangible improvements for artisanal miners.

3.1 Governance of Artisanal and Small-Scale Mining (ASM) in Zambia: Legislation, Policies, and Institutional Framework

Zambia's Artisanal and Small-Scale Mining (ASM) sector is governed by a combination of national legislation, policies, institutional frameworks, and regulations designed to promote sustainable mining practices while ensuring environmental protection and socio-economic benefits. The latest legal reforms, including the *Mineral Regulation Commission Act of 2024* and the *Geological and Mines Development Act of 2025*, have introduced significant changes to the regulatory landscape. These laws work alongside existing frameworks and other aligned laws such as the *Environmental Management Act (2011)*, the *Lands Act (1995)*, and other sector-specific policies to streamline ASM operations.

3.1.1 The Mineral Regulation Commission Act (2024)[10]

The *Mineral Regulation Commission Act (2024)* represents a significant reform of Zambia's mining regulatory framework, repealing and replacing the *Mines and Minerals Development Act (MMDA) of 2015.* This legislation establishes the Mineral Regulation Commission (MRC) as the centralized regulatory body responsible for overseeing all mining activities, including Artisanal and Small-Scale Mining (ASM). By consolidating regulatory functions previously dispersed across multiple government entities, particularly the Ministry of Mines and Minerals Development (MMMD), the Act aims to enhance efficiency in licensing, monitoring, and compliance enforcement across the sector.

The Act introduces several key reforms specifically targeting the ASM sector. Firstly, it simplifies licensing procedures while restricting Artisanal mining exclusively to Zambian citizens who may operate either as individuals or through registered cooperatives. For foreign participation, the Act establishes clear parameters through the Companies Act, defining specific ownership thresholds for different categories of mining enterprises:

1. A **Citizen-Influenced Company:** defined as a company where at least 5–25% of the equity is owned by Zambian citizens and they have significant control over management.
2. A **Citizen-Empowered Company:** requires 25–50% Zambian equity.
3. A **Citizen-Owned Company:** requires majority (>50%) Zambian equity.

Notably, the legislation extends the validity period for Artisanal mining licenses to three years, while actively promoting the formation of cooperatives as a mechanism for formalizing Artisanal mining operations. The big win in this Act is the creation of a department responsible for Artisanal and Small-Scale Mining.

In addition to these structural reforms, the Act strengthens monitoring and enforcement mechanisms to curb illegal mining activities and ensure compliance with both mining and environmental regulations. It

[10] Government of Zambia. (2024). Mineral Regulation Commission Act. Lusaka: Government Printer. (https://www.parliament.gov.zm/sites/default/files/documents/acts/Act%20No.%2014%20of%202024%20The%20Mineral%20Regulation%20Commission.pdf)

imposes stricter penalties for violations while emphasizing the adoption of cleaner mining technologies and environmentally sustainable practices.

3.1.2 The Geological and Mines Development Act (2025)[11]

The *Geological and Minerals Development Act (GMDA) of 2025* serves as a critical complement to the *Mineral Regulation Commission Act (MRC) of 2024* in Zambia's efforts to formalise and regulate the Artisanal and Small-Scale Mining (ASM) sector. While the MRC Act establishes the overarching regulatory framework through licensing, monitoring, and enforcement mechanisms, the GMDA provides the necessary technical, financial, and institutional support to ensure these regulations are effectively implemented. Collectively, these two pieces of legislation create a comprehensive governance system that addresses the key challenges of formalisation, environmental protection, and revenue collection in Zambia's ASM sector.

One of the primary ways the GMDA supports the formalisation of ASM is through its institutional provisions. The Act establishes a dedicated *Directorate of Artisanal and Small-Scale Mining*, which works closely with the MRC to map ASM activities and integrate informal miners into the legal economy. This directorate provides critical technical extension services and promotes the formation of mining cooperatives, addressing one of the major barriers to formalisation which is the lack of organizational capacity among small-scale miners. Furthermore, the creation of the *Artisanal and Small-Scale Mining Fund* under the GMDA provides financial resources for capacity building, equipment acquisition, and cooperative development, directly supporting miners in meeting the compliance requirements established by the MRC.

With regard to environmental protection, the GMDA strengthens the MRC's regulatory framework through its emphasis on sustainable mining practices. The Act mandates the Directorate of Geological Survey to provide comprehensive geological data and mapping services to ASM operators, enabling them to identify viable mineral deposits without resorting to environmentally destructive exploration methods. This scientific approach to mining, combined with the GMDA's restrictions on unapproved mineral removal and its promotion of cleaner technologies through technical guidelines, creates a robust system for environmental management that complements the MRC's enforcement capabilities. The GMDA's focus on zoning and land-use planning also helps prevent conflicts between Artisanal miners and large-scale operations, a persistent challenge in Zambia's mining sector.

The GMDA's provisions for revenue assurance and local economic participation further strengthen the MRC's governance framework. By establishing stringent auditing requirements for the ASM Fund and mandating preferential treatment for Zambian contractors and employees, the Act helps minimize revenue leakage while ensuring mining benefits remain within local communities. The geological data collection and mineral tracking systems which shall be established under the GMDA provide the MRC with valuable tools for monitoring production and verifying royalty payments, addressing one of the key

[11] Government of Zambia. (2025). Geological and Mineral Development Act. Lusaka: Government Printer. (https://www.parliament.gov.zm/sites/default/files/documents/acts/Acts%20No.%202%20of%202025%2C%20The%20Geological%20Minerals%20Development.pdf)

challenges in ASM taxation. These financial controls and local content requirements work in tandem with the MRC's licensing and enforcement mechanisms to create a more transparent and equitable mining sector.

3.1.3 Environmental Management Act (2011)[12] and ASM Regulations

Zambia's Environmental Management Act (EMA) of 2011 provides the legal backbone for sustainable mining practices in the ASM sector, with the Zambia Environmental Management Agency (ZEMA) serving as the primary enforcement body. Under the EMA, all Artisanal and Small-Scale Mining (ASM) operations, including gold mining (ASGM), are required to conduct Environmental Impact Assessments (EIAs) and obtain Environmental Permits before commencing activities. This regulatory framework is designed to mitigate the sector's environmental footprint, particularly in addressing deforestation, water pollution, and land degradation which are key challenges associated with informal ASGM operations.

ZEMA's enforcement mandate is critical to ensuring compliance. The agency monitors ASM activities to prevent mercury contamination (aligned with Zambia's commitments under the Minamata Convention[13]), enforce rehabilitation obligations for abandoned mine sites, and penalize non-compliance.

3.1.4 Lands Act (1995) and Land Use Planning[14]

The *Lands Act of 1995* serves as Zambia's foundational legislation governing land ownership and usage, playing a critical role in shaping the operational environment for Artisanal and Small-Scalemining (ASM). This law establishes important provisions that directly impact ASM activities through various key mechanisms. Firstly, it addresses land tenure security by requiring ASM operators to formally secure land rights either through traditional leaders (in customary land areas) or local authorities (in state land areas), creating a more structured approach to land access that helps reduce conflicts. Second, the Act enables the government to designate reserved ASM zones through statutory instruments, which serve to physically separate small-scale mining activities from large-scale concessions and agricultural areas, thereby minimizing sectoral conflicts over land use.

3.1.4 Other Relevant Legislation

Additional laws influencing ASM include:

a. Anti-Corruption Act, No. 3 of 2012; prohibits engagement of corrupt practises
b. Co-operative Societies Act, No. 20 of 1998; guides the formation of cooperatives which are essential for formalisation of the ASM sector.

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[12] Government of Zambia. (2011). Environmental management Act. Lusaka: Government Printer. (https://www.parliament.gov.zm/sites/default/files/documents/acts/Environmetal%20Mangement%20Act%2012%20of%202011.pdf)

[13] https://minamataconvention.org/sites/default/files/documents/national_action_plan/Zambia-NAP-2023-EN.pdf

[14] Government of Zambia. (1995). Land Act. Lusaka: Government Printer. (https://www.parliament.gov.zm/sites/default/files/documents/acts/Lands%20Act.pdf)

c. Among others, collectively ensure that ASM contributes to Zambia's economy while adhering to legal and environmental standards.
d. Customs and Excise Act that regulates mineral trade and export levies.
e. Occupational Health and Safety Act (2010) which ensures safe working conditions for ASM miners.

3.1.5 Policies and Strategic Plans

Zambia's Artisanal and Small-Scale Mining (ASM) sector operates within a comprehensive policy framework designed to promote formalisation, sustainable practices, and economic inclusion. The *National Mineral Resources Development Policy (2022)*[15] serves as the cornerstone of this framework, explicitly prioritizing ASM formalisation through simplified licensing procedures and improved access to financing mechanisms. This policy aligns with *Zambia's Export Diversification Strategy for Gold and Gemstones (2024)*[16], which specifically targets enhanced participation of Artisanal miners in the gold value chain, from extraction to beneficiation.

Complementing these sector-specific policies, the *Local Content Policy*[17] ensures that Zambian entrepreneurs derive maximum benefit from mineral resources by mandating preferential treatment for domestic businesses in mining-related procurement and employment. These policy instruments collectively work to integrate ASM operations into the formal economy, with the dual objectives of reducing poverty in mining communities and increasing government revenue from the sector.

The *8th National Development Plan (2022-2026)*[18] provides the strategic implementation roadmap for these policies, with dedicated provisions for Artisanal and Small-Scale Gold Mining (ASGM). The plan's comprehensive approach includes five key intervention areas: Firstly, it prioritizes formalisation through the creation of accessible legal pathways for informal miners, aiming to improve revenue collection and reduce illicit mining activities. Secondly, it establishes innovative financing mechanisms, including partnerships between the Mining Licensing Committee and financial institutions, to address the chronic capital constraints facing small-scale operators.

Thirdly, the plan mandates technology adoption, particularly the phase-out of mercury uses in gold processing to comply with Zambia's commitments under the *Minamata Convention*. Fourthly, it positions ASGM as a catalyst for rural economic development and job creation, with targeted programs to enhance skills and create alternative livelihoods in mining communities. Finally, the plan introduces a decentralized regulatory model that strengthens local government capacity to oversee and support ASM activities, improving both service delivery and compliance monitoring at the grassroots level.

[15] https://www.mmmd.gov.zm/wp-content/uploads/2024/09/National-Mineral-Resources-Development-Policy-2022.pdf

[16] https://www.mcti.gov.zm/wp-content/uploads/2024/07/Zambia-Export-Diversification-Strategy-for-Gold-and-Gemstones.pdf

[17] https://www.zda.org.zm/wp-content/uploads/2020/09/National-Local-Content-Strategy.pdf

[18] https://www.cabinet.gov.zm/newsite/wp-content/uploads/2023/12/8NDP-2022-2026.pdf

3.1.6 Institutional Framework and Enforcement

Several institutions oversee the governance of Artisanal and Small-Scale Mining (ASM) in Zambia. The Ministry of Mines and Minerals Development (MMMD) serves as the policy maker of mining activities, while the Mineral Regulation Commission (MRC) will regulate mining activities and compliance under the new 2024 MRC Act. The Zambia Chamber of Mines advocates for ASM, and the Federation of Small-Scale Mining Associations advocate for ASM miners' rights, while Local Government Authorities enforce bylaws on land use and community mining agreements.

Traditional leaders (chiefs and headpersons) are key stakeholders in ASM governance due to their authority over customary land. Their roles include land allocation, where chiefs approve (consent) access for ASM miners through informal agreements or community mining licenses. They also mediate conflicts between miners, farmers, and large-scale mining companies, and some collaborate with the Ministry of Mines and Local Authorities to formalize ASM operations. However, overlapping authority between traditional leaders and government agencies in some instances lead to tenure conflicts, highlighting the need for clearer legal frameworks under the 2025 Geological and Mines Development Act.

ZEMA plays a critical role in regulating ASM's environmental impact under the *Environmental Management Act (2011)*. ASM operators must submit Environmental Impact Assessments (EIAs) before mining begins to evaluate ecological risks. ZEMA monitors compliance with environmental laws, ensuring proper waste disposal and land rehabilitation. Additionally, in line with the Minamata Convention, ZEMA enforces restrictions on mercury use in gold processing, promoting safer alternatives. The agency also mediates community grievances related to environmental degradation caused by mining activities.

Despite this structured framework, enforcement remains inconsistent in practice. Government agencies often face capacity constraints, including limited funding, staffing shortages, and logistical challenges, which hinder effective oversight. Corruption which is also common at traditional leadership level, and bureaucratic delays further weaken compliance, allowing some ASM operators to bypass regulations.

3.2 Formalisation of Artisanal Miners per Study Site

UNEP (2012) defines formalisation as the process of integrating Artisanal and Small-Scale Gold Mining (ASGM) into the formal economy. It argues that this can only be achieved when programmes and public policies address the different dimensions of ASGM activities simultaneously and in an integrated manner. This is an approach that the Zambian Government has recognised through both its legal framework and policy documents. Similarly, the World Bank (2016), as cited by Banda (2021), notes that Zambia has a strong legislative framework for formalisation. The country was awarded a rating of **2.5 out of 4** for demonstrating that ASM operates under formal procedures and a **very high rating of 4 out of 4** for allowing miners to operate legally.

The findings of this study reveal a multi-dimensional framework that highlights a significant disconnect between policy and practice, particularly in relation to land tenure, business registration, licensing, and organisational structure, with serious implications for gender equity in Zambia's ASGM sector.

1. Land Tenure: The Predominance of Informal Allocation: Land ownership is the foundational step for formalisation. The data in figure 14 shows that the primary mechanism for accessing mining land is informal, with 55.4% (216/390) of miners operating on land allocated by a Chief or Headman. While this provides local legitimacy, it is a precarious form of tenure that can be easily revoked, creates barriers to securing formal licenses, and limits access to finance. Women are consistently underrepresented across all ownership types, holding less than 30% of any category. Their slightly higher share among those with "No ownership" (27.2%) highlights their concentration in the most informal and vulnerable segments of the sector.

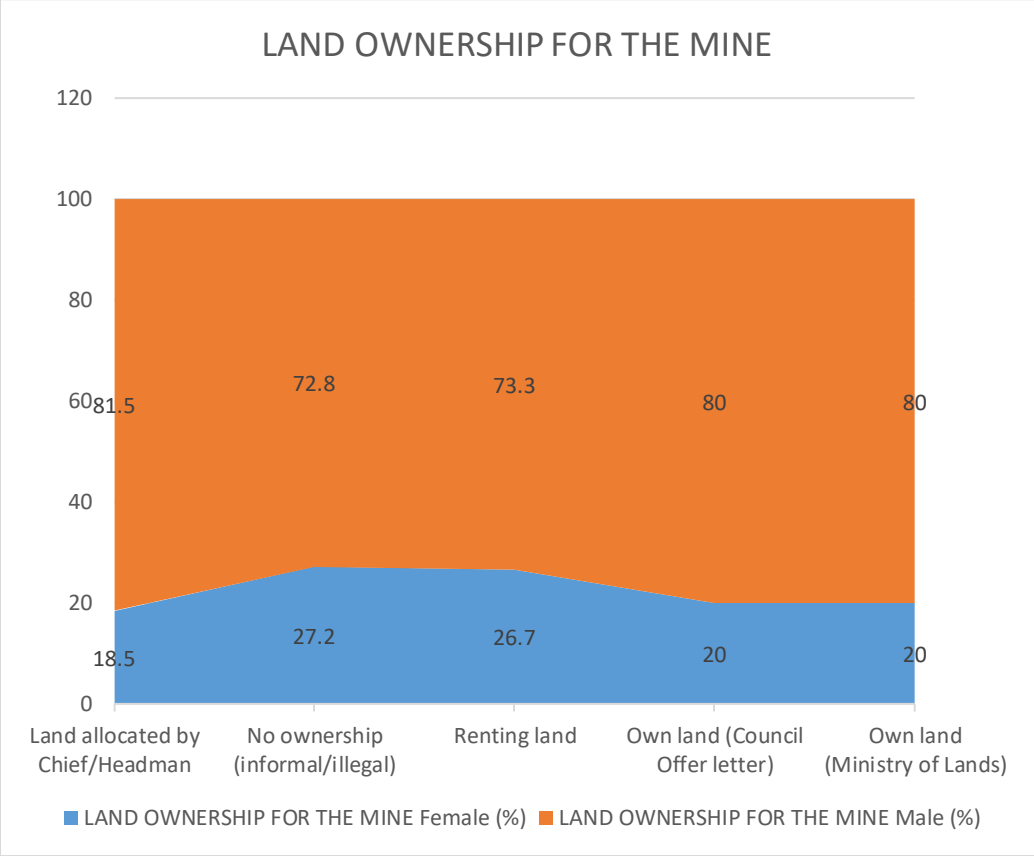


Figure 14: LAND OWNERSHIP FOR THE MINE

2. Business and Environmental Registration: Near-Total Exclusion: The data points to a crisis of legal registration:

- **PACRA Registration:** Only 4.6% (18/390) of miners are registered with the Patents and Companies Registration Agency (PACRA). Among this tiny, formalized group, female representation is lowest (11.1%), indicating that when formal business structures are established, they are overwhelmingly male led.
- **Licensing:** Formal mining and panning licenses are exceptionally rare. Only 5.4% (21/390) hold a mining license, and a mere 2.1% (8/390) hold a panning license. Alarmingly, there are zero women holding panning licenses or Environmental Compliance Permits (ZEMA). This indicates that the

few who navigate the complex regulatory and financial hurdles to obtain environmental and operational permits are exclusively men.

4. **Organizational Structure: The Dominance of Informality**: The organizational makeup of the workforce further underscores the informal nature of the sector. The vast majority of miners operate as "Individual Operators" (42.3%) or within "Unstructured Groups" (46.2%). Only 7.9% operate under formalized entities like Cooperatives or Companies. This fragmentation is a major barrier to implementing safety standards, accessing bulk financing, and engaging in collective bargaining. Women are best represented as "Individual Operators" (29.7%), suggesting they often work alone or in very small, informal family units, which may further isolate them from support networks and economies of scale.

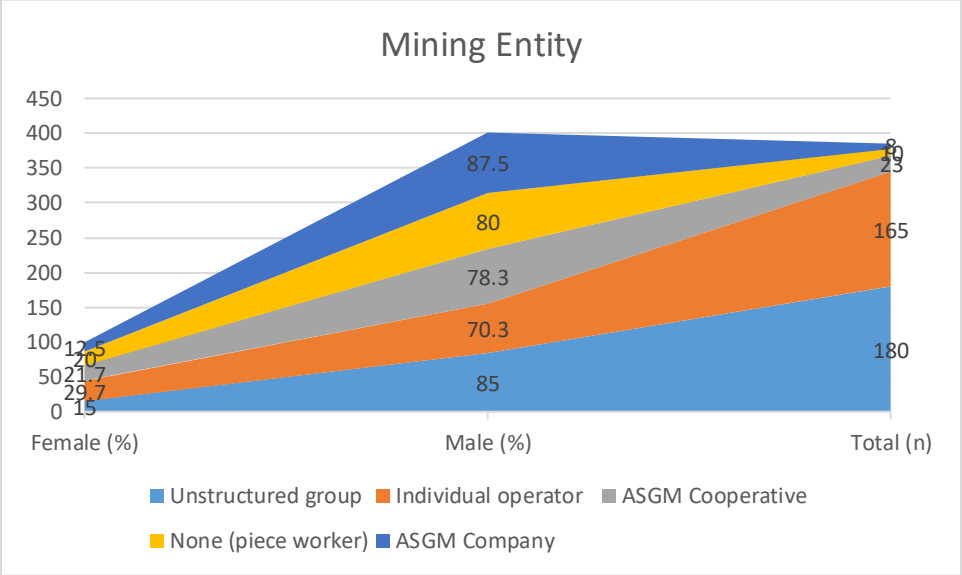


Figure 15: Mining Entity

Therefore, the findings highlight a critical formalisation gap: the system currently functions on a foundation of informal land tenure, with near-total exclusion from business registration and environmental permitting, particularly for women. The sector is characterized by fragmented, individualistic operations rather than structured entities. This state of informality entrenches gender imbalances, as women are systematically excluded from the few formalized pathways that do exist (licenses, permits, company leadership). Effective formalisation policy must therefore move beyond strong laws on paper to address these tangible barriers: securing land rights, simplifying and subsidizing the registration and licensing process, promoting cooperative formation, and implementing gender quotas or support programs to ensure women are not left behind as the sector formalizes.

3.2.1 How to get mining licence and what type of licence

In Zambia a critical first step to formalisation is securing ASGM legal permits to mine and process ore. The MRC Act 2024 regulates Artisanal and Small-Scale Mining (ASM) in Zambia by defining two main categories of rights: mining rights (exploration and mining licenses) and non-mining rights (mineral processing, gold panning, and trading permits). Artisanal mining licenses (AMLs) are reserved exclusively

for Zambian citizens or cooperatives, covering a maximum of 6.68 hectares and valid for three years, while small-scale mining licenses (SSMLs) are issued to citizen-owned, citizen-influenced, or citizen-empowered companies for areas between 6.68 and 1,000 hectares, with a ten-year validity. Non-mining rights on the other hand, include mineral processing licenses (25 years), gold panning certificates (2 years, renewable for Zambians only), and mineral trading permits (3 years, renewable).

This baseline study data in figure 16 below reveals significant disparities in mining license ownership across the six study sites, with widespread non-compliance being the dominant trend. From the 390 sampled miners surveyed, an overwhelming 94.0% (367 miners) of Artisanal miners operate without any valid mining license (indicating a high level of illegal gold mining), while only 6.0% (23 miners) possessed a mining license. Of those that operated under a mining license, the study further found that on 14.0% where females and the rest were males. Despite this high level of illegality, the study found that 84.0% of the miners are aware of the need to get the license but face various difficulties which they highlighted, among them include.

- The process being expensive
- The process taking long and very bureaucratic
- “Afraid because we are illegals”
- Distance from where I stay to where the offices are

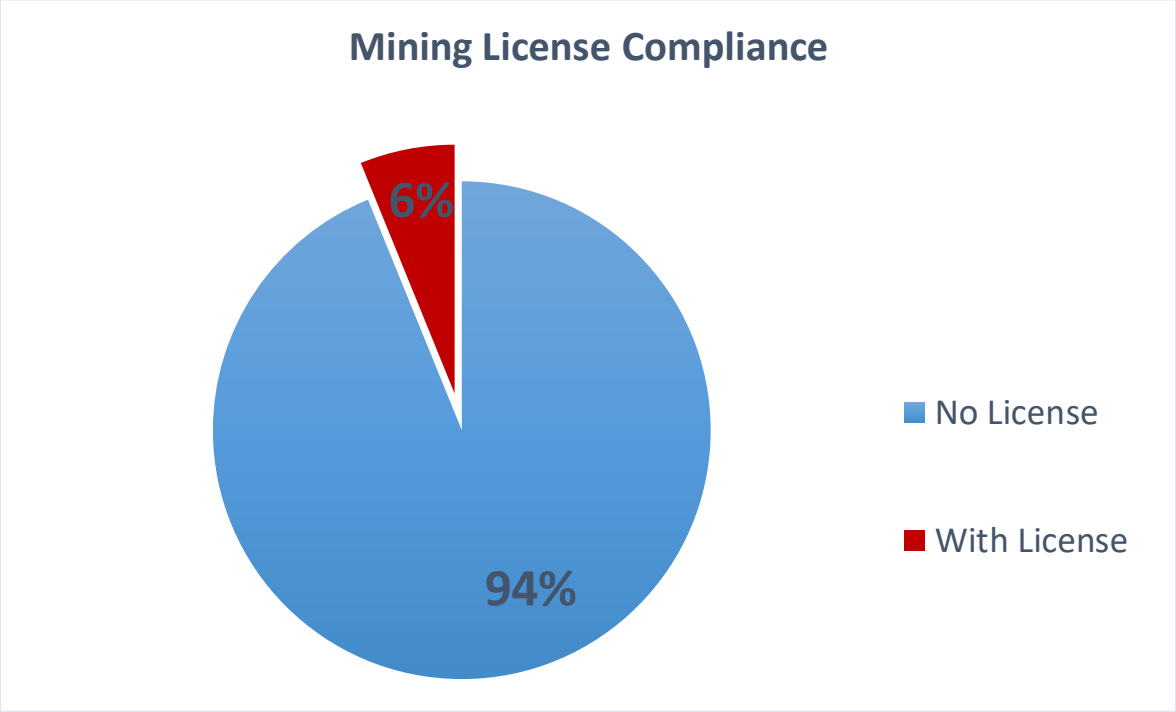


Figure 16: Miners with a Mining Licence

Breaking down the results by location, *Chitumba* (Vubwi District) emerged as the site with the highest rate of non-compliance (illegal miners), where 95.2% of miners lacked licenses, followed closely by *Luili/Matala (Mumbwa District)* at 90.1%. These figures suggest particularly weak enforcement or awareness in these areas. In contrast, *Sasare (Lusangazi District)* showed relatively better compliance with 11.7% of miners properly licensed, though this still represents a small fraction. *Kabombo (Rufunsa District)* followed with 10% licensing rate, while *Kanyelele (Mpika District) and Matipa (Chisamba District)* fell in the middle range at 4.4% and 5.6% respectively. Notably, *Kanyelele and Luili/Matala* also had the highest proportions of miners who were unsure about their licensing status (7.8% and 8.5% respectively), pointing to potential information gaps that need addressing. With a sample size of 390 miners, these findings carry statistical reliability at a 95.0% confidence level, making the trends clearly identifiable. The data paints a concerning picture of Zambia's Artisanal and Small-Scale Mining sector, where the vast majority operate outside legal frameworks.

3.2.2 *Site-Specific Findings of Mining License Compliance*

In reference to figure 17 below, ***Chitumba*** (Vubwi District) represents the most severe case of licensing violations, with 95.2% of miners (60 out of 63) operating without valid licenses. The site shows complete absence of any properly licensed operations, with 4.8% (3 miners) uncertain about their status. These 3 uncertain miners constitute 13.64% of all "don't know" responses across sites, suggesting Chitumba has particular problems with regulatory awareness. The absolute lack of licensed operations (0.0%) indicates either complete enforcement failure or insurmountable bureaucratic barriers in this location. ***Kabombo*** *(Rufunsa District* presents a mixed picture with 85.7% non-compliance (60/70 miners) stands out for having 10% licensed operators (7 miners), representing 33.3% of all licensed miners across sites. This performance suggests some successful formalisation efforts, though the high unlicensed rate and 4.3% uncertainty (3 miners) indicate ongoing challenges. Kabombo's licensing rate is triple the study average (5.4%).

Kanyelele *(Mpika District)* indicates-87.8% non-compliance (79/90), with 7.8% (7 miners) uncertain about licensing which is the highest uncertainty rate across sites (31.8% of all "don't know" responses). The 4.4% licensing rate (4 miners) is near the study average, but the high uncertainty suggests particular issues with regulatory communication in this area, where miners are aware of licensing requirements but remain confused about their own status. ***Luili/Matala*** *(Mumbwa District)* demonstrates severe non-compliance (90.1%, 64/71 miners), second only to Chitumba. With just 1.4% properly licensed (1 miner) and 8.5% uncertain (6 miners - 27.3% of all uncertain responses), the site shows both enforcement failures and awareness gaps. The single licensed miner represents only 4.8% of all licensed operators in the study.

Matipa *(Chisamba District)* compliance profile mirrors broader trends with 86.1% unlicensed (31/36), but shows slightly better than average licensing (5.6%, 2 miners) and uncertainty rates (8.3%, 3 miners). The two licensed miners account for 9.5% of all licensed operators, suggesting modest but meaningful formalisation success in this location**.** ***Sasare*** *(Lusangazi District)* emerges as the compliance leader with 11.7% properly licensed (7 miners) - comprising 33.3% of all licensed operators. The site also uniquely accounts for all cases (3) of "wrong site" licenses in the study (5.0% of its miners). While still showing 83.3% non-compliance, Sasare's performance suggests more effective formalisation efforts, possibly due to better enforcement or accessibility of licensing services.

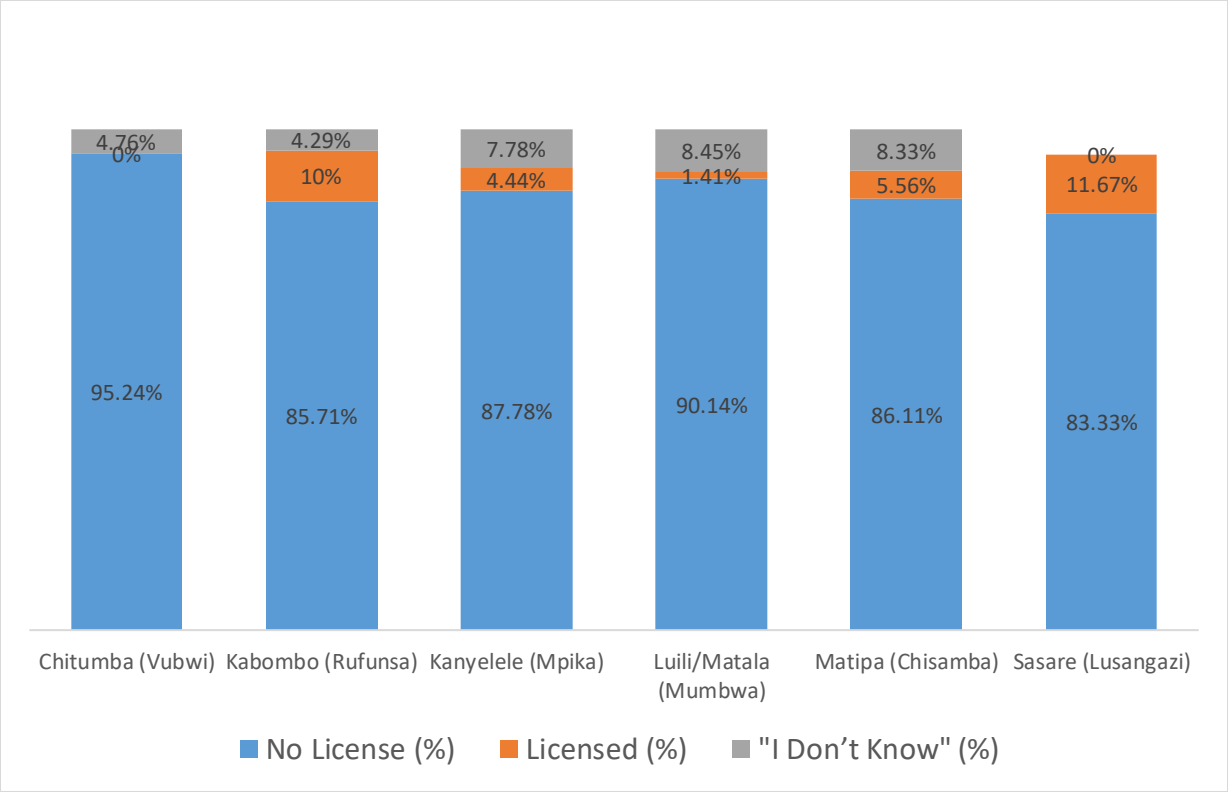


Figure 17: Mining License per study site

3.2.3 *Mining License Procedures*

To apply for an Artisanal Mining Right (AMR), Zambian citizens (individuals or cooperatives) must provide proof of identity (NRC or passport for foreign partners), an environmental project brief, and consent from landowners or local authorities, along with payment of application fees (**ZMW 1,200, 48.73 USD – June 2025)** for a Small-Scale Mining License (SSML), applicants must be Zambian-owned companies or cooperatives and submit a detailed work programme, feasibility study, Environmental Impact Assessment (EIA) for larger operations, proof of financial capacity, tax compliance documents (TPIN & ZRA registration), and approval from local authorities. The application fee for a SSML is (**ZMW 6000, 243.66 USD – June 2025)**. It is worthy to note that before applying for a mining license, miners must obtain land consent from the relevant authorities. If the land is under customary tenure, permission must be secured from the local chief and the community through a formal agreement. For state land, approval is required from the Ministry of Lands or the local council. In some cases, miners must also engage with the District Commissioner's office and the Ministry of Mines and Minerals Development to ensure there are no conflicts with existing licenses or land-use plans. This step is crucial to avoid disputes and ensure smooth operations. The process of obtaining a mining license begins with reserving the mining area by conducting a ground survey and submitting a request to the Ministry of Mines and Minerals Development or now the MRC. Once the area is confirmed as available, the applicant submits the completed application form along

with the required documents. The MMMD evaluates the application (which may take 30–90 days but 45 days now in the new law), conducts site inspections, and, if approved, issues the license upon payment of the necessary fees.

3.2.4 *Mining Cooperatives or Companies*

The ASGM sector can be formalized through the creation of cooperatives or companies, which help organize Artisanal miners into recognizable groups. Data from Table 11 reveals significant variation in organizational structures across mining sites.

Unstructured groups dominate overall (46.9%), particularly in Kabombo (62.9%) and Kanyelele (51.1%), while individual operators are most common in Luili/Matala (72.9%). Formal ASGM companies are rare (2.1% overall) and are concentrated almost entirely in Luili/Matala (representing 87.5% of all companies in the sample). Cooperatives, while more evenly distributed, cluster notably in Sasare (34.8% of all cooperatives) and Kabombo (30.4%).

Three key patterns emerge from this distribution in Table 13. Firstly, formal structures (companies and cooperatives) represent 8.0% of operations, underscoring the sector's deep-seated informality. Secondly, geographic specialization is evident: Luili/Matala exhibits a stark divide between a small number of formal companies (10.0% of its operations) and a large majority of individual operators. Thirdly, the prevalence of unstructured groups indicates most mining occurs outside any formal or stable framework. This organizational fragmentation is a major barrier to safety standards, access to finance, and collective bargaining.

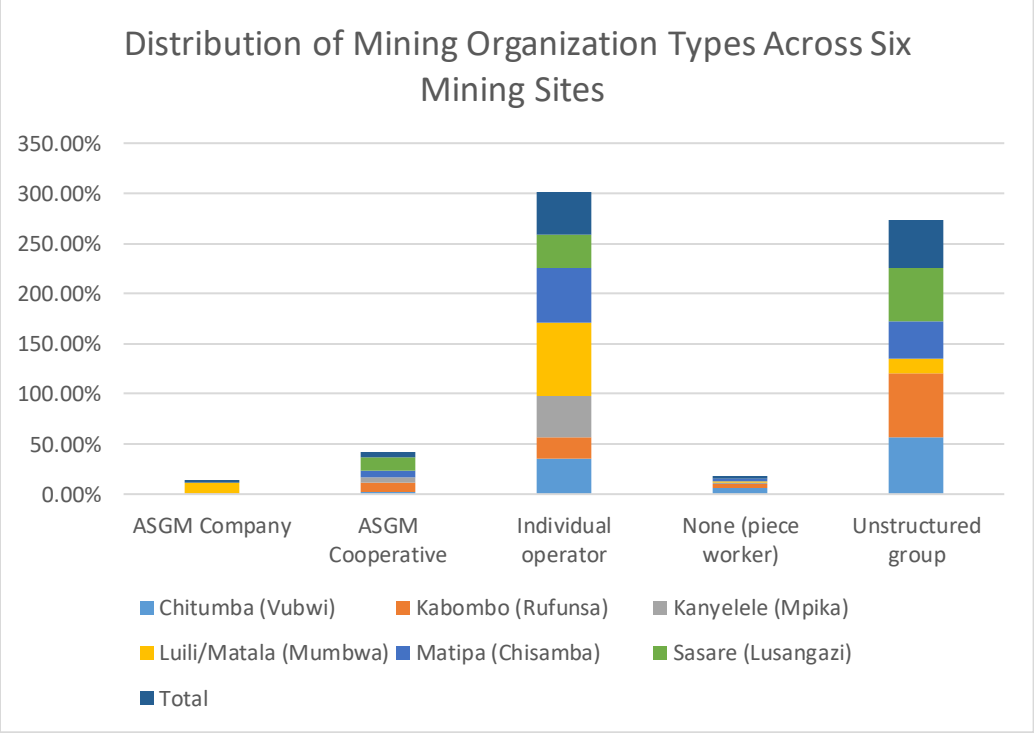


Figure 18: Distribution of Mining Organization Types Across Six Mining Sites

When examining gender-based participation (see Table 19), distinct trends emerge. Female miners are predominantly individual operators (58.3% overall), a much higher proportion than the general miner average (42.5%). This suggests women are more likely to work independently rather than in groups or formalized structures. Unstructured groups account for 32.1% of female miners, a lower share than the

sector-wide average (46.9%), indicating women are less involved in informal collectives. Formalisation among women remains minimal: only 1.2% work in ASGM companies (exclusively in Luili/Matala), while 6.0% participate in cooperatives, with the highest engagement in Kabombo (22.2%) and Sasare (15.4%). Piece work (Casual Employment/Temporal Employment) is slightly more common among women (2.4%).

These findings in Table 12 highlight the intersection of informality and gender dynamics. The low presence of women in companies and cooperatives suggests systemic barriers such as limited access to capital, land, or leadership roles. The high rate of female individual operators may reflect gendered work arrangements that leave women in more precarious, isolated roles. However, Kabombo's relatively higher female participation in cooperatives (22.2%) could signal a successful local model worth further study.

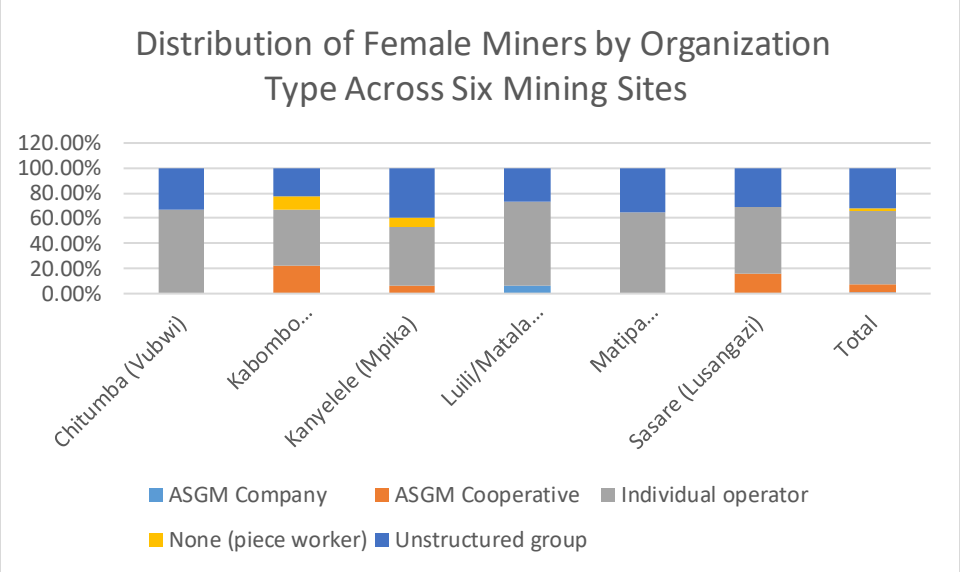


Figure 19: Distribution of Female Miners by Organization Type Across Six Mining Sites

The relationship between organizational type and licensing compliance, shown in Table 7, reveals three critical findings. First, cooperatives show the highest licensing rate, with 65.2% holding a site-specific license, suggesting this model most effectively facilitates regulatory compliance. Secondly, even formal entities face significant challenges: 21.7% of cooperatives and 62.5% of companies still lack proper licensing, indicating persistent bureaucratic or financial hurdles. Thirdly, the near-total non-compliance among individual operators (92.1% unlicensed) and unstructured groups (94.5% unlicensed) underscores how informality perpetuates illegal mining.

These findings from Table 7 suggest that while organizational formalisation—particularly the cooperative model—improves licensing rates, systemic barriers prevent even compliant structures from achieving full regularization. This highlights the need for policy interventions that simultaneously promote organizational development (e.g., cooperative formation) and directly address the accessibility of the licensing process itself.

Table 7: Licensing Status by Mining Organization Type

Mining Organization	I don't know	No License	Yes, but not for this site	Yes, for this site	Total
ASGM Company	12.5%	62.5%	0.0%	25.0%	100%
ASGM Cooperative	8.7%	21.7%	4.3%	65.2%	100%
Individual operator	7.3%	92.1%	0.0%	0.6%	100%
None (piece worker)	10.0%	80.0%	0.0%	10.0%	100%
Unstructured group	3.3%	94.5%	1.1%	1.1%	100%
Total	5.7%	88.1%	0.8%	5.4%	100%
*(Row percentages; n=390) *					

3.2.5 *PACRA registration*

Furthermore, the study reveals critical gaps in the formalisation of Zambia's mining sector through PACRA registration. Table 8 shows that only 4.6% of miners (18 out of 389) reported having their entities properly registered with PACRA, while a staggering 74.6% (290 miners) admitted to operating without registration. Notably, among the few registered entities, two-thirds (12 miners) held valid mining licenses while one-third (6 miners) remained unlicensed highlighting that PACRA registration alone doesn't guarantee licensing compliance. Several miners reported completing PACRA registration as a prerequisite for licensing but faced bureaucratic delays in actually receiving their licenses.

Table 8: PACRA Registration across study sites

PACRA Registration	Frequency	Percentage	Cumulative %
Don't Know	80	20.6%	20.6%
Prefer Not to Say	1	0.3%	20.8%
Not Registered	290	74.6%	95.4%
Registered	18	4.6%	100.0%
Total	389	100.0%	

Site-Specific Finding of PACRA Registration Compliance

According to table 9, ***Chitumba (****Vubwi District)* shows near-total lack of business registration, with 98.4% of miners (62/63) operating unregistered entities. Only one operator (1.6%) has completed PACRA registration, representing just 5.6% of all registered miners across sites. Notably, no miners reported uncertainty about registration status, suggesting clear awareness of their non-compliance. ***Kabombo (****Rufunsa District)* demonstrates relatively better results, with 10.1% registration rate (7/69 miners) - accounting for 38.89% of all registered operators in the study. However, 85.5% remain unregistered, and 4.35% are uncertain about their status. This makes Kabombo the second-best performing site for formal

business registration. ***Kanyelele (****Mpika District)* presents a paradoxical situation with the highest uncertainty (52.2% don't know registration status) and lowest explicit denial rate (46.7%). Only 1.1% are registered, suggesting potential communication failures where miners know registration exists but lack clarity about their own status. This "knowledge limbo" differs markedly from other sites. ***Luili/Matala (****Mumbwa District)* shows 70.4% unregistered miners and concerning 29.6% uncertainty rate, with zero registered operators. This complete absence of formal business entities, combined with high uncertainty, indicates severe formalisation challenges and potential awareness gaps in this location.

Matipa (*Chisamba District)* presents unique characteristics with 8.3% registration rate (3/36) - accounting for 16.7% of all registered miners. However, 66.7% remain unregistered, 22.22% are uncertain, and it's the only site with a respondent refusing to disclose status (2.8%). This suggests uneven formalisation progress with lingering resistance. ***Sasare (****Lusangazi district)* emerges as the registration leader with 10.0% compliance rate (6/60) - representing 33.33% of all registered miners. Only 1.7% express uncertainty, and 88.3% acknowledge being unregistered. This combination of high registration and low uncertainty suggests relatively effective formalisation efforts.

Table 9: PACRA registration by mining site

mining_site	pacra_registration				
	I don't know	I don't want to say	No	Yes	Total
Chitumba (Vubwi)	0.0%	0.0%	98.4%	1.6%	100.0%
Kabombo (Rufunsa)	4.4%	0.0%	85.5%	10.1%	100.0%
Kanyelele (Mpika)	52.2%	0.0%	46.7%	1.1%	100.0%
Luili/Matala (Mumbwa)	29.6%	0.0%	70.4%	0.0%	100.0%
Matipa (Chisamba)	22.2%	2.8%	66.7%	8.3%	100.0%
Sasare (Lusangazi)	1.7%	0.0%	88.3%	10.0%	100.0%
Total	20.6%	0.3%	74.6%	4.6%	100.0%

3.2.6 *Environmental Compliance Certificates/Permits*

The study reveals alarming gaps in environmental compliance among miners in the study sites, with only 1.0% (4 out of 389) holding valid Environmental Compliance Certificates (ECCs)/permits for their current operations. A staggering 98.5% of miners operate without any environmental certification, while 0.51% possess ECCs that don't cover their active mining sites. This near-total non-compliance presents a critical barrier to formalisation, as ECCs are mandatory for obtaining mining licenses.

Table 10: Environmental Compliance Certificates/Permits

ECC Status	Frequency	Percentage
No ECC	383	98.5%
ECC for another site	2	0.5%
Valid ECC for this site	4	1.0%
Total	**389**	**100%**

Site-Specific Findings of Environmental Compliance Certificate (ECC) Status

In table 11 below, ***Chitumba (****Vubwi District)* shows complete non-compliance with environmental regulations, with 100.0 % of miners (63 out of 63) operating without any form of ECC. The site has zero instances of either valid or incorrect-site certificates, making it the worst-performing location for environmental compliance. This total lack of certification suggests either complete absence of enforcement or insurmountable barriers to obtaining environmental approvals in this area. ***Kabombo (****Rufunsa District)* matches Chitumba's concerning record with 100.0% non-compliance (70 out of 70 miners lacking ECCs). The identical results across these two sites indicate regional enforcement failures and particularly challenging bureaucratic processes in this geographic cluster, with no miner even attempting compliance to certify their sites. Key drivers of this total non-compliance include geographic and logistical barriers, such as the long distance to regulatory offices, which make the application process physically and financially inaccessible. Furthermore, a widespread lack of understanding among miners about the purpose and benefits of the ECC process means there is no perceived incentive to undertake the costly and time-consuming procedure, as its advantages for safety, market access, or operational security are not clearly communicated. ***Kanyelele (****Mpika District)* emerges as the environmental compliance leader, though still with alarming gaps. While 96.7% remain uncertified, the site accounts for 75.0 % of all valid ECCs in the study (3 out of 4 total). This suggests some successful implementation of environmental regulations, though the overwhelming majority (87 miners) still operate without proper certification. ***Luili/Matala (****Mumbwa District)* presents a complex picture with 97.2% non-compliance. The site has one miner with a wrong-site certificate (1.4%) and one with proper certification (1.4%), representing 25% of all valid ECCs in the study. This makes it the second-best performing site, though still demonstrating near-total regulatory failure.

Matipa (*Chisamba District)* shows 100.0% lack of environmental certification (35 out of 35 miners), matching Chitumba and Kabombo's poor performance. The absence of any certificate holders - whether valid or wrong-site - suggests particular challenges in this location, possibly related to remoteness or lack of regulatory presence. ***Sasare (****Lusangazi district)* reports 98.3% uncertified miners (59 out of 60), with one wrong-site certificate holder (1.7%) and no properly certified operations. This places it slightly better than the worst-performing sites but still demonstrates fundamental failures in environmental regulation.

Table 11: Environmental Compliance Certificates/Permits by site

Mining Site	No	Yes, but not for this site	Yes, for this site	Total
Chitumba (Vubwi)	100.0 %	0.0%	0.0%	100.0%
Kabombo (Rufunsa)	100.0 %	0.0%	0.0%	100.0%
Kanyelele (Mpika)	96.7%	0.0%	3.3%	100.0%
Luili/Matala (Mumbwa)	97.2%	1.4%	1.4%	100.0%
Matipa (Chisamba)	100.0 %	0.0%	0.0%	100.0%
Sasare (Lusangazi)	98.3%	1.7%	0.0%	100.0%
Total	**98.5%**	**0.5%**	**1.0%**	**100.0%**

3.2.7 *Gold Panning License*

The baseline study on gold panning licenses reveals a critical formalisation gap in Zambia's ASGM sector, with only 2% of panners (8 out of 387) holding valid licenses for their current operations. This shockingly low compliance rate is compounded by the 97% of panners (377 miners) maybe panning gold without any license whatsoever, while a negligible 1% (2 panners) possess licenses that don't cover their actual panning sites. These figures paint a picture that gold panning is taking place in these study sites but almost completely unregulated subsector, where informal panning operations dominate and legal compliance remains exceptionally rare.

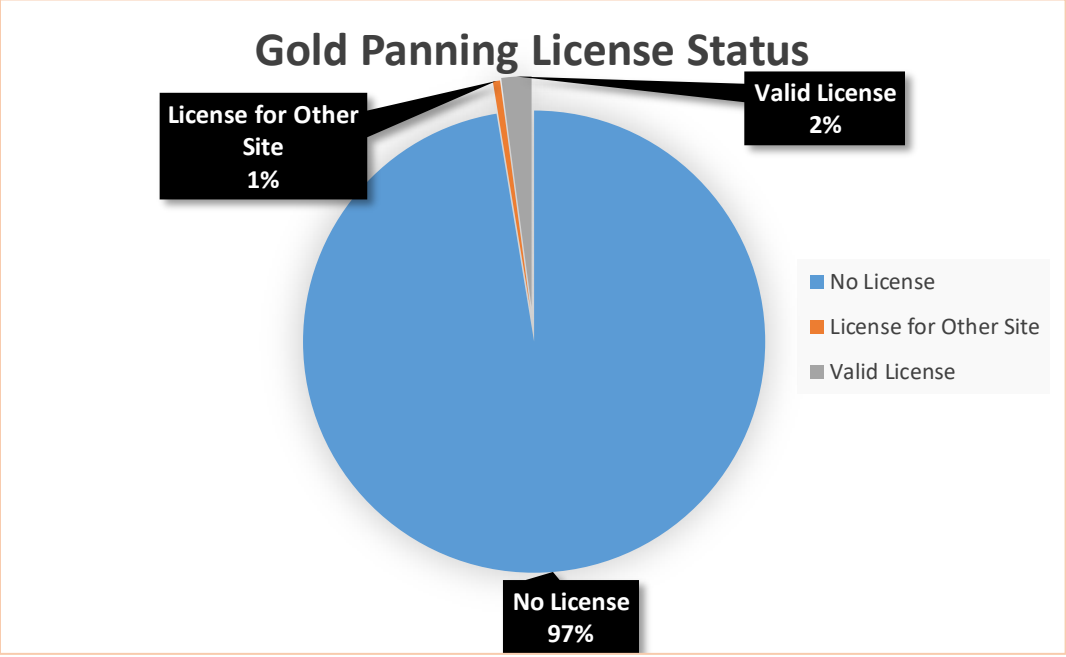


Figure 20: Gold Panning License Status

Site-Specific Analysis of Gold Panning License Compliance

Chitumba (*Vubwi District)* demonstrates near-total non-compliance with gold panning regulations, with 98.39% of panners operating without valid licenses. Only one individual (1.6%) holds a proper license, while none possess licenses for incorrect sites. This makes Chitumba one of the least formalized sites, suggesting either complete lack of enforcement or insurmountable barriers to obtaining licenses. Nonetheless, the single licensed panner represents just 12.5% of all licensed panners across sites. ***Kabombo (****Rufunsa District)* mirrors Chitumba's compliance crisis, with 98.6% unlicensed panners and just one licensed operator (1.4%). Like Chitumba, no panners here hold licenses for wrong sites, indicating either no attempt at compliance or immediate abandonment when facing bureaucratic hurdles. The sole licensed panner accounts for 12.5% of all licensed panners in the study.

Kanyelele (*Mpika District)* emerges as the most compliant site, though still problematic, with 4.4% licensed panners (4 individuals) representing half of all licensed panners across all sites. However, 94.4% remain unlicensed, and one panner (1.1%) holds an incorrect-site license. This suggests some successful formalisation efforts but highlights how even the "best" site still suffers from 95.0% non-compliance. ***Luili/Matala (****Mumbwa District)* shows identical compliance rates to Kabombo where 98.57% unlicensed with just one licensed panner (1.4%). The complete absence of wrong-site licenses implies either no attempt at compliance or immediate withdrawal when facing procedural challenges. This uniformity across multiple sites suggests systemic rather than local barriers.

Matipa (*Chisamba District)* presents a unique case with 97.1% unlicensed panners, but also the only site with a wrong-site license holder (2.9%). The absence of licensed panners contrasts with other sites, possibly indicating different enforcement approaches or particular geographic challenges in this location. ***Sasare*** *(Lusangazi District)* continues the dominant pattern, with 98.3% of miners operating without

licences and only 1.7% holding valid mining licences. Like most sites, there were no cases of miners operating under licences issued for other locations, reinforcing the finding that miners either obtain the appropriate licence for their mining site or operate entirely informally, with little or no middle ground.

Table 12: panning license by mining site

MINING SITE	NO (%)	YES, BUT NOT FOR THIS SITE (%)	YES, FOR THIS SITE (%)	TOTAL (%)
CHITUMBA (VUBWI)	98.4%	0.0%	1.6%	100.0%
KABOMBO (RUFUNSA)	98.6%	0.0%	1.4%	100.0%
KANYELELE (MPIKA)	94.4%	1.1%	4.4%	100.0%
LUILI/MATALA (MUMBWA)	98.6%	0.0%	1.4%	100.0%
MATIPA (CHISAMBA)	97.1%	2.9%	0.0%	100.0%
SASARE (LUSANGAZI)	98.3%	0.0%	1.7%	100.0%
TOTAL	**97.4%**	**0.5%**	**2.1%**	**100.0%**

3.3 *Mining License Awareness and Procedural Knowledge*

Baseline study depicted in figures 21 and 22 below reveal a significant disconnect between miners' general awareness of licensing requirements and their understanding of the actual application process. While 84.02% of respondents know that mining licenses are legally required, only 16.7% (65 out of 389) understand the specific procedures for obtaining one. A striking 66.3% (258 miners) explicitly stated they don't know the application process, with an additional 17.0% (66 miners) completely unaware of any procedures. This demonstrates that while most miners recognize the legal obligation to obtain licenses (84.0% awareness), procedural knowledge remains extremely limited - only about 1 in 6 miners understand how to actually comply.

These findings fundamentally reshape our understanding of the knowledge barriers to formalisation. The data suggests that *general awareness of licensing requirements does not equate to practical understanding of compliance pathways.* The cumulative percentages show that 83.3% of miners either don't know or are uncertain about application procedures, creating a substantial procedural knowledge gap that helps explain why high general awareness (84.0%) doesn't translate to license acquisition. This procedural knowledge deficit, combined with previously identified systemic barriers (cost, distance, bureaucracy), creates multiple layers of obstacles to formalisation.

The contrast between the 84.0% general license awareness and mere 16.7% procedural knowledge highlights a critical policy gap: current outreach efforts may successfully communicate legal requirements but fail to provide actionable information about compliance processes. This explains why awareness alone hasn't improved licensing rates, as miners who know they need licenses still lack the practical knowledge to obtain them. Addressing this procedural knowledge gap through targeted, step-by-step guidance could

help convert awareness into action, though it must be paired with reforms to reduce other systemic barriers.

Site-Specific Analysis of Mining License Awareness and Procedural Knowledge

Chitumba (Vubwi District) presents a concerning case of regulatory knowledge gaps. While 77.8% of miners are aware of licensing requirements, none (0.0%) understand the actual application procedures, highlighting a significant gap between awareness and practical knowledge of the licensing process**.** This complete disconnect between awareness and procedural knowledge suggests that outreach efforts in this area have only communicated surface-level information without practical guidance. The site's particularly high rate of procedural ignorance (90.5% outright denial of knowledge) explains why general awareness hasn't translated to compliance, indicating an urgent need for step-by-step application training tailored to Chitumba's miners. ***Kabombo*** *(Rufunsa District)* 75.7% license awareness contrasts sharply with only 14.5% procedural knowledge, revealing a similar but less extreme version of Chitumba's challenge. The site shows marginally better understanding than Chitumba, with 10 miners (14.5%) claiming procedural knowledge, suggesting some limited transmission of practical information. However, the 72.5% who explicitly deny knowing procedures confirms that most aware miners still lack actionable knowledge, requiring targeted interventions that convert awareness into practical compliance capacity.

Kanyelele (*Mpika District)* emerges as the knowledge leader among surveyed sites, with both high awareness (88.8%) and the best procedural understanding (32.2%). This unique combination suggests successful knowledge transfer mechanisms are operating here, possibly through peer networks or effective local extension services. The site's 54.4% who still lack procedural knowledge indicates room for improvement, but its relative success could provide valuable lessons for other locations, particularly in how it has managed to translate awareness into practical knowledge for nearly a third of miners. ***Luili/Matala (****Mumbwa District)* presents a puzzling case with the highest license awareness (95.8%) but significant procedural knowledge gaps - 36.6% complete ignorance and only 23.9% full understanding. This "awareness without knowledge" paradox suggests the site has received effective messaging about license requirements but inadequate follow-up on implementation. The data implies miners here know they should be licensed but remain stuck at the starting gate, needing focused procedural guidance to complement their existing awareness.

Matipa (*Chisamba District)* shows moderate performance on both metrics - 74.3% awareness and 13.9% procedural knowledge. While not as extreme as Chitumba or Kabombo, the site still demonstrates the common pattern were awareness dwarfs' practical knowledge. The 66.7% who explicitly deny procedural understanding indicates most miners here would benefit from simplified, accessible guidance on license applications to bridge this persistent gap. ***Sasare (****Lusangazi District)* maintains 85.0% license awareness but only 6.7% procedural knowledge, with a striking 83.3% admitting they don't know application processes. This mirrors the wider pattern but with particularly low procedural understanding relative to awareness. The site's challenges appear similar to Chitumba's, though less severe, suggesting needs for basic procedural education combined with awareness reinforcement to create effective compliance pathways.

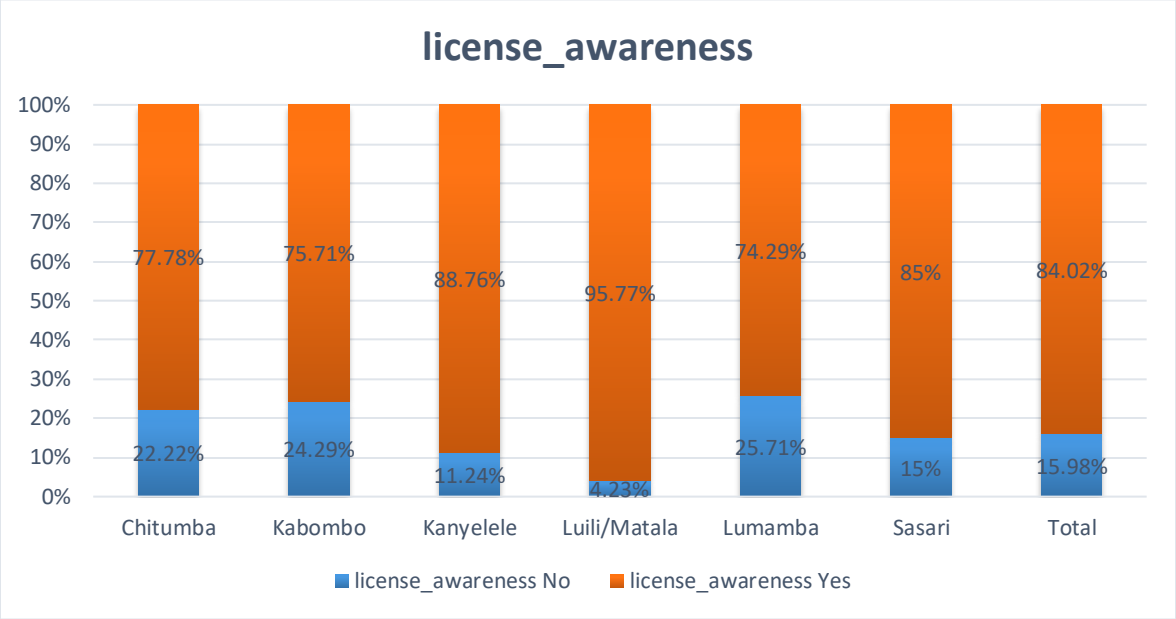


Figure 21: Licence Awareness by Site

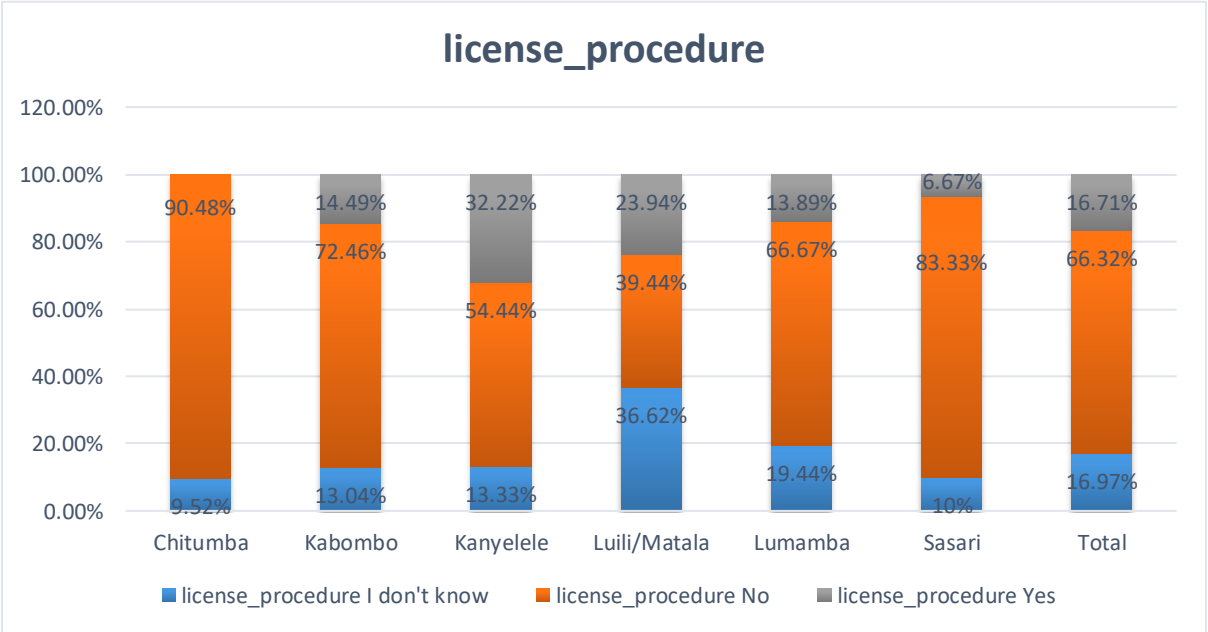


Figure 22: Licence Procedure Awareness by Site

3.4 Formalisation Progress

Zambia's mining formalisation metrics reveal severe compliance gaps across all key indicators according to table 13 below, with environmental regulations posing the greatest challenge as only 1.3% of miners

hold valid ECCs (ranging from 0% in Chitumba/Kabombo/Matipa to 3.3% in Kanyelele). Business registration shows marginally better but still critical underperformance at 4.6% overall, with stark site disparities from 0% in Luili/Matala to 10-10.1% in Sasare/Kabombo. Mining license compliance averages 5.4%, led by Sasare (11.7%) and Kabombo (10.0%), while Chitumba remains at 0%. Only 6.0% of miners belong to formal organizations, though these demonstrate stronger compliance particularly cooperatives, where 43.5% achieve PACRA registration and 65.2% obtain licenses, suggesting this model could drive broader formalisation if expanded. The data underscores systemic challenges with site-specific variations requiring tailored interventions.

Table 13: Formalisation Progress

Formalisation Indicator	Overall Rate	Site with Highest Rate	Site with Lowest Rate	Additional Context
Environmental Compliance (ECC)	1.0%	Kanyelele (3.3%)	Chitumba (0.0%)	Data not available for other sites.
Business Registration (PACRA)	4.6%	Kabombo (10.1%)	Luili/Matala (0.0%)	**43.5%** of registered entities are companies/cooperatives.
Mining Licenses	5.4%	Sasare (11.7%)	Chitumba (0.0%)	**65.2%** of license holders are cooperative members.
Cooperative Membership	6.0%	Sasare (13.3%)	Chitumba (1.6%)	N/A

3.5 Reasons for Low Mining License Compliance Among Artisanal Miners

The responses from miners reveal multiple systemic and practical barriers that explain the low licensing rates observed in Zambia's Artisanal mining sector. These challenges can be categorized into four main themes: financial constraints, bureaucratic hurdles, accessibility issues, and knowledge gaps.

Financial Barriers emerge as the most frequently cited obstacle, with miners repeatedly describing licenses as "expensive" and lamenting the "lack of finances to pay for other licenses." This financial burden appears prohibitive for many Artisanal miners operating on marginal incomes. The cost factor creates a significant barrier to entry, particularly when combined with other expenses like transportation to government offices.

"The process of acquiring a license is costly, it costed our cooperative about K8000, with other costs but still waiting to be given the license. …… the process and procedure to acquire a license is not clear, I had to ask from others who had license for him to know where to go and what to do" – a Miner from Sasare.

Bureaucratic Challenges constitute another major hurdle to formalisation. Miners report "long processes and so much time is wasted in trying to get a license," with specific complaints about ZEMA's delays in approving operations. The licensing system appears plagued by inefficiencies, including claims that "licenses don't come out" after application and allegations that "names get deleted on the cadastre portal." These administrative bottlenecks discourage compliance and foster frustration among potential applicants.

Critically, this inefficiency is compounded by a severe lack of transparency and fairness in the allocation of rights. A common grievance among local miners is that after applying for a license in their area, they are not granted the right. Instead, individuals from outside the district often perceived to have greater financial means or political connections “arrive and claim ownership” of the very site for which the local applicant had applied. This experience not only undermines trust in the licensing system but also forces local miners into a rational choice: continue operating without a license (illegally) or abandon their livelihood.

As one miner from Kabombo explained: *“The procedure and the process for acquiring the license is not clear. …… information is not given properly, and the offices needed for one to acquire the license are not mobile, so that makes it harder for miners to get the license.”*

This combination of opaque procedures, systemic delays, and perceived inequity in rights allocation creates a powerful disincentive to formalize, perpetuating the cycle of informality.

Geographical and Physical Accessibility issues compound these problems. Multiple respondents mention the "long distances" to government offices, with one explicitly stating, "the distance to their offices is far from where I stay." This geographic barrier is particularly challenging for miners in remote areas who may lack reliable transportation. The additional comment about "not having anyone to help us with the procedure" suggests a lack of decentralized support services to assist miners in navigating these physical barriers.

Knowledge and Literacy Barriers further exacerbate the situation. Several miners admit they "don't know the process of obtaining licenses" or "don't understand fully the process." This is compounded by the "illiteracy of majority of the miners," which creates a fundamental obstacle to engaging with formal regulatory processes. The fear expressed by some who are "afraid because we are illegals" suggests a psychological barrier stemming from this lack of understanding.

The responses paint a picture of a licensing system that is financially prohibitive, geographically inaccessible, bureaucratically cumbersome, and poorly understood by its intended beneficiaries. These interconnected barriers create a perfect storm of non-compliance, where even motivated miners face multiple, compounding obstacles to obtaining legal authorization. The mention of gender discrimination ("they do not allow females at the mine") adds another layer of exclusion for women miners.

Addressing these challenges would require a multi-pronged approach including fee restructuring, decentralized application processing, streamlined procedures, literacy-sensitive outreach programs, and potentially mobile licensing services to reach remote mining communities. The prevalence of these

complaints across multiple independent responses suggests these are systemic issues rather than isolated concerns, demanding comprehensive policy interventions rather than piecemeal solutions.

3.6 Chapter Conclusions

The findings from the study sites reveal significant gaps in the formalisation of Zambia's ASGM sector, despite the existence of a robust legal and policy framework. While recent legislative reforms, such as the Mineral Regulation Commission Act (2024) and the Geological and Mines Development Act (2025), provide a structured pathway for formalisation, compliance remains alarmingly low. Only 5.38% of miners hold valid mining licenses, 4.6% are registered with PACRA, and a mere 1.0% possess Environmental Compliance Certificates (ECCs). These figures underscore systemic challenges, including financial barriers, bureaucratic inefficiencies, lack of procedural knowledge, and accessibility constraints, which collectively hinder miners from transitioning into the formal economy.

Furthermore, the study highlights disparities in formalisation progress across different sites, with Sasare and Kabombo showing relatively better compliance compared to Chitumba and Luili/Matala, where near-total informality persists. The success of mining cooperatives in achieving higher licensing rates (65.2%) suggests that collective organization can facilitate formalisation, yet their adoption remains limited. Gender disparities also persist, with female miners predominantly operating as individual miners (58.3%) rather than within formalized structures. These findings indicate that while Zambia has made legislative strides, effective implementation, awareness campaigns, and targeted support mechanisms are urgently needed to bridge the gap between policy and practice.

3.7 Chapter Recommendations

To improve formalisation rates in Zambia's ASGM sector, the Government and other stakeholders should prioritise simplifying and decentralising licensing procedures. This could include establishing mobile licensing units in remote mining areas, reducing application fees for Artisanal miners, and streamlining administrative processes to minimise delays. In addition, targeted awareness campaigns should be conducted to educate miners on licensing requirements, environmental regulations, and the benefits of formalisation. Given that **84.0%** of miners know that licences are required, but only **16.7%** understand the application procedures, training programmes delivered in local languages and through community leaders could significantly improve compliance.

Another key recommendation is to strengthen institutional support for mining cooperatives, which have demonstrated higher levels of compliance. The Government should provide financial incentives, technical assistance, and capacity-building programmes to encourage miners to form or join cooperatives. Furthermore, gender-responsive policies should be implemented to ensure that women miners have equal access to licensing, financing, and leadership opportunities. Finally, enforcement mechanisms should be complemented by supportive measures rather than relying solely on punitive approaches. Miners should be provided with a clear and achievable pathway to formalisation, supported by accessible financing, such as the ASM Fund, and extension services.

To build trust and integrity in the licensing system, it is essential that the allocation of mining rights be transparent, consistent, and free from undue external influence. This includes ensuring that licenses are

granted based on verified applications and documented rights “not political or financial advantage” to create a fair and predictable regulatory environment that encourages compliance.

Table 14: Findings Conclusions and Recommendations for ASGM Legislation and Formalisation in the Study Areas

Findings	Conclusions	Recommendations
Policy-Implementation Gap:	Systemic Formalisation Barriers:	1. Streamline Licensing:
- 5.4% hold mining licenses	- Financial constraints	- Mobile licensing units
- 4.6% PACRA-registered	- Bureaucratic inefficiencies	- Reduced fees for ASGM
- 1.0% have ECCs	- Knowledge/access gaps	- Simplified paperwork for licensing
***Despite new laws (2024/2025 Acts) ***	*Robust laws ≠ compliance*	
Site Disparities:	Collective Models Work:	2. Promote Cooperatives:
- Sasare/Kabombo: Moderate compliance	- Cooperatives show 12x better formalisation	- Provide financial incentives to formalised cooperatives
- Chitumba/Luili: Near-total informality	- But adoption remains limited	- Provide technical assistance to formalised cooperatives
- Cooperatives: 65.2% licensed		- Capacity-building programs
Gender Divide:	Structural Exclusion:	3. Gender-Sensitive Policies:
- 58.3% female miners operate individually	- Women face disproportionate barriers to formalisation	- Targeted licensing access
- Low participation in formal structures		- Leadership opportunities
		- ASM Fund accessibility
Awareness Paradox:	Education Deficit:	4. Enhanced Outreach:
- 84.0% know licenses required	- Knowledge gaps hinder compliance more than willingness	- Local-language training
- Only 16.7% understand procedures		- Community leader engagement
		- Step-by-step procedure guides
Enforcement Context:	Carrot-Stick Imbalance:	5. Supportive Enforcement:
- Heavy reliance on punitive measures	- Punishment alone is ineffective without pathways	- ASM Fund financing
- Minimal support systems		- Extension services by the authorities similar to agriculture
		- Graduated compliance timelines

4. Mining Practices

Chapter 4: Summary

This chapter examined mining practices in Zambia, focusing on both large-scale mining (LSM) and Artisanal and Small-Scale Gold Mining (ASGM). Key findings reveal stark contrasts between LSM's mechanized, high-volume operations and ASGM's labour-intensive, often hazardous methods. The study identified two primary types of gold deposits across mining sites namely reef and alluvial. 41% of the mining sites have both alluvial and reef, while 25% work solely with alluvial and another 34% with reef gold deposits, reflecting Zambia's diverse gold endowment.

ASGM miners demonstrate high work engagement, averaging **25 operational days per month**, yet productivity remains low due to inefficiencies. The operations are conducted in production cycles where a cycle is defined as a complete batch process undertaken by a miner or a mining unit to transform a quantity of raw ore into a sellable product, cycles also include a mining cycle which is defined as a complete process undertaken by a miner or a mining unit to haul a specific quantity of raw ore for processing. The weighted average tonnage of ore mined across the mining sites per mining cycle is 1.58 tonnes of ore, though this varies widely from less than 0.5 tonnes per cycle in Kabombo and Sasare to 3–7.5 tonnes per cycle in Luili/Matala and Matipa. A typical miner per processing cycle handles 0.375 tonnes per cycle of ore, with most operations (67%) processing less than the mined amount.

Mercury use remains pervasive, with miners consuming an **average of 23.3 grams** per processing cycle per day, though some sites (e.g., Kabombo and Luili/Matala) report significantly higher usage. Mercury is purchased at an **average price of USD 0.5 per gram**, with most transactions (85%) costing below USD 83 for 135 grams. Despite its hazards, mercury continues to dominate gold processing due to its affordability and perceived efficiency, with a **mercury-to-gold ratio of 2.56:1** higher than the national average reported in Zambia's National Action Plan (NAP) which was estimated at 2:1.

The sector remains informal, with **94% of transactions lacking traceability** and **98% of miners lacking institutional support**, perpetuating exploitative pricing and financial exclusion.

The chapter underscores the urgent need for **formalisation, mercury reduction, and improved market access**. Site-specific strategies are essential, given the varying deposit types, productivity levels, and mercury reliance across locations. Strengthening the Ministry of Mines and Minerals Development's role, promoting alternative technologies, and enhancing financial and technical support for miners are critical steps toward sustainable development. Addressing these challenges requires coordinated efforts from the government, private sector, and mining communities to ensure long-term economic viability while minimizing environmental harm.

development and mining, mineral processing, metal extraction and refining, decommissioning and post-closure activities. Throughout this process, miners assess geological constraints, economic feasibility, and sustainable mineral processing methods. Zambia's mining industry is dominated by large-scale mining (LSM) of copper and cobalt, while Artisanal and Small-Scalemining (ASM) focuses on gold, gemstones, and small-scale copper deposits.

There are some key differences between LSM and ASM in Zambia including the type of equipment used, the scale of operations, ore grades, and adherence to safety standards. LSM relies on heavy machinery such as haul trucks, excavators, and drill rigs, allowing for the processing of thousands of tonnes of low to medium-grade ore daily. In contrast, ASM operations are largely manual, using basic tools like picks, shovels, and small crushers to extract smaller volumes of medium to higher-grade material. Additionally, LSM follows strict occupational health and safety regulations, whereas ASM frequently operates with limited protective measures, leading to higher risks of accidents and environmental harm.

4.1.1 Mining Site Characteristics and Ore Extraction

Zambia's gold deposits can be broadly categorized into alluvial/placer deposits and primary/hard rock deposits. Alluvial deposits, found in riverbeds and sediment layers, contain free gold or gemstones eroded from their original sources. Artisanal miners extract these minerals through manual panning, sluice boxes, or small dredging operations, as well as mercury amalgamation. However, these methods raise environmental concerns, including river siltation, mercury pollution, and water contamination. Zambia is experiencing an increase in mercury use in ASGM, though efforts are being made to promote cleaner alternatives. On the other hand, primary deposits such as gold-bearing quartz reefs or hard rock veins require hard rock mining techniques. Despite the hard rock nature, ASGM miners extract these ores using hand tools, and basic machinery before processing them in small crushing plants or transporting them to centralized mills utilising wet pans.

The study revealed that Zambia's gold mining occurs across three distinct deposit types as shown in figure 23 below: *41% of sites mine both alluvial and reef/hard rock gold, demonstrating geological diversity; 34% exclusively extract reef/hard rock deposits, typically requiring use of appropriate tools and techniques; while 25% work solely alluvial deposits, representing smaller-scale operations*. This distribution (41% mixed, 34% hard rock, 25% alluvial) highlights the country's varied gold endowment, with three-quarters of sites containing reef/hard rock potential, and a quarter relying exclusively on surface-level alluvial deposits that characterize Artisanal mining. The findings underscore Zambia's dual mining economy for a combination of industrial-scale hard rock operations with widespread alluvial workings.

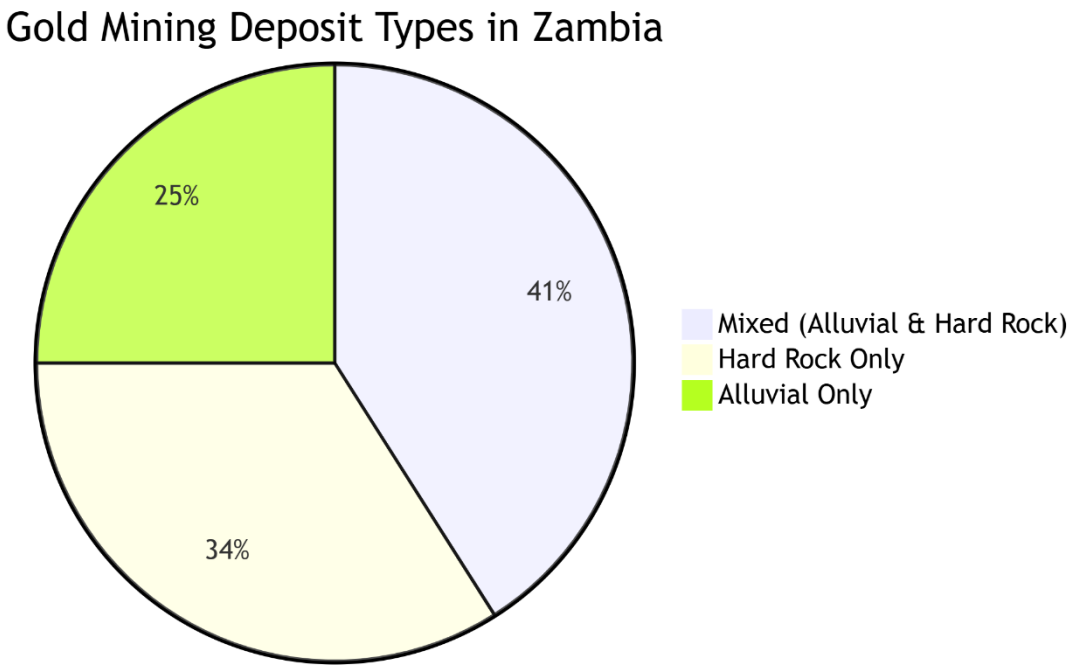


Figure 23: Gold Mining Deposit Types in Zambia

Site Specific findings

Chitumba *(Vubwi District);* This site features a mixed deposit type (both alluvial and reef/hard rock), with most miners exploiting alluvial deposits. Miners employ both surface placer mining and hard rock mining techniques, making it a versatile operation.

Kabombo *(Rufunsa District)* is a 100% reef gold mining site, with no alluvial deposits present. Gold production requires specialized hard rock mining methods, including drilling and mechanized processing.

Kanyelele *(Mpika District)* contains 100% mixed deposits (both alluvial and reef/hard rock), similar to Chitumba. This allows for combined mining approaches, leveraging both surface placer techniques and deeper hard rock excavation. Similar to Kanyelele ***Luili/Matala*** *(Mumbwa District)* site consists of 100% mixed deposits, indicating the coexistence of alluvial and reef/hard rock gold. The dual mineralization supports flexible mining strategies, accommodating both Artisanal and mechanized operations even though the reef is mostly worked with high mechanised systems.

Matipa *(Chisamba District),* particularly the sampling area having been along the Lombwa riverbed, is the only site with 100% alluvial deposits, containing no reef/hard rock or mixed mineralization owing to the location of the mining activities. Gold is exclusively recovered through placer mining methods, making it ideal for small-scale, manual operations.

Sasare *(Lusangazi District)* features 100% mixed deposits (both alluvial and reef/hard rock), with no exclusive deposit type. Like other mixed sites, it enables a combination of surface and subsurface mining techniques.

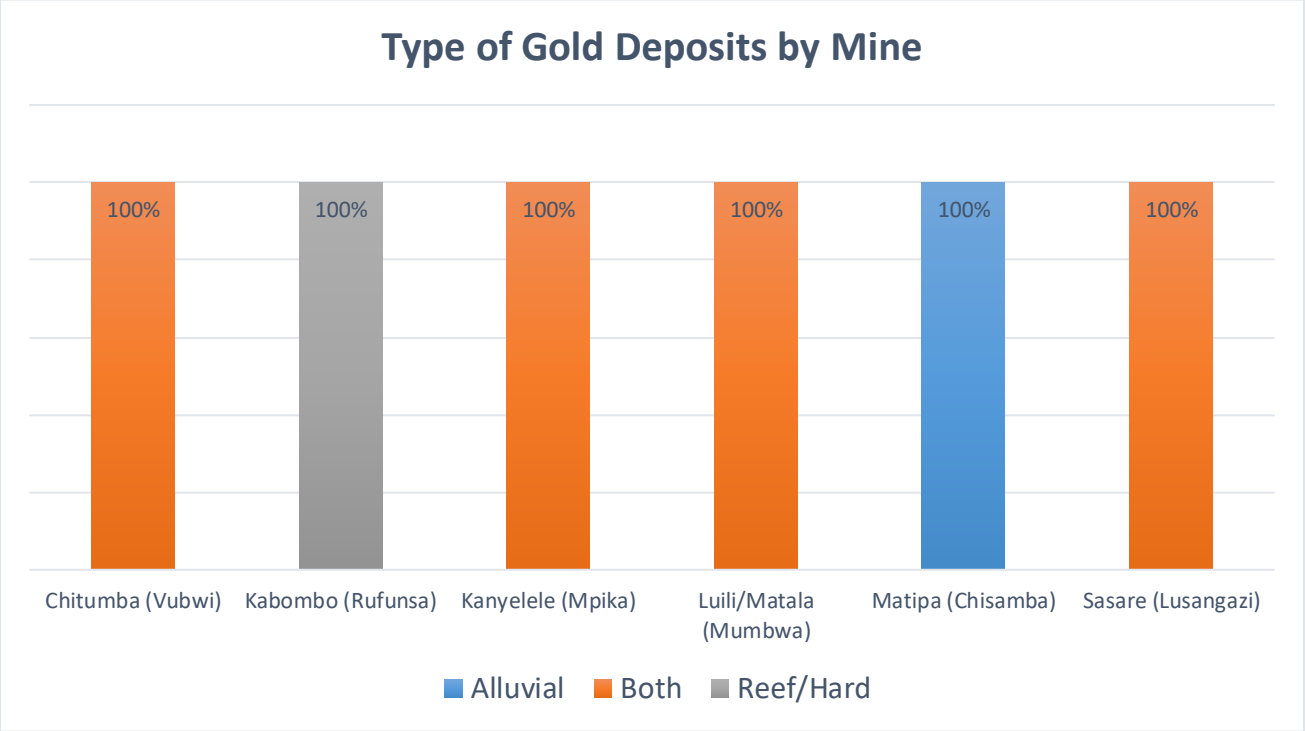


Figure 24: Type of Gold Deposits by Site

4.2 Artisanal Gold Mining Operations in Zambia

4.2.1 Overview of Mining Operations (Ore Extraction)

a) *Labour Organization and Group Structures in Artisanal Gold Mining*

The labour structure in Artisanal and Small-ScaleGold Mining in Zambia is overwhelmingly informal, characterized by loose and transient work arrangements. The data reveals that **46.9%** of miners operate in unstructured groups, which are typically ad hoc teams formed around specific pits or processing sites. These groups lack formal leadership or defined roles, with members often joining and leaving based on immediate needs. Another **42.5%** of miners work as individual operators, either digging their own small claims or hiring temporary labourers when necessary. Only a small fraction of miners of about **5.9% are part of cooperatives**, which offer slightly more stability through shared resources and collective bargaining. Meanwhile, only **2.1%** are employed by formal ASGM companies, indicating that corporate involvement in this sector remains minimal.

Within these informal structures, hierarchy is fluid. **70.7%** of respondents identify as **"members"** of a mining group, suggesting a lack of clear leadership roles. However, **15.6%** are **owners**, typically individuals who control access to mining pits or processing equipment. Formal management is rare, with only **1.9%** of workers holding managerial positions and **3%** serving as supervisors, who are often responsible for overseeing safety or work distribution. The absence of structured labour organization contributes to inefficiencies, such as inconsistent work output and disputes over resource allocation. This informality also leaves workers vulnerable to exploitation, as there are few mechanisms to enforce fair wages or safe working conditions.

b) *Work Roles, Payment Systems, and Livelihood Dependence*

The study revealed that Artisanal and Small-ScaleGold Mining in Zambia involves a wide range of labour roles, with many workers performing multiple tasks depending on daily needs. **Miners (16.2%)** focus on excavation and ore extraction, while **panners (4.2%)** specialize in separating gold from sediment using water. **Crushers (2.9%)** process ore, often with rudimentary tools like hammers or grinding stones. However, role specialization is limited as many workers combine tasks, such as **miner-panner-crushers (4.2%)**, shifting between jobs as required. Support roles, such as transporters (4.4%) and security personnel, exist but are less common, reflecting the sector's reliance on minimal infrastructure.

Payment systems are highly irregular, mirroring the unpredictable nature of gold mining. **46.7%** of workers are paid daily, while **44.6%** receive weekly wages, reflecting the need for immediate cash flow in an unstable economy. Monthly payments (8.5%) are rare and usually reserved for supervisors or equipment owners. Income from mining is the primary livelihood for 86.6% of workers, with few alternative sources. While **54.1%** report their earnings as sufficient, a significant portion of about **19.2%** struggle to meet basic needs, and another **18.9%** experience intermittent financial instability.

The baseline study further established that on average, miners demonstrate high work engagement, with 93.2% of total miners working more than 20 days per month with a median of ***25 days per month*** in a

dominant range 20–31 days. Therefore, a typical Artisanal and Small-ScaleGold miner in Zambia based on the study sites worked 25 days in a month, the study established. This relentless schedule underscores the sector's precariousness where miners cannot afford breaks due to the lack of savings or alternative income streams. Only **7.7%** supplement their earnings with farming, highlighting the near-total dependence on gold mining for survival. The combination of irregular payments, hazardous work conditions, and economic insecurity creates a cycle of vulnerability, where miners remain trapped in informal labour with little opportunity. However, this intensive labour input rarely translates to proportional output which is typical for Artisanal and Small-ScaleGold Miners. While Kabombo and Sasare show the highest work frequencies (60.9% and 78% daily operations respectively) as shown in table below, they paradoxically yield the lowest ore production volumes (84.1% and 83.1% extracting <500kg/day). This inverse productivity relationship underscores systemic inefficiencies in Artisanal methods. More productive mid-scale operations (1-5 tonnes/day) emerge in Luili/Matala (43.7% of miners) and Matipa (33.3%), suggesting these sites may benefit most from targeted mechanization support.

Table 15: Distribution of Workdays per Month by Mining Site

Mining Site	Less than 10 days (%)	10 to 15 days (%)	15 to 20 days (%)	20 to 25 days (%)	25 to 31 days (%)	Every day (%)	Total (%)
Chitumba (Vubwi)	3.2%	4.8%	7.9%	15.9%	36.5%	31.7%	100.0%
Kabombo (Rufunsa)	0.0%	1.4%	1.4%	20.3%	15.9%	60.9%	100.0%
Kanyelele (Mpika)	0.0%	0.0%	2.3%	32.6%	30.2%	34.9%	100.0%
Luili/Matala (Mumbwa)	3.0%	1.5%	7.5%	34.3%	19.4%	34.3%	100.0%
Matipa (Chisamba)	0.0%	0.0%	11.1%	27.8%	36.1%	25.0%	100.0%
Sasare (Lusangazi)	0.0%	0.0%	0.0%	22.0%	44.1%	33.9%	100.0%
Total	1.1%	1.3%	4.5%	25.8%	29.5%	37.9%	100.0%

The study findings in table 16 below reflects the fact that nearly *half of the miners* are extracting ore of less than 0.5 tonnes per cycle, while only a tiny fraction reaches the 10+ ton mark. The same table further established a critical average (*mean*) *daily output of ore per miner of **1.58 tonnes*** across all the study sites. However, a *median* of **0.375 tonnes** per miner per cycle, 0.25 tonnes as a *lower bound* production per miner per cycle, and 3-7.5 tonnes *upper bound* production per miner per cycle was established.

Table 16: Quantity of daily gold ore extraction per miner

Ore Range	Frequency	Percent	Cumulative Percent	Estimated Midpoint (tonnes)	Weighted (tonnes)	Weighted Average (tonnes)
Less than 500 kg	174	45.0%	45.0%	0.25	43.5	
500 kg to 1 ton	102	26.4%	71.3%	0.75	76.5	
1 ton to 5 tonnes	81	20.9%	92.3%	3	243	
5 tonnes to 10 tonnes	27	7.0%	99.2%	7.5	202.5	
10 tonnes to 20 tonnes	3	0.8%	100%	15	45	
Total	387	100%			610.5	**1.58**

{**Note: 500 kg = 0.5 tonnes; midpoint values are chosen for approximation purposes; Average Daily Output per Miner = (Total Frequency/Total Weighted Tonnes) = 1.58tonnes*}

On the other hand, the study further established that ***record-keeping practices*** among the miners highlight a stark formalisation divide which affects their knowledge of how much gold ore they dig on a daily basis. Across all sites, 81.2% of miners maintain no ore extraction records, with compliance rates plunging to ≤5% in Sasare and ≤10% in Kabombo. Kanyelele emerges as an exception (41.6% documentation rate), followed by Luili/Matala (26.8%), indicating these locations may be more receptive to formalisation initiatives.

Three universal challenges constrain productivity in ore extraction: 1) transport limitations (manual carrying dominates in 4/6 sites, with 84.4% of Sasare miners hindered by mountainous terrain), 2) tool shortages (affecting 7.9-25.4% of miners), and 3) water management issues (particularly acute in Chitumba (12.7%) and Luili/Matala (31.3%)). These barriers collectively consume 15-30% of operational capacity site wide.

The baseline data reveals several critical intervention areas. Improving access to water could significantly increase ore recovery rates in **Chitumba** and **Luili/Matala**, while investments in transport infrastructure are urgently needed in the mountainous **Sasare** and the difficult terrain of **Kabombo**. **Kanyelele's** relatively strong documentation practices position it as a suitable pilot site for formalisation programmes. Notably, **26.9%–43.7%** of miners in **Chitumba, Luili/Matala, and Matipa** achieve a production of **1–5 tonnes of ore per cycle**, demonstrating that moderate-scale productivity is attainable despite prevailing challenges and providing a benchmark for improving operations at other mining sites.

Mine Operations by Study Site as presented in Table 26

1. Chitumba (Vubwi District)

Chitumba's mining operations demonstrate a paradox of intensive labour inputs yielding limited outputs. The site shows remarkable work dedication, with 68.0% of miners working 25 or more days per month - including 31.8% who work daily. However, this effort translates poorly to productivity, as 69.9% extract ≤1 ton of ore daily. This disconnects stems from multiple structural limitations. The near-total reliance (82.5%) on manual ore carrying creates severe bottlenecks in material movement, while persistent water access issues (12.7%) disrupt processing operations. Tool shortages (7.9%) compound these problems, forcing miners to work longer hours with inefficient equipment. The site's record-keeping deficit (only 18.8% maintain documentation) further obscures productivity analysis and prevents operational improvements.

Gender disparities are particularly stark, with 83% of women producing under 500kg/day across all age groups, suggesting systemic barriers in role allocation or resource access. Unlike more mechanized sites like Luili/Matala, Chitumba lacks centralized processing infrastructure, forcing miners to either sell unprocessed ore at depressed prices or engage in labour-intensive manual processing - both options that significantly reduce potential earnings. Weather disruptions (14.3%) add another layer of unpredictability, with seasonal rains frequently flooding pits and halting operations for days at a time.

2. Kabombo (Rufunsa District)

Kabombo presents the most extreme case of labour inputs failing to correlate with outputs. Here, 60.9% of miners work every single day of the month - the highest continuous work rate among all sites - yet 84.1% mine less than 0.5 tonnes of ore per cycle. This poor performance stems fundamentally from the site's geological formation (reef gold) coupled with inadequate technology. Hard-rock gold mining requires explosives and mechanized drills for efficient mining, but most Kabombo miners rely on basic hand tools. The resulting inefficiency is compounded by frequent land disputes (7.1% as primary complaint, 21.7% when combined with tool issues) that disrupt operations. Transport limitations are particularly severe, with 10.1% using bicycles for ore transportation - an utterly inadequate solution given production demand. The site's mountainous terrain accounts for 50% of all terrain-related challenges reported across all locations, creating backbreaking work conditions.

Women miners face especially dire circumstances, with nearly 90% trapped in the lowest productivity category regardless of work frequency. This suggests they are systematically excluded from more productive roles and technologies. The complete absence of production record-keeping (≤10%) reflects the highly informal nature of operations and hampers any attempts at productivity analysis or improvement. Unlike Luili/Matala where processing plants create efficiency, Kabombo miners must handle the full production chain manually, from extraction through crushing to transportation.

3. Kanyelele (Mpika District)

Kanyelele maintains steady operations, with 62.8% of miners working 20+ days monthly (32.6% at 20-25 days, 30.2% at 25-31 days). Ore production capacity shows relative balance across scales: 33.7% extract 500kg-1 ton daily, 29.2% <500kg, and 19.1% achieve 1-5 tonnes. The site stands out for record-keeping, with 41.6% compliance - the highest among all locations. However, miners face significant barriers including financial constraints (21.1%), tool shortages (20%), and waterlogged pits (3.3%). Transport infrastructure proves particularly inadequate, with 16.5% lacking vehicles entirely and 6.6% reporting impassable terrain conditions that hinder operations.

The relationship between female miners' working days per month and their daily gold ore production reveals important patterns across different mining sites and age groups. The study finding at Kanyelele site presents an interesting case where work frequency and productivity appear somewhat linked. Here, 50% of young women work every day while producing relatively low outputs (57% under 500kg/day), whereas the oldest group (36-45 years) works exclusively every day but splits between very high (50% at 5+ tonnes/day) and very low productivity. This polarization implies that at Kanyelele, older women either take on physically demanding high-output roles or are relegated to less productive work, possibly due to varying health or strength conditions. The middle-aged group shows more balance in both work frequency and productivity, suggesting this may be their peak productive period.

4. Luili/Matala (Mumbwa District)

Luili/Matala operates under a distinct hybrid model that combines Artisanal and Small-Scale Gold Mining approaches. The site serves as a regional processing hub, featuring Somali-owned plants where miners take their ore for mechanized processing, a structure that incentivizes high volume production. The site shows two distinct work patterns among miners, with equal proportions (34.3% each) working either 20-25 days monthly or daily. Productivity scales, accordingly, with 43.7% extracting 1-5 tonnes per cycle (the highest mid-scale output among sites), though 16.9% remain at Artisanal levels (<0.5 tonnes per cycle). Record-keeping shows moderate adoption at 26.8%. Operational challenges centre on water access (accounting for 31.3% of all water-related challenges across sites) and frequent flooding (25%). Transport methods show greater diversity than other sites, with 25.7% using small trucks and 12.9% employing oxcarts, though 21.1% still cite excessive distances to processing plants as problematic.

The gender productivity patterns reveal that younger women (18-25) work most frequently (60% daily) but maintain moderate outputs (mostly 0.5 -1 tonnes per cycle), while middle-aged women (26-35) achieve higher productivity (50% at 1+ tonnes per cycle) despite fewer workdays - suggesting experience or role specialization benefits. Most strikingly, the oldest workers (36-45) show extreme variation, with half producing 5+ tonnes per cycle, likely indicating access to mechanized roles that younger workers cannot obtain. The mix of alluvial and reef deposits allows for diverse extraction methods, with some miners able to leverage semi-mechanized approaches where geology permits.

5. Matipa (Chisamba District)

Matipa's site operations show characteristics of a sit transitioning from purely Artisanal to more organised small-scale mining, though significant constraints remain. The workforce divides sharply between intensive (36.1% at 25-31 days/month) and moderate (25% ≤20 days) work frequencies. Ore production reflects this transitional state: 47.2% mine 0.5-1 tonne per cycle, while 33.3% attain 1-5 tonnes - likely indicating some adoption of basic machinery. However, record-keeping remains below average (≤15% compliance), hindering operational analysis. The site struggles with chronic labour shortages (19.4%) that limit production scaling, and suboptimal recovery rates (16.7%) suggest inefficient processing methods. Transport relies on mixed methods, with 41.7% still dependent on manual carrying and 8.3% lacking proper vehicles entirely, creating supply chain bottlenecks. The alluvial-only deposits, while easier to mine than reef deposits, may limit production depth and overall yield potential. Gender patterns show most women (73%) producing 0.5-1 tonne per cycle while working 20-30 days/month - stable but unexceptional performance across age groups.

Unlike Luili/Matala where older women achieve high productivity, Matipa's oldest workers (who are most likely to work daily at 43%) show no corresponding output gains, suggesting they compensate for lower per-day productivity with more workdays. This may indicate physical limitations or lack of access to labour-saving technologies that could boost their efficiency.

6. Sasare (Lusangazi District)

Sasare represents perhaps the most challenging operational environment among all sites. Miners maintain exceptionally heavy work schedules (78% work 25+ days monthly, including 33.9% who work daily), yet achieve the poorest outputs (83.1% mine <0.5 tonnes per cycle). This disconnects stems fundamentally from the site's extreme geographic constraints - 84.4% of miners cite mountainous terrain as their primary limitation, forcing 86.4% to rely on manual ore carrying. These brutal working conditions are compounded by tool shortages (25.4%) and water access issues (8.5%). Record-keeping is virtually non-existent (≤5% compliance), reflecting the highly informal nature of operations. The site's gender disparities mirror Kabombo's, with nearly 90% of women trapped in the lowest productivity category regardless of work frequency. This persistent pattern across age groups confirms these are systemic constraints rather than individual capacity issues. Women appear systematically excluded from any emerging mechanized roles and confined to the most physically demanding, least productive tasks.

Unlike Luili/Matala where processing infrastructure creates efficiencies, or Kanyelele where some semi-mechanized operations exist, Sasare miners must overcome geographic barriers with purely manual methods – a scenario that guarantees low productivity despite backbreaking labour inputs. The site's isolation and difficult terrain reduce access to equipment markets and prevent miners from acquiring the technical knowledge needed to improve operations.

The age-based patterns reveal several important trends. Younger women (18-25) tend to be high-frequency workers but rarely reach the highest productivity tiers, possibly due to lack of experience or being assigned supporting roles. Middle-aged women (26-35) show the greatest variability, at some sites they emerge as the most productive demographic (Luili/Matala), while at others they remain constrained (Chitumba). This suggests this age group has the greatest potential for productivity gains given the right opportunities. Older women (36-45+) present a paradox, they are either the most productive workers on

site (as seen in Luili/Matala's 5+ ton/day producers) or are completely marginalized into low-output roles, with little middle ground.

These findings have important policy implications. Firstly, they demonstrate that simply increasing work frequency will not necessarily improve productivity without addressing underlying constraints such as limited access to equipment and mining rights. Secondly, the site-specific variations highlight the need for tailored interventions. For example, improving access to mining tools may benefit Chitumba, while better work organisation could enhance productivity in Kanyelele. Finally, the age disparities suggest the need for targeted support programmes, including training for younger workers, ergonomic adaptations for older miners, and leadership opportunities for middle-aged women, who show the greatest productivity potential. By understanding these interconnected patterns of work and productivity, stakeholders can develop more effective and context-specific approaches to supporting women in Artisanal mining communities.

Table 17: Comparative Analysis of Labour, Production, and Operations by Site

Site	Work Frequency (Top Categories)	Production Capacity (Dominant Range)	Record Keeping Rate	Primary Extraction Challenges	Dominant Transport Method	Transport Barriers
Chitumba (Vubwi)	25-31 days (36.5%), Daily (31.8%)	≤1 ton/day (69.9%)	18.8%	Water access, tool shortages	Manual (82.5%)	Weather disruptions
Kabombo (Rufunsa)	Daily (60.9%)	<500kg/day (84.1%)	<10%	Land disputes, tool shortages	Bicycles (10.1%)	Terrain (50% of reports)
Kanyelele (Mpika)	20-25 days (32.6%), 25-31 (30.2%)	500kg-1ton (33.7%)	41.6%	Finance gaps, tool deficits	Manual (dominant)	No vehicles (16.5%)
Luili/Matala (Mumbwa)	20-25 days (34.3%), Daily (34.3%)	1-5 tonnes/day (43.7%)	26.8%	Water shortages, flooding	Small trucks (25.7%)	Distance to plants
Matipa (Chisamba)	25-31 days (36.1%), 15-20 (11.1%)	500kg-1ton (47.2%)	<15%	Manpower shortages	Mixed (41.7% manual)	Vehicle shortages
Sasare (Lusangazi)	25-31 days (44.1%), Daily (33.9%)	<500kg/day (83.1%)	<5%	Mountain transport	Manual (86.4%)	Mountain terrain (84.4%)

4.3. Gold Ore Processing in Zambia

4.3.1 Overview of Ore Processing Across Study Sites

The mining operations across the surveyed sites demonstrate a diverse range of ore processing methodologies and logistical frameworks, each presenting unique operational characteristics and challenges. Processing methods vary significantly from rudimentary manual techniques to semi-mechanized and fully mechanized systems, with only *17.3%* of operations owning dedicated processing plants/equipment. This low ownership rate indicates heavy reliance on either communal processing facilities or traditional Artisanal methods, creating substantial variation in processing efficiency and gold recovery rates. The choice between on-site processing and transported ore depends on multiple factors including ore grade, available infrastructure, and economic viability, with significant implications for both operational costs and production output.

Transportation logistics present another critical dimension of these mining operations, with costs varying widely across different sites. Nearly half (49.1%) of operations report transport costs below 21 USD monthly, suggesting localized processing for many miners. In fact, the median monthly transportation cost across all sites is less than 21 USD. However, a significant portion of miners face higher expenses: 19.1% incur moderate costs between 42–208 USD for ore movement, while 13.8% face substantial expenses of 208–417 USD, typically associated with longer distances to processing plants or more remote mining locations. These transport costs directly impact profitability, particularly for small-scale operators who must balance the expense of ore movement against potential recovery yields. The frequency of transport also varies considerably, with 30.4% of operations moving ore daily and another 30.1% transporting material 20-25 days per month, indicating either continuous operations or dependence on regular processing schedules.

The processing of gold ore in Artisanal and Small-ScaleGold Mining (ASGM) operations varies significantly based on the methodology employed and the geological occurrence of the gold deposits. These differences manifest in batch sizes, processing durations, extraction rates, and overall efficiency. A comprehensive examination reveals how the fundamental distinction between alluvial (placer) and reef (hard rock) deposits creates divergent processing requirements and challenges that directly impact miners' productivity and profitability.

For manual operations, which dominate the Artisanal and Small-ScaleGold Mining sector, processing typically involves small batches of 10-50kg with relatively short processing cycles of 1-5 hours. These operations predominantly utilize rudimentary techniques such as panning, basic sluicing, or mercury amalgamation, all of which severely limit processing capacity. Baseline data indicates that approximately 67.0% of miners process less than 0.5 tonnes of ore at a time, with a substantial proportion (14.0%) handling extremely small batches of under 10kg and another 17.0% working with 20-50kg quantities.

However, the overall average tonnage across all sites is **higher, approximately equivalent to 0.543 tonnes mined per cycle,** owing to a small group of small-scale miners (10.0%) processing much bigger batches between 1-5 tonnes of ore. These bigger operations, which often use mechanized plants, skew the

average upward, even though they represent only a fraction of all miners. The typical (median) miner processes about **0.375 tonnes per cycle**, which is noticeably lower than the average, confirming that most work at a smaller scale while a few handles significantly more.

These constraints are particularly pronounced in alluvial mining operations, where the lack of mechanization forces miners to rely on labour-intensive methods that achieve poor recovery rates of just 30-50% of the available gold. While alluvial deposits are theoretically simpler to process due to their unconsolidated nature, manual methods become inefficient at scale without proper equipment, failing to maintain consistent throughput or recovery.

In contrast, semi-mechanized operations demonstrate substantially greater processing capacity, handling 0.5-5 tonnes batches with longer cycle times of 5-8 hours. These operations, more commonly associated with reef gold mining, incorporate equipment such as small crushers, ball mills, or mechanized sluices that improve both throughput and extraction rates. The reef gold deposits necessitate this more intensive processing approach, as the gold is locked within quartz veins and requires mechanical liberation before extraction can occur.

Semi-mechanized systems can achieve significantly better extraction rates of 60-80%, but their implementation is hampered by the need for consistent power sources, regular maintenance, and higher capital investment factors frequently lacking in Artisanal mining contexts. The transition from manual to semi-mechanized processing represents a critical threshold in operational efficiency, but one that remains out of reach for many miners due to these systemic barriers.

The type of gold deposit fundamentally shapes the entire processing methodology and its associated challenges. Alluvial deposits, characterized by their loose, unconsolidated nature, allow for processing techniques that are less equipment-intensive but more water-dependent. Panning, the most basic alluvial method, is only viable for tiny batches under 10kg and achieves poor recovery rates. Sluicing offer slightly better capacity at 20-100kg per hour but still suffer from significant gold losses. Mercury amalgamation, while hazardous, represents a common step up, potentially recovering 10-30% of gold when properly implemented. However, alluvial processing faces acute challenges in water-scarce environments, as the techniques require substantial water volumes for effective separation, creating seasonal and geographical constraints on productivity.

Reef deposits present entirely different challenges due to their hard-rock nature. The gold-bearing quartz veins require initial size reduction through crushing before any concentration or extraction can occur. Manual crushing with hammers or mortars is prohibitively labour-intensive, typically limiting processing to under 50kg per day. The introduction of basic mechanization through ball mills or jaw crushers becomes essential for processing reef deposits at any meaningful scale, enabling throughput of 500kg or more per day. However, these systems demand reliable power sources and maintenance knowledge that often exceeds the capacity of Artisanal mining groups. Without proper milling, a significant portion (30-50%) of the gold remains trapped in the ore and is never recovered, representing both an economic loss for miners and an environmental hazard when improperly discarded.

Site-specific conditions further modulate these general patterns. In locations like Luili/Matala, where both alluvial and reef deposits coexist, we observe a mix of processing approaches ranging from manual panning to semi-mechanized crushing. Kabombo's exclusively reef deposits leave miners struggling with the limitations of manual crushing unless they can access mechanized alternatives. Matipa's alluvial-only deposits simplify initial processing but face water availability constraints that cap production capacity. These geological realities, combined with equipment access and operational knowledge, create the observed productivity differences across sites.

The implications of these processing limitations are profound. For alluvial miners, the inability to scale up processing without proper equipment creates a ceiling on potential earnings, trapping many in cycles of low productivity. Reef miners face even greater barriers, as the absence of crushing equipment render their ore essentially un-processable at profitable scales. The extraction rate disparities between methods (30% extraction without size reduction versus 80% with adequate milling) represent massive differences in potential income from the same amount of mined ore.

Addressing these challenges requires targeted interventions tailored to ore characterisation. For alluvial operations, promoting water-efficient gravity processing and mercury-free techniques could improve both productivity and environmental outcomes. Reef mining areas would benefit most from shared crushing facilities that overcome capital barriers to mechanization. Across all deposit types, training on optimal processing methods specific to the local geology could help miners maximize recovery rates with available resources. These improvements, while not eliminating all constraints, could significantly enhance the economic viability of Artisanal mining operations while reducing their environmental footprint.

What This Means for Mining Operations

1. Most miners operate at Artisanal and Small-Scale level. The median miner processes approximately **0.375 tonnes per cycle**, with two-thirds of miners processing under 0.5 tonnes per cycle. This scale necessitates labour-intensive methods like manual panning or sluicing, which limit output, result in high costs per kilogram, and constrain profitability per cycle
2. A small but important group (10%) operates at a much larger scale, processing 1,000kg or more per cycle. These miners likely use some form of machinery, which improves efficiency and lowers costs per kilogram.
3. The difference in scale creates two distinct mining realities: the majority struggle with higher processing costs due to small batch sizes, while the minority benefit from economies of scale. This gap affects profitability, with larger operators having a clear advantage in efficiency and output.
4. Scale and method are intrinsically linked to gold extraction rates. Small-scale manual methods (especially for alluvial ore) often recover only 30-50% of the gold present, while semi-mechanized operations can achieve 60-80%. This means two miners working the same quantity of ore can have drastically different incomes based solely on their processing efficiency.

Table 18: Mean quantity of ore processed per cycle per miner

Ore Range	Frequency	Percent	Cum. Percent	Midpoint (Kg)	Weighted (Kg)	Weighted Average (Kg)
Less than 10 Kg	53	13.7	13.7	5	265	
10 to 20 Kg	22	5.68	19.38	15	330	
20 to 50 Kg	67	17.31	36.69	35	2,345	
50 to 100 Kg	38	9.82	46.51	75	2,850	
100 to 250 Kg	30	7.75	54.26	175	5,250	
250 to 500 Kg	51	13.18	67.44	375	19,125	
500 to 1000 Kg	88	22.74	90.18	750	66,000	
1000 to 5000 Kg	38	9.82	100	3,000	114,000	
Total	387	100			210,165	**543**

{**Note: midpoint values are chosen for approximation purposes; Average ore processed per cycle per Miner = (Total Frequency/Total Weighted Tonnes) = 543 Kg or 0.543tonnes*}

Defining Production Cycle

For the purposes of this study, a **Production Cycle** is defined as the complete process undertaken by a miner or a mining unit to transform a specific quantity of raw ore into a saleable gold product.

This cycle is defined by two key dimensions:

1. **Cycle Quantity (Median):** The typical quantity of ore processed to completion in one cycle is **375 kg**. This is the *median* value, representing the experience of the typical miner and accounting for the wide variation between small-scale manual operators and larger, semi-mechanized ones. This quantity varies significantly by site, influenced by deposit type (alluvial vs. hard rock) and level of mechanization.
2. **Cycle Duration:** The time required to complete one cycle is not fixed but is determined by the completion of the **0.375 tonnes per cycle** benchmark quantity. The study found this duration varies based on the miner's technology and role:
    - For manual/support roles (e.g., panning, crushing): A cycle may be completed within a single intensive workday (5-8 hours).
    - For individual claim owners or small groups: Processing this quantity often spans multiple days.
    - For the lowest-yield, purely manual operations: Accumulating and processing this amount can extend to a week or more.

In essence: A production cycle is complete when the miner has processed the typical median batch of **375 kg of ore**, regardless of whether that takes one long day or several days of work. This definition separates the concept of a *workday* from a *production cycle*, acknowledging that for most artisanal miners, a full cycle of extraction, processing, and concentration is a multi-day endeavour.

4.3.1 Site-Specific Processing Characteristics

Below is a detailed breakdown of each site's ore processing methods, logistics, and operational dynamics.

1. Chitumba (Vubwi District) Chitumba's ore processing is heavily reliant on traditional, low-cost techniques, with near-equal usage of manual panning (49.2%) and wooden/metal sluices (49.2%). This indicates a strong preference for Artisanal methods over mechanized processing, a direct result of the site's predominant alluvial deposits which lend themselves to these gravity separation techniques. The unconsolidated nature of alluvial material allows for simple panning and sluicing without the need for crushing. Only 1.6% of miners transport ore to off-site plants, meaning the vast majority process material locally along the riverbanks where the alluvial deposits are found. Ownership of processing plants is the lowest among all sites (22.2%), further reinforcing the dominance of traditional Artisanal manual operations suitable for alluvial material, with panning of gold along the riverbanks and no use of any chemical. The minimal use of mercury (4.3%) suggests safer but potentially less efficient gold recovery from the alluvial concentrates, as rudimentary methods often result in lower yields compared to mechanized alternatives.

Transportation logistics in Chitumba are characterized by low costs and infrequent movement of ore. A significant 83.9% of miners incur transport costs below ~21 USD, the lowest expense bracket in the study. Only 5.3% transport ore fewer than 10 days per cycle, indicating that most miners' process material on-site without relying heavily on external facilities. The most common processing batch sizes are 20–50 kg (50.0% of miners) and 50–100 kg (22.2%), reflecting medium-scale, labour-intensive operations. Given the reliance on manual techniques, processing cycles are short (1-5 hours). The frequency of processing varies, with 30.2% of miners operating 20–25 days per month and 23.8% processing daily, suggesting steady but not continuous activity.

The study further observed a paradox where younger women demonstrate relatively high processing volumes (57% process 100-250kg per cycle) despite irregular work frequencies, while middle-aged women show more consistent but lower outputs. This suggests that younger miners may engage in intensive bursts of labour when opportunities arise, whereas older workers adopt more sustainable but less productive routines.

Key challenges in Chitumba include limited mechanization, which restricts processing efficiency and gold recovery rates. The low ownership of processing plants means miners have little control over advanced processing methods, keeping productivity at subsistence levels.

2. Kabombo (Rufunsa District)

Kabombo stands out for its extreme reliance on manual extraction (68.6%), the highest rate among all reef gold sites, reflecting minimal mechanization and the challenges of processing its reef deposits manually. The reef gold nature of Kabombo site requires crushing before concentration, yet most miners depend on directly panning ineffectively crushed ore resulting in poor recovery. However, **22.9%** of miners reported transporting their ore to nearby processing plants, while **8.6%** own processing plants, indicating a reliance on third-party processing facilities that are better equipped to handle refractory reef material.

An alarming **91.3%** of miners use mercury, the highest rate recorded in the study. This is particularly concerning for reef processing because adequate particle size liberation is often not achieved, preventing mercury from efficiently amalgamating with gold that remains locked within the ore or host minerals.

Transportation in Kabombo is frequent but low-cost, with 47.8% of miners moving ore daily, the highest transport frequency observed. Despite this, most miners incur minimal transport expenses (majority below ~21 USD), suggesting that processing plants are relatively nearby but still require daily ore movement due to small batch sizes. The primary batch sizes processed are 0.2–0.5 tonnes (50.8%) and less than 0.1 tonnes (28.3%), reinforcing the Artisanal nature of operations. Given the dominance of manual panning, processing cycles are short (1-5 hours per batch). The frequency of processing is the highest among all sites, with 52.2% of miners operating daily, indicating near-continuous activity.

Kabombo presents a stark contrast, with extreme polarization in both processing frequency and volumes. Here, middle-aged women work daily but achieve minimal outputs, while the oldest workers (46+) process remarkably large quantities (0.5-1 tonne) during their infrequent 10-15 monthly work cycles, indicating potential access to better equipment or more productive ore sources.

Key challenges in Kabombo include severe mercury contamination risks due to high usage, which poses long-term health and environmental dangers despite low quantities used at once. The high frequency of daily ore transport suggests logistical inefficiencies, as miners must constantly move small quantities rather than consolidating larger batches, a situation exacerbated by the mountainous terrain. The lack of mechanization and plant ownership further limits productivity, keeping recovery rates low despite intensive labour input.

3. Kanyelele (Mpika District)

Kanyelele is the most semi-mechanized site, evidenced by the fact that 82.0% of miners reported transporting ore to processing plants, the highest off-site reliance in the study. This is necessary for its mixed alluvial and reef deposits that require different processing approaches. The reef components demand crushing that individual miners cannot accomplish manually. However, only 25.8% of the miners interviewed own some form of processing equipment leaving most of the miners to depend on external facilities better equipped to handle both their ore, which are likely owned by larger operators or cooperatives. A notable 41.8% report using "other" processing methods, which may include rudimentary crushing or grinding setups for the reef material. Mercury usage is moderate (42.9%), with 10.2% combining it with other chemicals such as washing powder (*safu*), suggesting some diversification in processing techniques to cope with different ore types.

Ore transportation for processing in Kanyelele is costly, with 39.5% of miners paying ~208–417 USD per trip, again the highest expense bracket observed. This indicates long distances to processing plants or high fees charged by plant operators/transporters. Transport frequency is mixed, with 42.2% processing ore 20–25 days per month, reflecting a semi-regular schedule rather than daily operations. The dominant batch size is 500–1,000 kg (54.5%), indicating bulk processing, likely due to mechanized methods. Processing cycles are long (5-8 hours per batch) compared to manual sites, given the reliance on plant-

based methods. The frequency of processing shows 24.4% operating daily, while 42.2% work 20–25 days per month, suggesting structured but not continuous activity.

Kanyelele demonstrated a more balanced approach, where middle-aged women emerge as the most productive demographic, processing 500-1000kg per cycle while maintaining regular work schedules. This site exemplifies how experience and consistent engagement can yield optimal results.

Key challenges include high transport costs, which erode profit margins, and partial mechanization, leading to inconsistent processing standards. The dependence on external plants reduces miners' control over processing quality, while the use of mercury, though not as widespread as in Kabombo or Luili/Matala, still poses health risks.

4. Luili/Matala (Mumbwa District)

Luili/Matala employs a mixed-method approach to ore processing that reflects its unique position as a regional processing hub. While the survey data shows 32.4% manual processing (for alluvial ore) and 28.2% wooden/metal sluices, the ground reality reveals a more complex industrial ecosystem. The site hosts over 40 Somali-owned wet pan mills, each operating 40 pans that process 1.5 tonnes of ore per 5-8-hour cycle utilising 150-200g of mercury per pan mill. These industrial-scale operations, though representing a small fraction of survey respondents, dominate the actual processing capacity and explain the site's high mercury usage (83.1% reported usage). Though outside the scope of this study, this site also hosts at least 3 large-scale gold mining companies operating fully mechanised and non-mercury plants with large smelters.

Majority of the miners (including those from surrounding sites) function as ore suppliers to these wet pan plants rather than independent processors. They mine reef ore from numerous pits across the area and transport it to the Somali-operated plants for crushing and amalgamation. A smaller segment of miners works alluvial deposits using manual methods (panning/sluicing) or even gold detectors for nugget hunting, but these represent the minority. The survey's focus on Artisanal miners rather than plant operators likely underrepresents the true scale of mechanized processing and mercury consumption occurring daily.

The site's processing landscape shows clear stratification:

1. Industrial Tier: Somali-owned wet pan plants processing reef gold at scale (accounting for most mercury use).
2. Artisanal Tier: Local miners processing alluvial gold manually (32.4% panning, 28.2% sluicing).
3. Hybrid Tier: Some miners (21.1%) use smaller machine plants, while 23.9% own basic processing setups.

This industrial concentration makes Luili/Matala unique in Zambia's gold mining landscape, with processing infrastructure far exceeding other sites. The wet pan plants' dominance explains several observed patterns:

- The large batch sizes (47.4% process 1,000-5,000 kg).
- High transport frequency (39.3% move ore daily).
- Extreme mercury dependence despite partial mechanization.

Transportation logistics show frequent ore movement, with 39.3% of miners transporting material daily, a necessity given the site's reliance on both on-site and off-site processing. Transport costs are moderate, with some miners paying ~42–208 USD per trip, likely due to mid-range distances to processing plants and the availability of transport due to a good road network. The primary batch size processed is 1,000–5,000 kg (47.4%), the largest among all sites, reflecting the capacity of mechanized plants. Processing cycles take 5-8 hours. The frequency of processing is high, with 33.9% operating daily and 24.6% processing 15–20 days per month, suggesting sustained but not always continuous activity.

Luili/Matala shows the most diverse patterns, with some young women achieving high outputs (20% processing 1000+kg) alongside daily work, while older workers bifurcate into either very high or very low productivity categories. This polarization suggests that physical demands may force older miners into either intensive mechanized roles or less strenuous but marginal activities.

The site faces significant obstacles, including severe mercury contamination risks from widespread usage, inconsistent gold recovery rates due to mixed manual and mechanized processing methods, and high logistical costs from dependence on transported ore for plant processing.

5. Matipa (Chisamba District)

Matipa strikes a balance between manual and mechanized processing, with 50.0% using manual panning (for its alluvial deposits) and 36.1% relying on plants (likely for occasional reef material), though only 5.6% own equipment implying that the majority depend on third-party facilities. Notably, 48.6% use mercury (mainly for alluvial processing), while 51.4% use alternatives like dishwashing soap, indicating a shift toward safer (if less efficient) processing methods compared to other high-mercury sites, with the alluvial deposits being amenable to these alternative methods.

Transport costs are among the lowest, with 77.1% paying less than ~21 USD per trip, suggesting processing plants are nearby and on-site processing is common. Transport frequency is relatively low, with 41.7% processing ore 20–25 days per month rather than daily. The most common batch size is 500–1,000 kg (44.4%), pointing to semi-mechanized operations. Processing cycles vary from 1-5 hours (for manual) to 5-8 hours (for plant-based methods). The frequency of processing shows 22.2% operating daily, while 41.7% work 20–25 days/month, indicating structured but flexible activity.

Matipa stands out for its stability, with most women processing **moderate to high volumes (0.25–1 tonne)** at consistent frequencies (**20–25 times per month**), creating a sustainable model in which experience is associated with higher productivity.

The site faces several critical constraints in its ore processing operations. Most significantly, low plant ownership reduces miners' control over processing quality and consistency. Additionally, while mercury free alternatives improve safety, if not well optimised they result in lower gold extraction rates compared to mercury almagamtion methods. Finally, low mechanization levels prevent the site from achieving the scalability and efficiency of fully industrialized operations.

6. Sasare (Lusangazi District)

Sasare's gold mining operations present a complex picture shaped by its mixed geological deposits and limited infrastructure. The site contains both alluvial deposits along riverbanks and reef deposits in the surrounding hills, leading miners to adopt different processing methods based on the nature of ore they process. Those exploiting reef deposits typically transport their ore to small, diesel-powered hammer mills for initial crushing before further processing the material through vibrating panning mats and mercury amalgamation. These basic crushing setups, while representing the primary mechanization available at the site, are often shared among multiple miners and operated intermittently due to fuel costs and maintenance needs.

The alluvial miners follow more traditional methods, working riverbank deposits directly through direct panning without the crushing stage. This group accounts for the majority of purely artisanal processors. A smaller but notable segment of miners specialise in nugget hunting using metal detectors, bypassing conventional processing altogether by recovering gold nuggets directly from the deposits. This diversity of approaches creates a processing landscape where mechanization exists but remains limited and fragmented.

The processing infrastructure at Sasare consists mainly of shared hammer mill stations for reef ore crushing, supplemented by vibrating concentration mats and mercury amalgamation plates for final gold recovery. This setup explains the universal use of mercury reported among surveyed miners, as both crushed reef material and alluvial concentrates undergo amalgamation. The seemingly low mechanization rates in official data reflect several ground realities—most hammer mills are communally operated rather than individually owned, final processing remains manual even after crushing, and many miners continue to identify primarily as "panners" regardless of whether they use crushed ore.

Transportation is infrequent, with just 6.9% moving ore fewer than 10 days per month, the lowest frequency observed. Costs are moderate (31% pay ~42–208 USD), likely due to on-site operations. The primary batch sizes are small: 20–50 kg (38.8%) and 50–100 kg (29.0%), aligning with manual methods. Processing cycles are short (1-5 hours per batch), but the frequency of processing varies, with 22.0% operating daily and 30.5% working 20–25 days/month.

Sasare presents an interesting anomaly, where relatively low work frequencies coincide with surprisingly substantial outputs, particularly among older women. This indicates that when women do work at Sasare, they process significant quantities, possibly due to concentrated effort or access to richer ore deposits.

The mining operations in Sasare face three critical obstacles that severely limit both productivity and worker safety. The most pressing issue is extreme mercury exposure, which creates dangerous health hazards for miners and causes lasting environmental damage to the surrounding ecosystem. Additionally, the near-total lack of mechanization (with 83% reliance on manual panning) drastically reduces both processing capacity and gold recovery rates. Furthermore, the site's isolation from proper processing facilities forces continued dependence on primitive techniques, perpetuating the cycle of inefficiency and hazardous working conditions.

Cross-Site Patterns

Across all sites, clear age-based patterns emerge younger women often work more frequently but with lower outputs, middle-aged women typically reach peak productivity, and older workers either transition to high-volume specialist roles or are gradually marginalized. These findings underscore the need for targeted interventions that address site-specific barriers while recognizing the evolving capabilities of women miners throughout their careers. Improving tools and infrastructure at low-output sites, creating more predictable work schedules at irregular operations, and developing age-appropriate role allocations could significantly enhance both productivity and working conditions for women in Artisanal mining.

Table 19: Comparative Summary of ore processing by site

SITE	DOMINANT METHOD	TRANSPORT COST (PER TRIP)	MERCURY USE	KEY ISSUE
CHITUMBA (VUBWI)	Manual panning/sluices (98.4% combined)	Lowest (< ~21 USD)	4.3%	Low efficiency, minimal plant ownership
KABOMBO (RUFUNSA)	Manual panning (68.6%)	Low (< ~21 USD), but daily transport	91.3%	Extreme mercury hazard
KANYELELE (MPIKA)	Machine plants (82% use)	Highest (~208–417 USD)	42.9%	Very high transport costs
LUILI/MATALA (MUMBWA)	Mixed manual/mechanized	Moderate (~42–208 USD)	83.1%	High quantities of mercury per cycle
MATIPA (CHISAMBA)	Manual (50%) / Plants (36%)	Low (< ~21 USD)	48.6%	Trade-offs in chemical safety vs. recovery
SASARE (LUSANGAZI)	Manual panning (83.1%)	Moderate (~42–208 USD)	80.0%*	Widespread mercury contamination

4.4 Mercury Use in Gold Processing

Mercury (Hg) has been used significantly in Artisanal and Small-Scale Gold Mining (ASGM) due to its ability to amalgamate with gold. However, its use poses severe health and environmental risks, including neurological damage, kidney failure, and ecosystem contamination. Despite global efforts to phase out mercury under the Minamata Convention, many miners continue to rely on it due to its affordability, accessibility, and lack of viable alternatives. The processing typically involves mixing mercury with crushed ore to form a gold-mercury amalgam, which is then heated to evaporate the mercury, leaving behind raw gold. This process releases toxic vapours and often leads to improper disposal, contaminating water sources and soil.

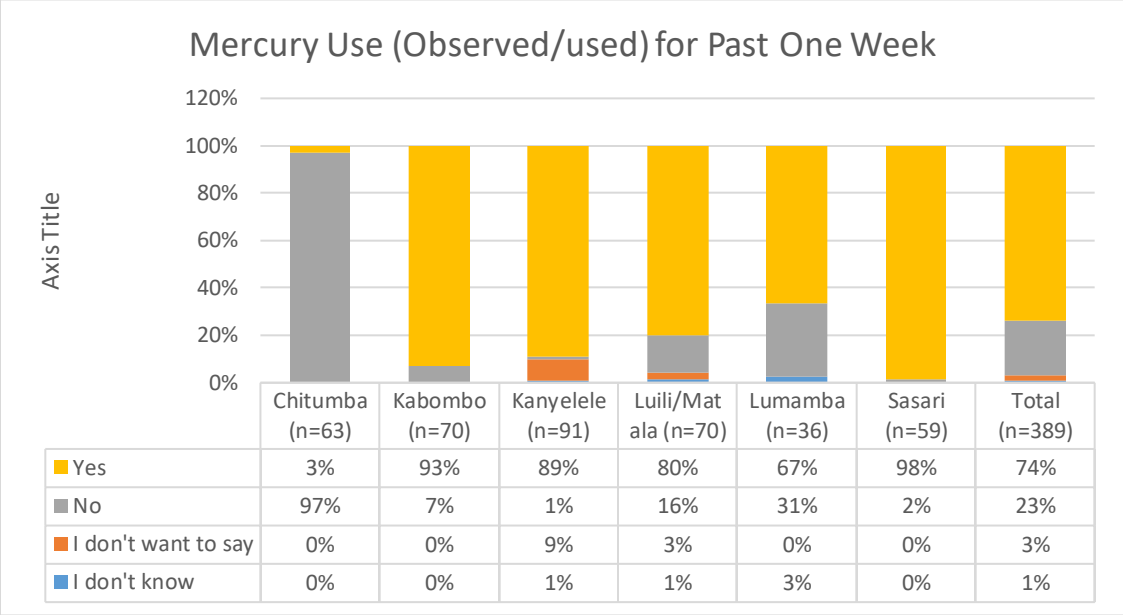
4.4.1 Overall Mercury Prevalence

The extent of mercury use varies significantly across mining sites, influenced by factors such as ore composition, processing techniques, and miner awareness. Some sites exhibit minimal usage due to alternative methods or stricter regulations, while others show heavy dependence driven by efficiency and tradition.

The baseline data according to figure 25, reveals that mercury use is widespread across the six gold mining sites studied. Out of 389 total responses, 286 (73.5%) confirmed its presence ("Yes"), while only 90 (23.1%) denied its use ("No"). A small fraction of respondents, 13 (3.3%), were either uncertain ("I don't know") or unwilling to disclose ("I don't want to say"), as its access is often obtained secretly. This indicates that mercury remains a dominant method in gold extraction across most of these locations, with only a minority reporting its absence.

The prevalence of mercury varies significantly by location. Sasare, Kabombo, and Kanyelele show the highest mercury use, with 98.3%, 92.9%, and 89.0% of respondents, respectively, confirming its presence. These sites likely rely heavily on mercury for gold processing, which aligns with common practices in Artisanal and Small-ScaleGold Mining. Luili/Matala (80.0%) and Matipa (66.7%) also report substantial mercury use, though Matipa's lower percentage suggests some variation in practices. In stark contrast, Chitumba stands out as an exception, with only 3.2% acknowledging mercury use and 96.8% denying it. This could indicate alternative extraction methods, stricter local norms, or underreporting due to external pressures.

A small but notable portion of respondents were hesitant or unwilling to provide clear answers. Kanyelele had the highest number of "I don't want to say" responses (8 out of 10 total), which may reflect concerns over legal repercussions or social stigma. Meanwhile, the few "I don't know" responses were scattered across Kanyelele, Luili/Matala, and Matipa, suggesting limited awareness or inconsistent observations in those areas. These responses highlight potential challenges in gathering accurate data on mercury use, particularly in communities where the topic is sensitive.



	Chitumba (n=63)	Kabombo (n=70)	Kanyelele (n=91)	Luili/Matala (n=70)	Lumamba (n=36)	Sasari (n=59)	Total (n=389)
Yes	3%	93%	89%	80%	67%	98%	74%
No	97%	7%	1%	16%	31%	2%	23%
I don't want to say	0%	0%	9%	3%	0%	0%	3%
I don't know	0%	0%	1%	1%	3%	0%	1%

Figure 25: Mercury Observed/Used in the past One Week by Sites

The findings emphasize the need for targeted interventions in sites with the highest mercury prevalence, such as Sasare, Kabombo, and Kanyelele. Strategies could include promoting mercury-free extraction techniques, increasing regulatory oversight, and educating miners on the health and environmental risks of mercury. Meanwhile, Chitumba's outlier status is an important point of pivot as the site rarely use mercury as almost everyone uses non-mercury processes.

4.4.1 Mercury Quantity Added to the Ore per Production Cycles

According to table 20 and 21, the data provides a detailed breakdown of mercury quantities utilised during processing across six gold mining sites, revealing distinct patterns in application levels. Most operations fall within a moderate range of mercury addition, with a few notable exceptions showing extremely high quantities. The weighted **mean** mercury added stands at **approximately 23.3 grams** per processing cycle, though this average is skewed upward by a small number of high-quantity applications. The **median value of 15 grams** better represents typical addition patterns, as it is less influenced by outliers.

A clear majority of miners (97.7%) report using between 0.5 and 50 grams of mercury per cycle. The most common usage range is 20-50 grams, accounting for 41.4% of all responses. Significant proportions of miners also fall into the 10–20-grams (26.8%) and 3–10-gram (17.2%) categories. At the extreme end, 2.3% of respondents' report using 100-200 grams per cycle, quantities that are unusually high and may indicate inefficient processing methods or wet pan usage. This right-skewed distribution shows that while

most operations add modest amounts of mercury, a few cases of excessive addition pull the average significantly higher than the median.

Table 20: Mercury Addition Range and Mean Quantity Across Sites

Addition Range (g)	Frequency	Percent	Cum. Percent	Midpoint Quantity (g)	Weighted Quantity (g)	Weighted Mean Quantity (g)
0.5 – 1 g	14	5.4%	5.4%	0.75	10.5	
1 – 3 g	18	6.9%	12.3%	2	36	
3 – 10 g	45	17.2%	29.5%	6.5	292.5	
10 – 20 g	70	26.8%	56.3%	15	1050	
20 – 50 g	108	41.4%	97.7%	35	3780	
100 – 200 g	6	2.3%	100%	150	900	
Total	261				6069	23.25

Table 21: Mercury addition bounds (upper, median, lower)

Estimate Type	Usage (g)
Lower Bound	0.75
Median	15
Mean (Average)	~23.3
Upper Bound	35–150

Detailed Site-Specific Analysis of Mercury Addition Patterns

Kabombo (Rufunsa District)

According to figure 26, Kabombo stands out as the most concerning site for mercury pollution, demonstrating extreme patterns of mercury addition. The data reveals that 50.0% of all miners adding 100-200g of mercury per cycle are concentrated in Kabombo, representing the highest level of hazardous usage across all sites. Additionally, 34.4% of miners fall into the 20-50g addition range, indicating widespread heavy usage. What makes Kabombo particularly alarming is the complete absence of low-quantity users there are no reported cases of miners adding just 0.5-1g per cycle, and only 5.6% use 1-3g. This suggests a mining culture heavily reliant on excessive mercury, likely due to inefficient processing methods for its reef deposits, which require crushing and intensive amalgamation. Immediate interventions, such as mercury retorts, centralized processing plants, and strict enforcement of usage limits, are critical to reducing environmental and health risks here.

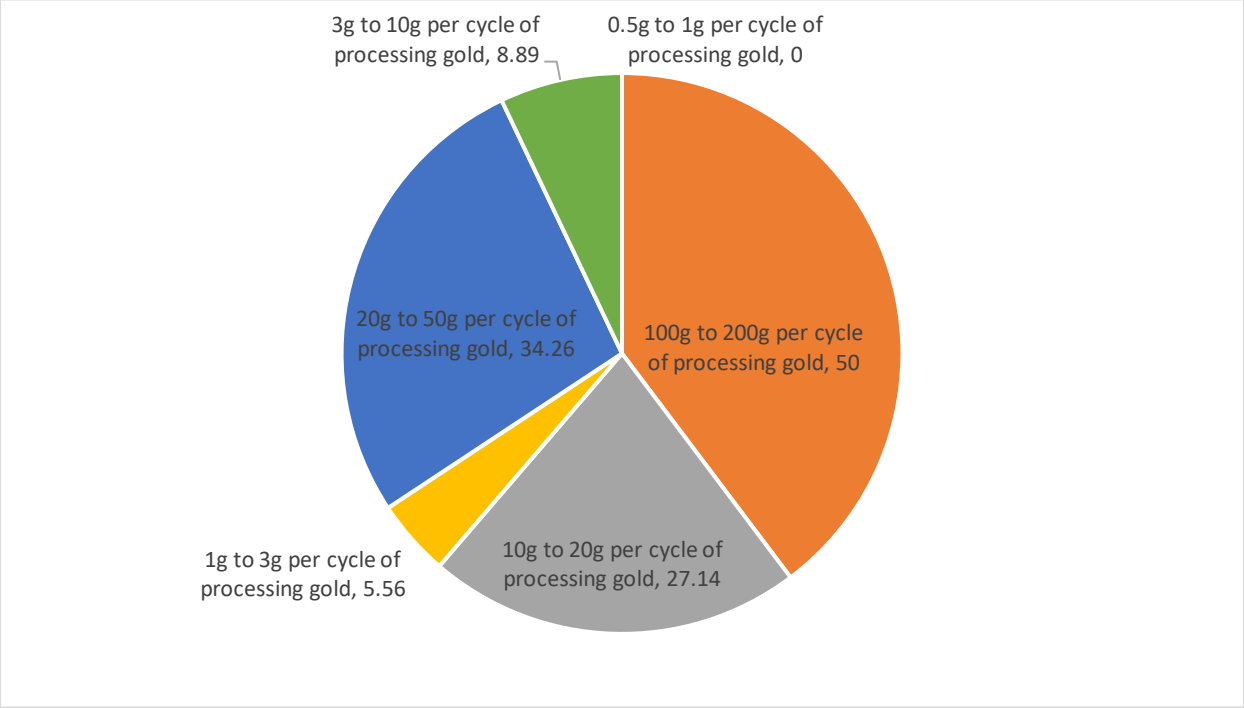


Figure 26: Quantity of mercury added to ore per processing cycle

Luili/Matala (Mumbwa District)

According to figure 27, Luili/Matala presents a dualistic mercury addition profile, reflecting its role as a regional processing center. The site accounts for 16.7% of extreme users (100-200g per cycle), second only to Kabombo, while also hosting a significant number of high-quantity processors (27.8% in the 20-50g range). However, unlike Kabombo, Luili/Matala also has a notable low-usage segment (21.4% adding 0.5-1g), likely representing alluvial panners working independently of the larger wet pan plants. The near absence of mid-range additions (only 2.2% in 3-10g) suggests a stark divide between small-scale and industrial operators. Given the dominance of Somali-owned wet pan plants, interventions should focus on regulating these facilities, promoting mercury-free alternatives like borax, and improving recovery efficiency to reduce reliance on excessive amalgamation.

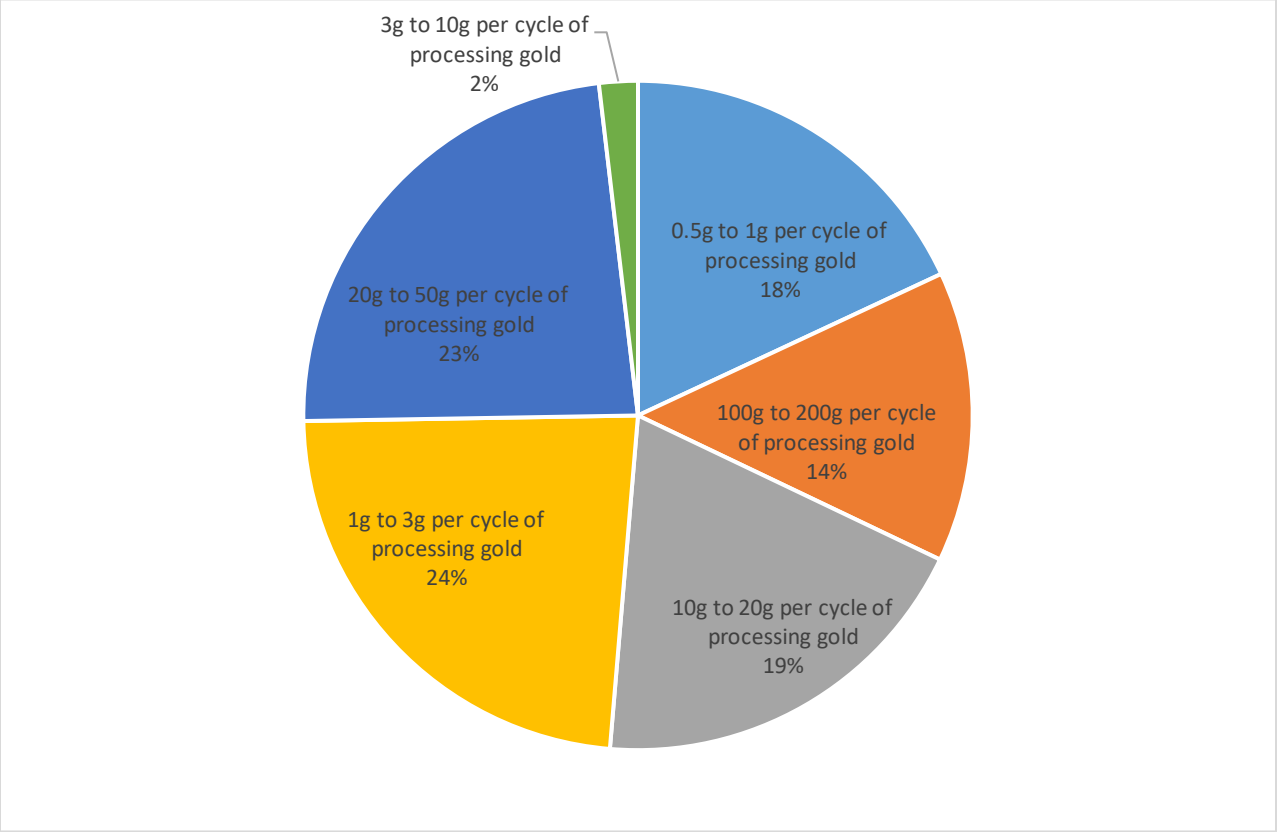


Figure 27: Quantity of mercury added to ore per processing cycle

Kanyelele (Mpika District)

According to figure 28, Kanyelele exhibits the most balanced mercury usage among all sites. A striking 60% of miners add 3-10g per cycle, indicating widespread adoption of moderate, controlled mercury application. Another 23.15% fall into the 20-50g range, but crucially, no extreme users (100-200g) were reported. Additionally, 21.4% of miners use just 0.5-1g, showing that conservative practices coexist with mid-range usage. This balance likely stems from Kanyelele's mixed alluvial and reef deposits, which encourage varied processing approaches. The site could serve as a model for mercury reduction, with strategies such as scaling up its moderate usage norms, reinforcing best practices, and introducing retorts to capture and reuse mercury safely.

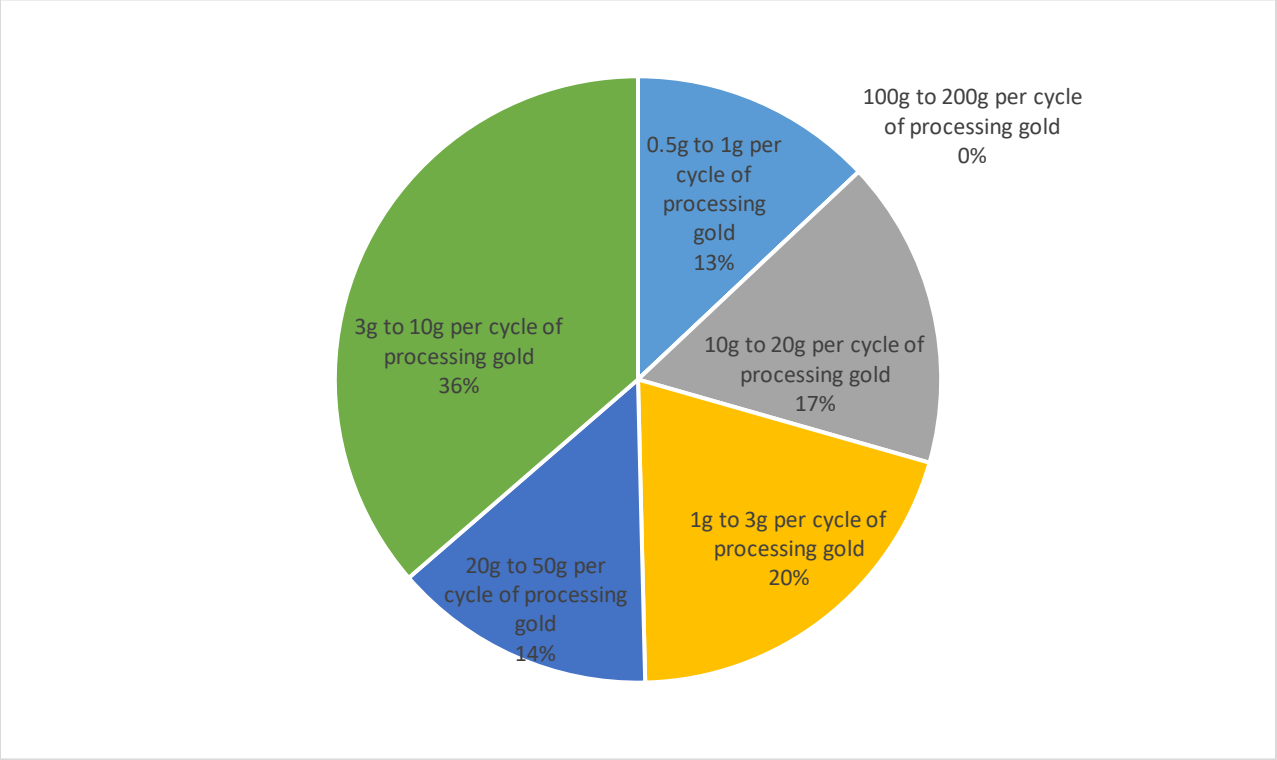


Figure 28: Quantity of mercury added to ore per processing cycle

Sasare (Lusangazi District)

According to figure 29, Sasare demonstrates the lowest overall mercury dependency, with 35.7% of miners adding only 0.5-1g per cycle the highest proportion of minimal users at any site. Another 18.6% use 10-20g, while heavy usage is limited (8.3% in 20-50g). Notably, no extreme additions (100-200g) were reported, making Sasare one of the safest sites in terms of mercury pollution. This restraint may be linked to its remote location and limited access to industrial processing, forcing miners to rely on manual methods. Interventions here should focus on preserving these low-usage practices while introducing mercury-free techniques (e.g., gravity concentration) to further reduce reliance on amalgamation.

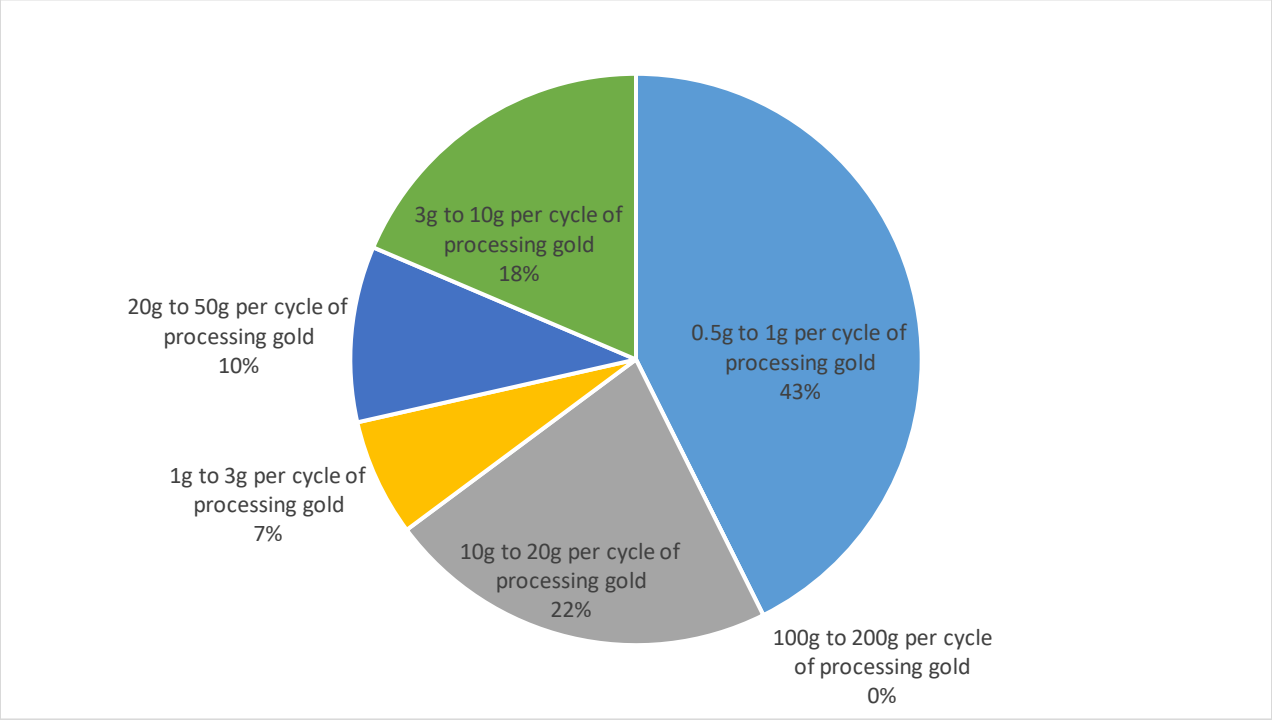


Figure 29: Quantity of mercury added to ore per processing cycle

Matipa (Chisamba District)

According to figure 30, Matipa presents a contradictory mercury profile, with both conservative and extreme users coexisting. The site accounts for 33.3% of miners adding 100-200g, the second-highest rate after Kabombo. Yet, it also has a significant low-usage segment (21.4% in 0.5-1g). The data suggests two distinct groups: one using rudimentary panning (low mercury) and another engaged in intensive reef processing (high mercury). This dichotomy calls for targeted strategies, such as retraining high-quantity users, promoting shared milling facilities to reduce individual mercury needs, and stricter monitoring of extreme additions.

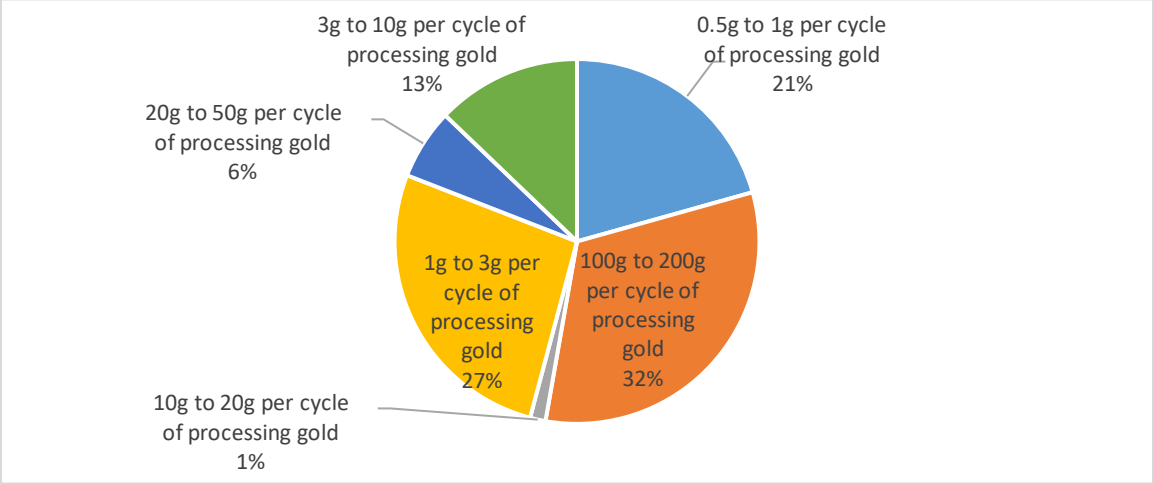


Figure 30: Quantity of mercury added to ore per processing cycle

Chitumba Vubwi District)

According to figure 31, Chitumba remains the outlier, with near-zero mercury usage. Only 2.9% of miners' report additions of 10-20g, while no other usage categories are represented. This exceptional case may result from community norms, regulatory enforcement, or alternative processing methods. Chitumba should be studied as a best-practice model, with its strategies such as effective enforcement, education, or access to mercury-free technology replicated at high-risk sites like Kabombo and Luili/Matala.

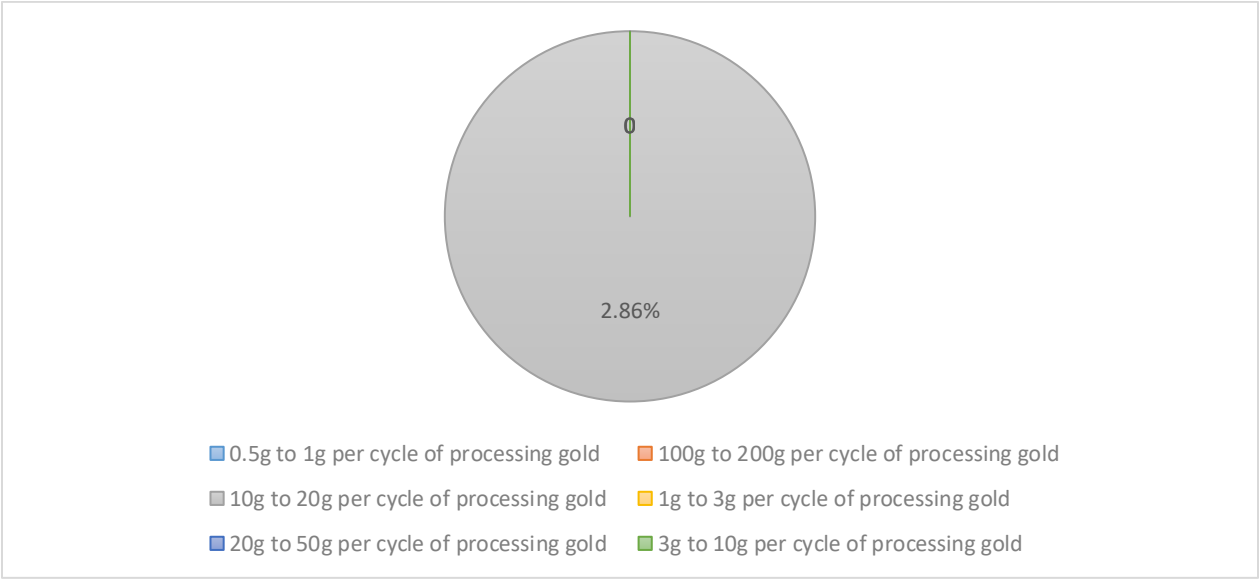


Figure 31: Quantity of mercury added to ore per processing cycle

Comparison of Mercury Utilised Quantities by Mining Sites by Gender

The study reveals significant differences in mercury addition patterns between male and female miners across various mining sites, highlighting both gender-based and location-specific trends in Artisanal gold processing.

Female miners generally show more moderate mercury additions, with 38.0% adding 20-50g per cycle compared to 42.6% of males, suggesting that women may employ more conservative approaches or have less access to large quantities of mercury. However, there are notable exceptions (see figure 32) at Luili/Matala, 61.5% of female miners report adding 20-50g per cycle, actually exceeding the male rate of 51.2% at the same site, indicating this location has particularly mercury-intensive processing methods regardless of gender. The most striking gender disparities appear in the extremes of mercury additions; However, the patterns strongly suggest that local mining culture and available technology influence mercury added more than gender alone.

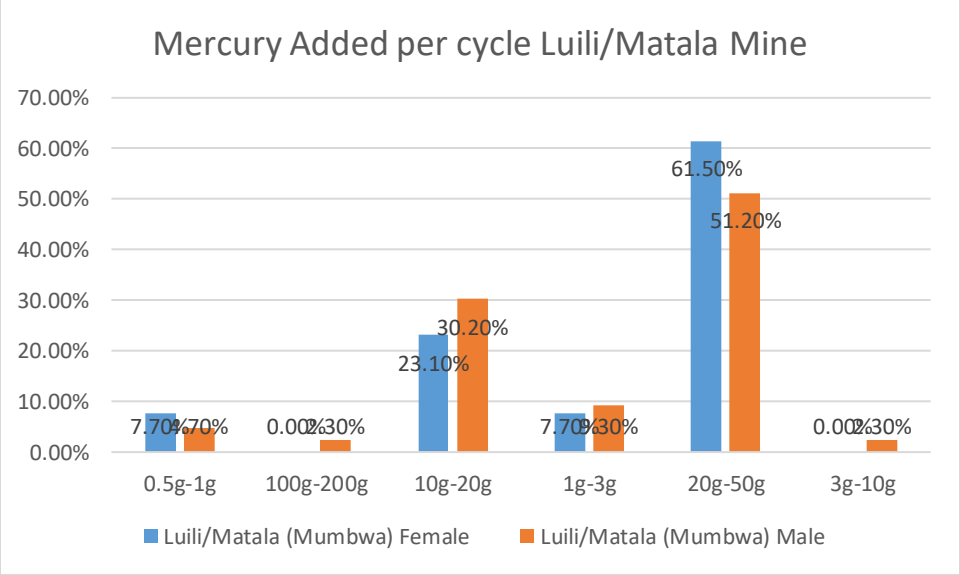


Figure 32: Mercury Utilised per cycle at Luili/Matala Mine by gender

Female miners at Sasare demonstrate a bipolar distribution, with 28.6% utilising very small amounts (0.5-1g) and another 28.6% adding moderate-large amounts (20-50g), while their male counterparts show more consistent mid-range addition. At Matipa, the pattern reverses males are more likely to use both the lowest (18.8% at 0.5-1g) and higher ranges (31.3% at 3-10g), whereas female addition clusters in the middle ranges according to figure 33. This suggests that gender roles in processing may vary significantly by location, with no uniform pattern across all sites.

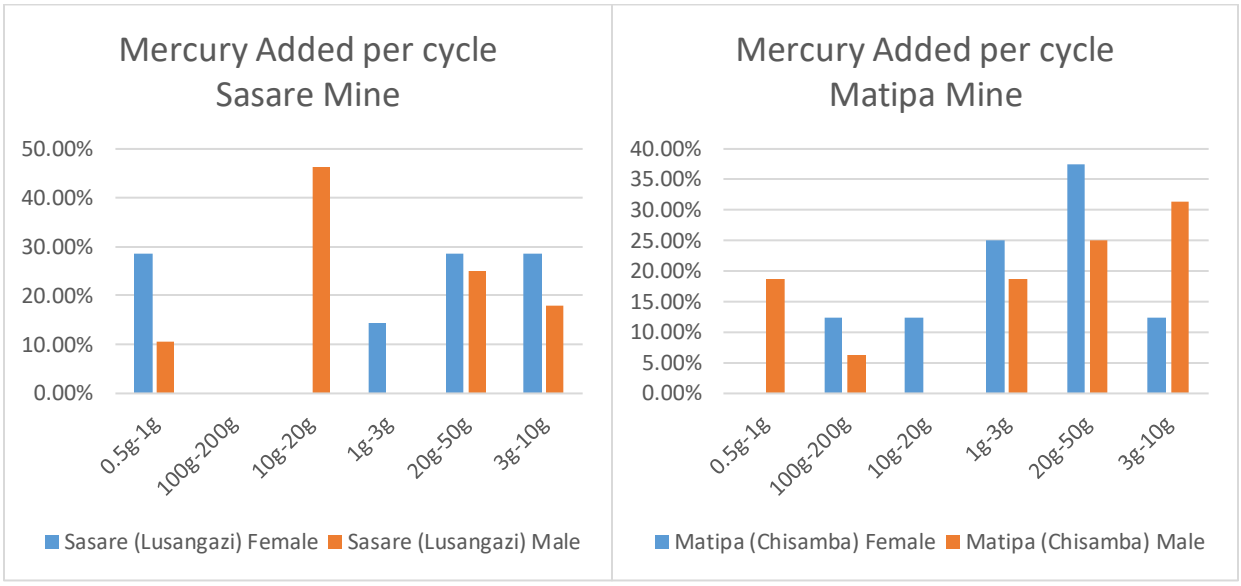


Figure 33: Mercury Utilised Per cycle in Sasare and Matipa Mines

Site-specific practices emerge as perhaps the strongest determinant of mercury used. Chitumba stands out with 100.0% of male miners adding 10-20g per cycle, showing remarkable consistency that could indicate standardized processing methods. According to figure 34, Kabombo presents the most concerning figures, with 61.8% of male miners using 20-50g per cycle, the highest rate of heavy usage among all groups. The female miners at Kabombo also show substantial mercury use, though more varied (37.5% each at 10-20g and 20-50g).

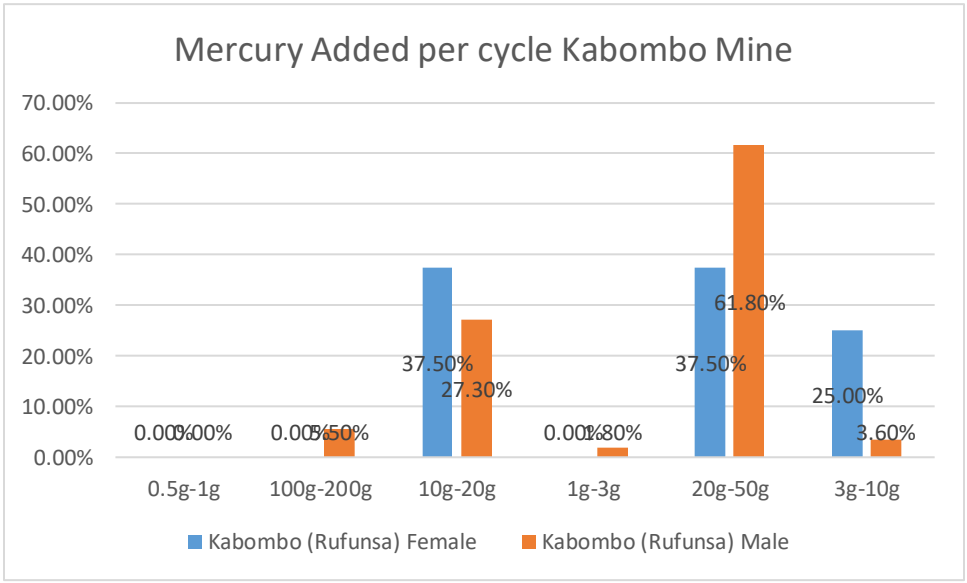


Figure 34: Mercury Utilised per cycle in Kabombo

The findings have important implications for mercury reduction interventions. At high-usage sites like Kabombo and Luili/Matala, gender-neutral technological solutions could have the greatest impact. However, the gender disparities at sites like Sasare and Matipa indicate that training programs may need to be tailored differently for male and female miners. The consistent mid-range usage at Chitumba could serve as a model for implementing safer mercury limits across other sites. Ultimately, these patterns

underscore the need for both site-specific and gender-sensitive approaches to reducing mercury use in Artisanal gold mining.

4.4.2 Mercury Prices Across Mining Sites

The baseline study indicates a consistent pattern of low mercury costs across most mining sites, with significant implications for usage patterns. According to table 23 and 24, a striking 85.0% of miners reported purchasing mercury for prices below ~83 USD for approximately 135 grams (equivalent to a water bottle lid's capacity). This translates to a median price of just ~0.3 USD per gram, making mercury an extremely affordable input for gold processing for a typical Artisanal miner. The prevalence of such low prices helps explain the widespread use of mercury, particularly in sites like Kabombo and Sasare where over 90% of miners employ it. However, the mean price of ~0.5 USD per gram indicates that while most transactions occur at rock-bottom prices, a minority of purchases at higher price points pull the average upward.

Significant variations emerge when examining price distributions across different mining locations. Kabombo shows remarkable price consistency, with 96.6% of miners paying the lowest price bracket, while Kanyelele presents a more complex picture with 71.6% in the lowest tier but 28.4% paying moderately higher prices between ~83–208 USD for 135g. Luili/Matala follows a similar pattern to Kabombo but includes a rare case of much higher pricing (~208–417 USD for 135g). These differences likely reflect varying supply chain dynamics.

The relationship between mercury prices and usage prevalence reveals important insights. Sites with the most consistent low prices (Kabombo, Sasare) show nearly universal mercury adoption, demonstrating how affordability drives usage. Kanyelele's mixed price distribution corresponds with its high but slightly lower mercury prevalence (89.0%). The most intriguing case is Chitumba, where both minimal mercury use and absence of high price reports suggest successful enforcement against the mercury trade. These patterns underscore how local market conditions significantly influence miners' access to and reliance on mercury.

The pricing data carries important policy implications. In sites with uniformly low prices and high usage, introducing cost-competitive alternative technologies may be most effective. For areas showing price variability, improving supply chain transparency could help stabilize prices. The extreme price outliers suggest some illegal trade activity that warrants targeted enforcement.

Table 22: Mercury Price Range and Mean Price Across Sites (for ~135g)

Price Range (USD)	Frequency	Percent	Cum. Percent	Midpoint Price (USD)	Weighted Price (USD)
< 83 USD	216	85.0%	85.0%	~41.7	9,000
83 – 208 USD	36	14.2%	99.2%	~145.8	5,250
208 – 417 USD	1	0.4%	99.6%	~312.5	312.5
417 – 625 USD	1	0.4%	100.0%	~520.8	520.8
Total	254	100.0%			15,083.3
Weighted Mean					~59.4 USD

*(Note: mean price for ~135g is ~59.4 USD) *

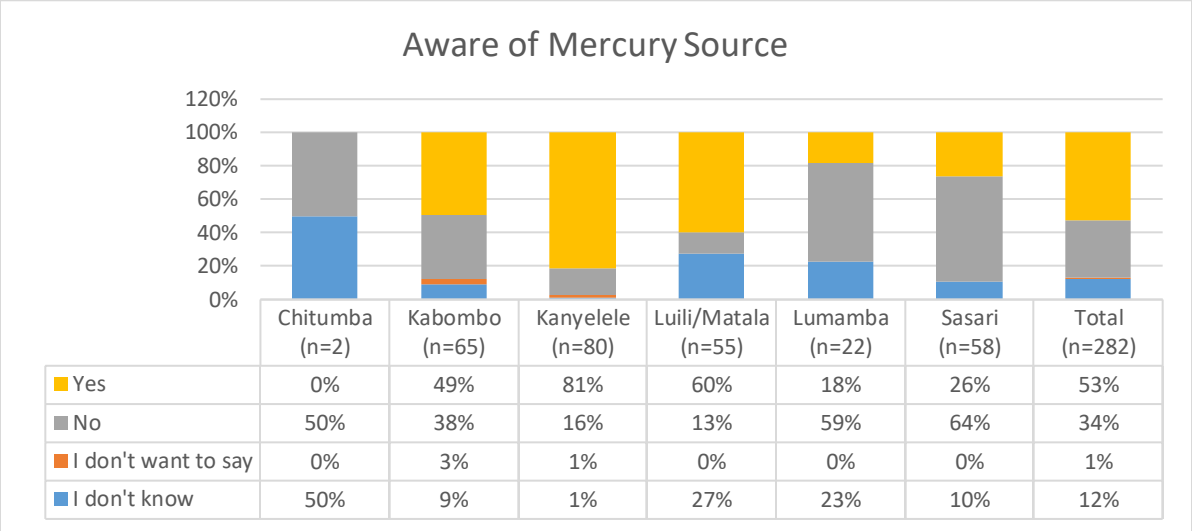
Table 23: Mercury Price Bounds for ~135g and Per Gram

Estimate Type	Price for ~135g (USD)	Price for 1g (USD)
Lower Bound	~41.7	~0.3
Median	~41.7	~0.3
Mean (Average)	~59.4	~0.5
Upper Bound	~145.8	~1.1

4.4.4 Mercury Sources and Supply Chains

Figure 35 below reveals significant gaps in miners' knowledge about mercury suppliers, with only 52.8% able to identify their sources. Among those who acknowledged knowing their suppliers, the majority came from Kanyelele (81.3%) and Luili/Matala (60.0%), suggesting well-established but potentially informal supply networks in these areas. Conversely, 34.0% of miners admitted they did not know where their mercury originated, while 12.1% refused to disclose this information—a pattern particularly evident in Sasare (10.3% unwilling to answer) and Kabombo (9.2% uncertain). This opacity likely stems from illicit trade concerns, as mercury is often smuggled into mining regions through unregulated channels.

Notably, Chitumba's miners (50.0% unaware of sources) exhibited the lowest mercury use, reinforcing that supply chain transparency (or lack thereof) directly influences consumption patterns. The few reports of extremely high prices (~417–625 USD per 135g) in Kabombo and Luili/Matala further suggest black-market dealings during shortages. These findings highlight how weak regulatory oversight allows mercury to circulate unchecked, sustaining its widespread use despite known risks.



	Chitumba (n=2)	Kabombo (n=65)	Kanyelele (n=80)	Luili/Matala (n=55)	Lumamba (n=22)	Sasari (n=58)	Total (n=282)
Yes	0%	49%	81%	60%	18%	26%	53%
No	50%	38%	16%	13%	59%	64%	34%
I don't want to say	0%	3%	1%	0%	0%	0%	1%
I don't know	50%	9%	1%	27%	23%	10%	12%

Figure 35: Knowledge of Mercury Sources by Site

Figure 36: Sample of mercury used in gold processing

4.4.4 Awareness of Mercury's Health Impacts

Miners demonstrate fragmented but concerning awareness of mercury's dangers, with cancer being the most frequently cited risk (appearing in nearly half of qualitative responses). Other recognized health effects include organ damage (particularly liver and stomach), chronic skin conditions, and delayed wound healing. The repeated description of mercury as "slow poison" suggests miners understand its cumulative toxicity, though this awareness rarely extends to environmental consequences like water contamination or ecosystem damage. Notably, only 41% of survey respondents formally acknowledged mercury's harmfulness, with sites like Chitumba showing paradoxical patterns – 94% of miners there were unaware of risks because they have a lowest close to zero mercury usage, implying other deterrents beyond health

knowledge (According to figure 37).

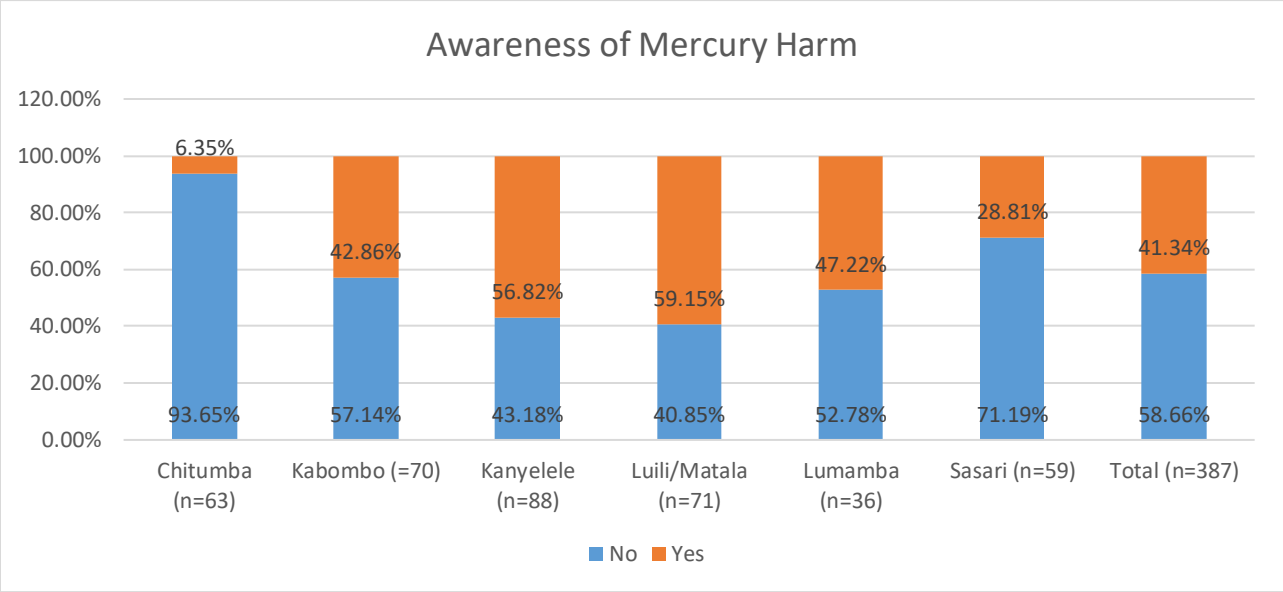


Figure 37: Miners Awareness Risk to Mercury Exposure

4.4.5 Persistence of Mercury Use Despite Risks

The study found five interconnected drivers to explain continued mercury reliance despite the risk it pauses. (a) Economic factors dominate, with 82% of miners citing low cost as the primary reason. (b) Operational efficiency proves equally compelling; this is so because mercury's ability to quickly aggregate gold particles outperform labour-intensive alternatives. (c) Social dynamics further entrench usage, as 55% of respondents reported peer pressure ("everyone uses it") as a key factor. This creates a vicious cycle: even in sites like Kanyelele where 57% recognize mercury's dangers, 81% continue usage due to these compounded pressures. (d) The convenience factor ("easy to use") and (e) lack of alternative knowledge complete this self-reinforcing system.

"I would definitely switch if given the right training, but I believe we first need to identify a viable alternative to mercury. Once that's in place, we should focus on educating miners and providing consistent, intensive training. That way, the transition away from mercury can truly begin." – a Miner at Sasare

4.4.6 Knowledge of Alternative Technologies

According to figure 38, miners identified three categories of mercury-free methods, though awareness remains critically low at just 22%. (a) Gravity separation techniques (water panning, rubber mats, wooden sluices) were most commonly mentioned (86% of alternative responses), but these rudimentary methods typically yield less gold than mercury amalgamation. Few miners (8%) referenced more efficient systems like (b) centrifugal concentrators or (c) chemical processes like cyanide leaching, the latter likely discouraged by its own toxicity risks. Chitumba's exceptional 67% awareness rate (versus <7% elsewhere) is basically because the current methods they are using does not involve the use of mercury hence the majority referenced their current method of riverbed panning using woods and sticks to make shaking tables, though its unique success also suggests the need for localized approaches.

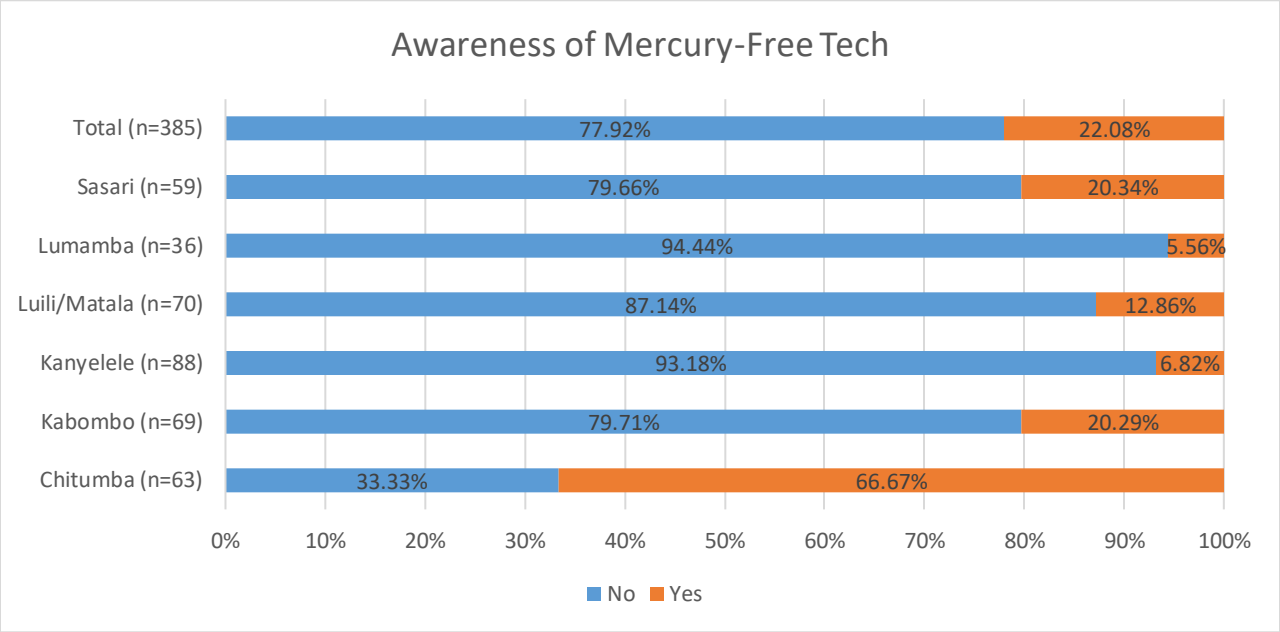


Figure 38: Miners Awareness of Mercury Free Technologies by Site

4.4.7 Barriers to Adopting Safer Methods

Four major obstacles emerged from the miners' responses. Knowledge gaps were nearly universal (89%), with many dismissing alternatives as *mythical or inferior*. Physical access issues (37%) and high costs (41%) for equipment like shaking tables further limit adoption. Cultural resistance encapsulated in responses like "our fathers always used mercury" compounds these structural barriers. Site-specific patterns reveal nuanced challenges: Kabombo miners primarily cite cost (57%), while Matipa struggles with equipment access (44%). This variation underscores the need for tailored interventions rather than one-size-fits-all solutions.

4.4.8 Pathways to Sustainable Change

Breaking the mercury dependency cycle requires multi-pronged strategies. Health messaging should shift from abstract cancer warnings to demonstrating immediate impacts like non-healing wounds, effects miners already recognize but don't necessarily connect to mercury. On the practical side, establishing equipment libraries could overcome access barriers, while gold premium programs could offset the higher costs of alternative technologies. Regulatory measures should focus on disrupting mercury supply chains in high-use areas while designating "alternative technology zones" near success stories like Chitumba. Critically, interventions must prove that mercury-free methods can be faster and more profitable, addressing the core economic drivers that currently sustain hazardous practices.

Site-Specific Mercury Usage Patterns

Chitumba (Vubwi District); This site remains a notable exception with only 3.2% mercury adoption, the lowest across all locations. Usage is limited to small quantities (10-20g per cycle), while 96.8% completely

avoid mercury. Paradoxically, health awareness is critically low (93.7% unaware of risks), yet alternative method adoption is highest (66.7% familiarity). The uniformly low to no mercury prices suggest avoidance stems from cultural preferences or successful alternative method promotion rather than cost barriers. Notably, 50% of miners cannot identify mercury sources, while the other half do not know indicating either effective supply restrictions or strong community norms against its use. The presence of water-based extraction methods (panning, rubbers) appears well-established here.

Kabombo (Rufunsa District); Exhibits extreme mercury dependence with 92.9% usage, primarily in moderate (15-30g) to heavy (20-50g) quantities. Monthly consumption is alarmingly high, with 26.9% using 20-50g monthly. Despite affordable prices (< ~83 USD for 135g for 96.6%), the supply chain shows concerning opacity where 38.5% won't disclose sources and 1.7% pay black-market premiums (~417–625 USD for 135g). Moderate health awareness (57.1% unaware) combines with severe knowledge gaps about alternatives (79.7%), making this a high-priority site for intervention. The "everyone uses it" social pressure (cited by 55% of users) particularly reinforces the status quo.

Kanyelele (Mpika District); Shows polarized usage patterns with 89.0% adoption split between light (3-10g) and heavy (20-50g) applications. Unique among sites, 28.4% pay premium prices (~83–208 USD for 135g), potentially indicating regulated supply chains (81.3% report legal purchases). Despite relatively high health awareness (56.8% recognize dangers), alternative method knowledge is nearly absent (93.2%). The emphasis on mercury's speed and ease (20% of responses) suggests replacement technologies must match its operational efficiency. The site's 8.8% refusal rate to discuss mercury sources may indicate some underground trade.

Luili/Matala (Mumbwa District); Represents one of the heaviest usage sites, with 80.0% adoption dominated by large quantities (53.6% use 20-50g/cycle; 25.3% consume 30-60g monthly). While 60.0% source mercury legally and prices stay low (< ~83 USD for 135g for 87.3%), the significant health awareness (59.2%) without behavioural change reveals the limitations of knowledge-only interventions. The 1.8% paying ~208–417 USD for 135g suggest sporadic supply issues. Alternative method awareness is marginally better here (12.9%), with particular interest in gold detectors, but cost barriers (22.2%) prevent wider adoption.

Matipa (Chisamba District); Presents the most inconsistent usage patterns while 66.7% employ mercury, practices range from very light (20.8% at 1-3g) to heavy (29.2% at 20-50g). Pricing shows similar variability, with 23.8% paying ~83–208 USD for 135g. The site's 59.1% non-disclosure of sources suggests strong informal networks. Health awareness is evenly split (52.8% unaware), while alternative method knowledge is nearly absent (94.4%). The coexistence of minimal and heavy users implies two distinct miner subgroups, requiring differentiated intervention approaches.

Sasare (Lusangazi); Demonstrates near-universal mercury use (98.3%) across surprisingly varied quantities from trace amounts (14.3% at 0.5-1g) to moderate doses (37.1% at 10-20g). Extremely low prices (< ~83 USD for 135g for 97.2%) combine with highly opaque sourcing (63.8% undisclosed) to maintain this dependence. Alarmingly, health awareness is worst here (71.2% unaware), compounded by minimal alternative knowledge (79.7%). The documented use of rubber mat washing (25%) suggests latent receptivity to alternatives, but major barriers persist in access (8.3%) and technical knowledge (83.3%).

Table 24: Summary of Mercury Economics and Awareness by Site

Site	Avg. Mercury Added/Cycle	Price for 135g (USD)	% Aware of Harms	% Using Alternatives
Chitumba	10–20g (3.2% users)	< ~41.7 (100%)	6.4%	66.7%
Kabombo	15–50g (79.1% users)	< ~41.7 (96.6%)	42.9%	20.3%
Kanyelele	3–50g (89.0% users)	~41.7–145.8 (28.4%)	56.8%	6.8%
Luili/Matala	20–60g (80.0% users)	< ~41.7 (87.3%)	59.2%	12.9%
Matipa	1–50g (66.7% users)	~41.7–145.8 (23.8%)	47.2%	5.6%
Sasare	0.5–20g (98.3% users)	< ~41.7 (97.2%)	28.8%	20.3%

4.5 Gold Production Yield and Market Supply Chain

4.5.1 Gold Production per cycle

The data in table 25 reveals significant variability in gold production per cycle among Artisanal and Small-ScaleGold Miners, with outputs ranging from less than 0.5 grams to over 200 grams. Most miners (79.33%) produce 5 grams or less per cycle, with the largest group (38.24%) falling in the 1g–5g range. This indicates that the majority of ASGM operations are traditionally subsistent and labour-intensive. Meanwhile, a small fraction of high-yield miners (5.43%) produces 25 grams or more per cycle, significantly skewing the ***weighted mean output to 6.7 grams*** per production cycle per miner at a statically confidence level of 99%. The **median output of *3 grams*** better represents the **typical miner's production**, highlighting the subsistence nature of most ASGM activities.

Table 25: Gold produced per cycle per miner

Gold Output Range	Frequency	Percent	Cum. Percent	Midpoint Output (g)	Weighted Output (g)	Weighted Mean Output (g)
Less than 0.5g	46	11.9%	11.9%	0.25	11.5	
0.5g to 1g	113	29.2%	41.1%	0.75	84.75	
1g to 5g	148	38.2%	79.3%	3	444	
5g to 10g	34	8.8%	88.1%	7.5	255	
10g to 15g	18	4.7%	92.8%	12.5	225	
15g to 25g	6	1.6%	94.3%	20	120	
25g to 50g	12	3.1%	97.4%	37.5	450	
50g to 100g	8	2.1%	99.5%	75	600	
100g to 200g	1	0.3%	99.8%5	150	150	
200g and above	1	0.3%	100.0%	250	250	
Total	387				2590	6.69

Table 26: Estimated Lower Bound, Median, Mean, and Upper Bound Gold produced per cycle

Estimate Type	Gold Output per cycle (g)	Comment
Lower Bound	0.75	Dominated by “less than 0.5g” and “0.5g to 1g” categories
Median	3	Cumulative frequency crosses 50% in the “1g to 5g” group
Mean (Average)	~6.7	As per table 38 above
Upper Bound	37.5–75	Very few entries at high-end yields: “100–200g” and “200g+”

Assuming the production quantities per cycle *is kept constant, and the miners operate 25 days per cycle* (as early established in previous sections), monthly production estimates would further illustrate the economic viability of ASGM. A typical miner (median 3g/cycle) would produce around *75 grams per cycle*, while the average miner (mean 6.7g/cycle) would yield approximately *167.5 grams*. However, these figures mask extreme disparities while most miners earn modest incomes, the top 5% (producing ≥25g/cycle) generate *937.5 grams or more monthly*.

The production volume distribution highlights both the challenges and opportunities within ASGM. Most miners operate at subsistence levels, reinforcing the need for policies that support sustainable livelihoods. Meanwhile, the presence of high-yield outliers demonstrates the sector's potential profitability when efficient extraction and processing methods are employed. Interventions should focus on improving access to mechanization, formalizing high-yield operations, and providing support to low-yield miners to enhance productivity and economic stability.

Gold Production levels by Site

Kanyelele (Mpika District): The Model of Balanced Gold Production

Kanyelele demonstrates how moderate mechanization can create sustainable gold production, with **12.1%** of miners achieving 10-15 grams per cycle and many others producing 5-10 grams. This balanced output results from the site's unique combination of geological advantages and technological adaptation. The presence of both alluvial and reef deposits allows miners to employ different approaches—traditional panning for alluvial gold (yielding 1-5 grams) and shared hammer mills for crushing reef ore, which, when combined with moderate mercury use (20-50g per cycle), enables better recovery rates. Miners maintain steady production through consistent work patterns (typically 20-25 days per month), avoiding the exhaustion seen at more intensive sites. However, Kanyelele's potential remains constrained by several factors: limited access to processing plants (only 25.8% ownership among miners), high transport costs to shared mills (39.5% pay ~208–417 USD per trip), and variable ore quality from different pits. These constraints explain why, despite having some equipment, most production remains in the mid-range rather than reaching the peak yields of fully industrialized sites.

Luili/Matala (Mumbwa District): Industrial Efficiency at an Environmental Cost

Figure 39: Wet pan processing Plant for Gold in Mumbwa's Luili/Matapa site

Luili/Matala stands as the production leader among all surveyed sites, with 11.3% of miners extracting an impressive 25-50 grams per cycle. This exceptional performance stems from its industrialized processing system centered around wet pan plants, each capable of handling 1.5 tonnes of ore in 5–8-hour cycles using 150-200g of mercury. Several key factors drive this high productivity: the bulk processing of both alluvial and reef material (with 47.4% of miners handling 1,000-5,000kg batches), complete mechanized crushing that maximizes gold liberation from reef deposits, and continuous operations supported by daily work (33.9% of miners) or near-daily schedules (24.6% working 15-20 days/month). However, this industrial efficiency comes with substantial drawbacks, including severe mercury pollution (83.1% usage rate), dependence on externally owned processing plants (only 23.9% local ownership), and intensive logistics requirements (39.3% of miners transport ore daily). Luili/Matala thus presents a paradox while demonstrating the production potential of advanced mechanization, it also highlights the environmental and social trade-offs that must be addressed in scaling up Artisanal mining operations.

Kabombo (Rufunsa District): The Paradox of High Investment, Low Returns

Kabombo presents a troubling case of intensive mercury use yielding disappointing returns, with most miners producing only 1-5 grams per cycle despite 57.8% using 20-50g of mercury. This inefficiency stems from fundamental mismatches between the site's geological challenges and its processing methods. The exclusive presence of reef deposits demands effective crushing for effective gold liberation, yet most miners (68.6%) persist with manual processing techniques. The mountainous terrain further complicates equipment access and operation. Processing limitations exacerbate these challenges the lack of centralized crushing facilities (only 8.6% plant ownership among miners) forces reliance on inadequate methods, while the extraordinarily high mercury usage (91.3% of miners) becomes wasteful when applied to inadequately liberated ore. Even with intensive labour input (52.2% working daily), the combination of these factors creates a worst-case scenario of significant mercury pollution coupled with poor gold recovery. Kabombo's situation underscores a critical lesson: efforts to reduce mercury use must be accompanied by basic mechanisation improvements, as mercury cannot compensate for the inadequate liberation of gold from ore. The site highlights the limitations of relying on mercury without the appropriate processing technologies needed to achieve efficient gold recovery.

Sasare (Lusangazi District): The Challenge of Hard Rock Mining with Manual Methods

Figure 40: Hammer Mill used for gold processing in Sasare mine

Sasare's mining operations face significant geological and technological constraints that result in the lowest gold yields among all surveyed sites, with most miners producing only 0.5-1 gram per cycle. The site's mountainous terrain contains exclusively reef deposits that are particularly resistant to manual extraction methods, unlike mixed-deposit sites that can utilize alluvial alternatives. This challenging geology is compounded by severe technological limitations—83.1% of miners rely entirely on manual panning, while the few available shared hammer mills prove inadequate for effective ore liberation. The universal mercury usage (100% of miners) becomes particularly ineffective as it's applied to inadequately crushed ore, leading to substantial gold losses. Work patterns reflect these difficulties, with irregular schedules (only 22.0% working daily and 30.5% operating 20-25 days per month) and physically exhausting labour yielding minimal returns. Without access to proper mechanized crushing equipment, Sasare's miners remain trapped in low-productivity methods that cannot effectively process the hard rock gold deposits, perpetuating a cycle of intensive labour with poor recovery rates.

Chitumba (Vubwi District): Environmentally Sustainable but Inefficient Production

Figure 41: Artisanal tools used for panning gold in Chitumba (Vubwi District)

Chitumba presents a case of environmentally safer but economically limited mining operations, with 43.6% of miners producing modest yields of 0.5-1 gram per cycle. The site's exclusively alluvial deposits allow for simpler processing methods, with near-equal distribution between manual panning (49.2%) and basic sluice boxes (49.2%). While this approach results in minimal mercury usage (only 4.3% of miners employ it) and consequently lower environmental impact, it also means no significant efficiency gains are achieved. The labour dynamics show steady work patterns (30.2% operating 20-25 days per month) and low transportation costs (83.9% paying less than ~21 USD per trip), indicating sustainable but unambitious operations. Chitumba's example demonstrates how alluvial mining without technological upgrades—such as motorized sluices or improved concentration methods—inherently limits production potential and earnings capacity, despite its advantages in reduced chemical use and simpler logistics.

Matipa (Chisamba District): The Duality of Inconsistent Processing Approaches

Matipa's gold production reveals a stark dichotomy between high and low performers, resulting from inconsistent processing methods across the site. While some miners achieve respectable outputs of 5+ grams per cycle through the use of small crushers, others remain stuck at minimal production levels of 0.5-1 gram using outdated manual panning techniques. This polarization stems from several key factors: the alluvial deposits contain variable gold concentrations that reward more efficient methods; processing approaches are split between traditional panning (50%) and basic plant equipment (36.1%); and mercury usage shows a clear divide with 48.6% of miners employing it while 51.4% use alternatives like washing soap. The lack of standardized, optimized methods across the site creates unequal outcomes where technological adoption directly determines economic success. Some miners thrive with basic mechanization while others struggle with archaic techniques, highlighting how inconsistent technology uptake can create wide disparities in productivity within the same mining community.

Cross-Site Comparative Analysis and Recommendations

The examination of the sites under study reveals several crucial lessons for improving Artisanal gold production. Firstly, the necessity of matching mechanization to geology becomes apparent - reef-dominated sites like Sasare suffer without crushing equipment, while alluvial sites like Chitumba miss opportunities by not adopting improved gravity technology. Secondly, mercury efficiency, which is enhanced by mechanised processing systems, proves more important than the quantity of mercury used. This is demonstrated by the contrast between Luili's effective use of mercury in effectively liberated ore versus Kabombo's wasteful application of mercury to poorly liberated ore. Finally, labour patterns

naturally adapt to technological capabilities, with daily work only becoming profitable when paired with industrial methods, while intermittent work better suits manual alluvial operations. These insights suggest that targeted interventions should focus on introducing appropriate crushing technology for reef sites; upgrading concentration methods for alluvial deposits; providing training on optimized mercury use; and developing site-specific approaches that respect existing work patterns while gradually introducing efficiency improvements. Such tailored strategies could help break cycles of low productivity while maintaining environmental and social sustainability.

Mercury-Gold (Ratio) Processing Efficiency Across Mining Sites

This detailed examination assesses mercury usage efficiency in Artisanal gold mining operations through three critical metrics: **a) mercury consumption per ton of ore processed, b) mercury-to-gold ratio in ore, and c) mercury-to-gold ratio in production.** The analysis reveals substantial variations in operational efficiency across different mining locations, highlighting both best practices and areas requiring urgent intervention.

a) Mercury Consumption per Ton of Ore (g/t)

The analysis of mercury consumption per ton of ore processed reveals significant variations across mining sites, with an overall average of **2.02g Hg per ton (2:1)** that conceals substantial disparities in operational efficiency. According to figure 42, Kabombo emerges as the least efficient site, consuming mercury at a rate of 6.48g per ton - nearly six times higher than Luili/Matala, which demonstrates best practices with only 0.11g Hg per ton. Intermediate consumption levels are observed at Sasare (1.23g/t) and Kanyelele (0.25g/t), clearly indicating that factors such as ore characteristics, degree of mechanization, and specific processing techniques play crucial roles in determining mercury requirements. These findings underscore the importance of site-specific approaches to mercury reduction, as blanket strategies would fail to address the unique challenges and opportunities presented by each operation's geological and technological context. The extreme range in consumption rates, from 0.11g to 6.48g per ton, highlights both the potential for dramatic improvements at inefficient sites and the existence of proven, low-mercury techniques that could be replicated across the sector.

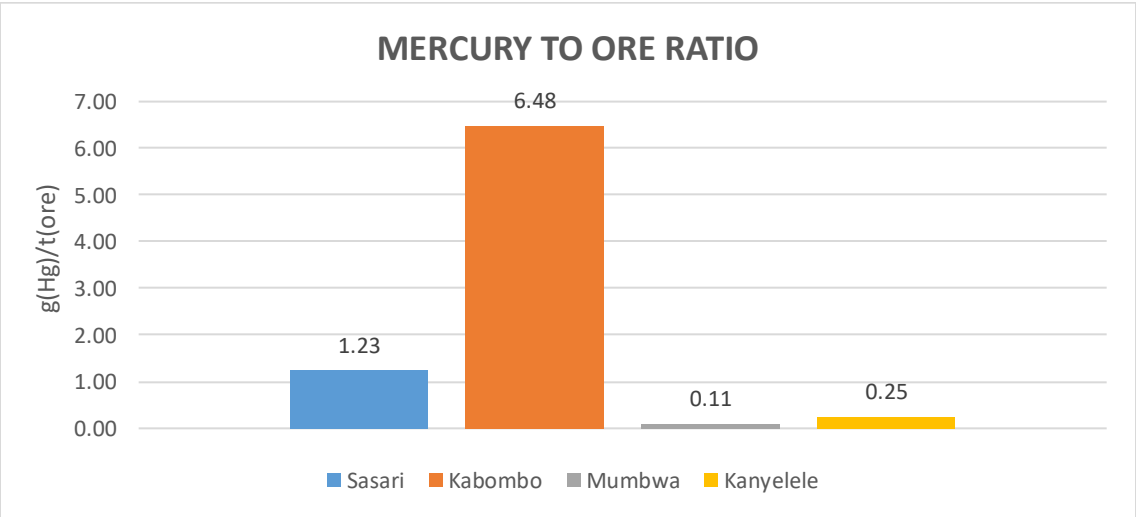


Figure 42: Mercury Consumption per Ton of Ore (g/t)

b) Mercury per Gram of Gold Produced (g(Hg)/g (Au prod))

According to figure 43, the ratio of mercury per gram of gold produced (g(Hg)/g (Au prod)) serves as a key indicator of operational efficiency, measuring how much mercury is used during the extraction process for each gram of recovered gold with an overall average of **2.56g Hg per Au (g) produced (2.56:1**). It basically measures the quantity of mercury used (consumed) to produce gold. Kabombo once again emerges as the least efficient site, with a staggering ratio of 5.71 grams of mercury used per gram of gold produced—a figure that underscores both significant economic waste and severe environmental harm due to mercury pollution. In stark contrast, Luili/Matala (0.85g Hg/g Au) and Kanyelele (1.31g Hg/g Au) demonstrate far greater efficiency, suggesting the implementation of better mercury retention methods, such as optimized amalgamation techniques with mechanised machinery. In cases like Luili/Matala and Mpika where mercury use has been optimised with efficient gold recovery, the use of retorts to capture and recycle mercury vapour can be used as a method that reduces the impact of mercury pollution to the environment. Meanwhile, Sasare (2.36g Hg/g Au) occupies a middle ground, using more than twice as much mercury per unit of gold produced compared to the best-performing sites, indicating room for improvement in its extraction and mercury recovery practices. These disparities highlight the urgent need for adopting more efficient and environmentally responsible gold processing methods, particularly in high-mercury usage/low gold recovery areas like Kabombo, to mitigate both economic losses and ecological damage.

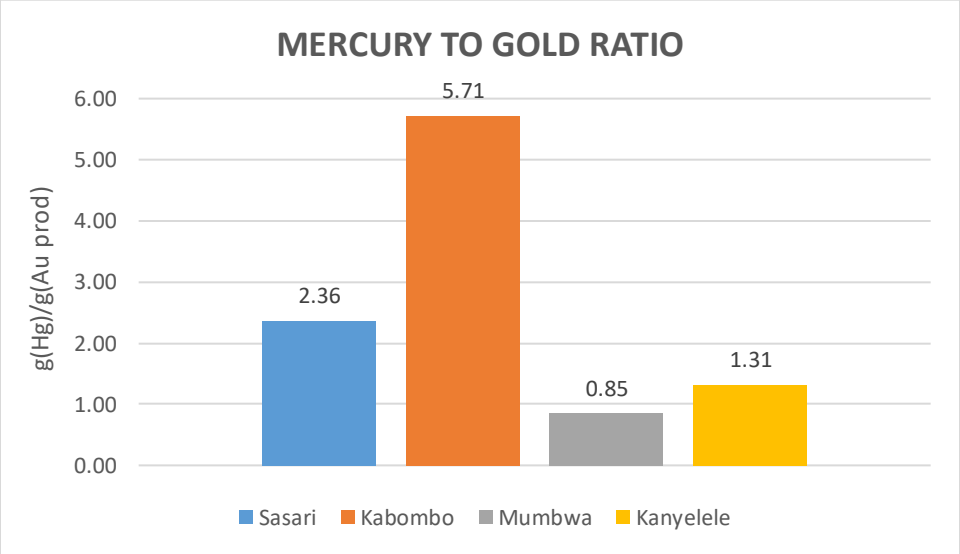


Figure 43: Mercury per Gram of Gold Produced (g(Hg)/g (Au prod)

Strategic Recommendations for Mercury Reduction

The analysis suggests several targeted interventions to improve mercury efficiency across sites. For Kabombo, priority should be given to introducing mechanized crushing to improve gold liberation before mercury application. Sasare would benefit most from standardization of best practices and introduction of gravity concentration methods to reduce mercury dependence. Kanyelele's shared processing model should be expanded and replicated at other sites, while Mumbwa's techniques deserve detailed study and emulation. Across all locations, the introduction of mercury retorts and training in optimal mercury

management could reduce environmental contamination. Policy measures should include both incentives for adopting efficient technologies and enforcement of basic environmental standards. The wide variation in performance between sites operating similar deposits proves that substantial improvements are possible through better techniques rather than just technological upgrades. A phased implementation approach, starting with the most inefficient operations, would yield the greatest environmental and economic benefits.

4.5.2 Monthly Gold Sales

The monthly gold sales data from Artisanal and Small-Scalemining operations reveals a sector characterized by extreme disparities in output. According to table 27 and 28, most miners operate at subsistence levels, with nearly a third (30.93%) selling less than 10 grams of gold per month and another 44.07% selling between 10-50 grams. This means that about 75% of all miners are subsistent Artisanal operators with limited market output. A much smaller but economically significant group of miners achieves substantially higher sales volumes. These high-volume sellers, though few in number, contribute disproportionately to the total gold supply. The *weighted mean sales volume of 74.4 grams per miner* reflects this imbalance, as it's heavily skewed by top performers. The median figure of *30 grams* provides a more accurate picture of what a typical miner earns.

These sales patterns have important implications for how the ASGM sector functions. The prevalence of subsistent sellers means local gold markets are dominated by numerous small transactions, typically facilitated by middlemen or local traders. This fragmentation makes supply chains inefficient and leaves most miners vulnerable to price manipulation. Meanwhile, the existence of high-volume producers' points to significant inequality within the sector, where a small elite captures most of the economic benefits.

From a policy perspective, this data suggests the need for differentiated approaches. For the majority of subsistence-level miners, interventions should focus on improving market access, providing fair pricing mechanisms, and offering financial services to help them stabilize their incomes. For high-volume producers, the priority should be formalisation and integration into more regulated supply chains. The extreme concentration of sales among a few miners also highlights the potential for wealth redistribution mechanisms, such as cooperatives or profit-sharing arrangements, to create more equitable outcomes across the sector.

The sales distribution further underscores how mechanization and access to capital create a dividing line in ASGM operations. Those with better equipment and resources can process more material and achieve sales volumes that are orders of magnitude higher than their manual mining counterparts. This technological divide suggests that targeted equipment financing programs could help bridge the gap between subsistence miners and more commercially viable operations, potentially raising incomes for a significant portion of the ASGM workforce.

Table 27: Monthly Gold Sales per Miner

Range (Monthly Gold Sold)	Frequency	Percent	Cum. Percent	Midpoint Quantity (g)	Weighted Quantity (g)	Weighted Mean Quantity (g)
Less than 10g	120	30.9%	30.9%	5	600	
10g–50g	171	44.1%	75.0%	30	5130	
50g–100g	33	8.5%	83.5%	75	2475	
100g–200g	36	9.3%	92.8%	150	5400	
200g–500g	20	5.2%	97.9%	350	7000	
500g–1000g	5	1.3%	99.2%	750	3750	
1000g–2000g	3	0.8%	100.0%	1500	4500	
Total	388				28855	74.4

Table 28: Estimated Lower Bound, Median, Mean, and Upper Bound Monthly Gold Sales per Miner

Estimate Type	Monthly Gold Sold (g)	Comment
Lower Bound	5	Dominated by "Less than 10g" category
Median	30	Cumulative frequency crosses 50% within the "10g–50g" range
Mean (Average)	~74.4	As per table 40 above
Upper Bound	150–350	Few miners reach 1000g+, only 3 responses

4.5.3 Gold Pricing and Market Dynamics

Gold prices across mining sites in Zambia; Gold prices in Zambia's Artisanal mining sector show a clear concentration in two primary ranges. Nearly half of all transactions (48%) occur between ~42–83 USD per gram, while another 49% fall in the ~83–167 USD per gram bracket. This distribution indicates most miners receive relatively consistent prices, with the weighted mean price of ~93 USD per gram closely matching the median of ~94 USD per gram. Such alignment suggests a stable, though potentially exploitative, pricing structure across most mining sites.

A small fraction of miners (3%) receives less than ~42 USD per gram for their gold, representing the most disadvantaged transactions. These occur in areas with particularly weak bargaining power (Kabombo and Chitumba). At the opposite extreme, only one recorded transaction (0.3%) in Kanyelele exceeded ~167 USD per gram, reaching ~208 USD per gram. This outlier represents exceptionally high-quality gold and a rare direct sale to premium buyers, but its singularity confirms it is not representative of typical market conditions.

Gold Price Determination Across Mining Sites; The data on gold price determination reveals a market overwhelmingly controlled by buyers, with miners having minimal influence. Across all sites, 78.6% of miners report that buyers set gold prices, reflecting a systemic power imbalance. This trend is most extreme in Chitumba (100% buyer-controlled) and Kabombo (94.2%), where miners operate in a near-monopsony environment. While other sites like Kanyelele (77.5%), Matipa (72.2%), and Sasare (71.2%) show slightly less buyer dominance, the broader pattern persists. The sole exception is Luili/Matala, where buyers determine prices for only 54.9% of miners, and processing plant owners play a significant role (43.7%). This suggests that sites with more mechanized operations exhibit marginally better pricing dynamics. However, miners rarely set their own prices—only 0.3% of respondents overall reported doing so.

The regional disparities highlight the interplay between market informality and production infrastructure. Sites with semi-mechanized processing demonstrate how vertical integration can dilute buyer monopolies. In contrast, fully informal sites exemplify the worst-case scenario. These divides suggest that interventions must be site-specific.

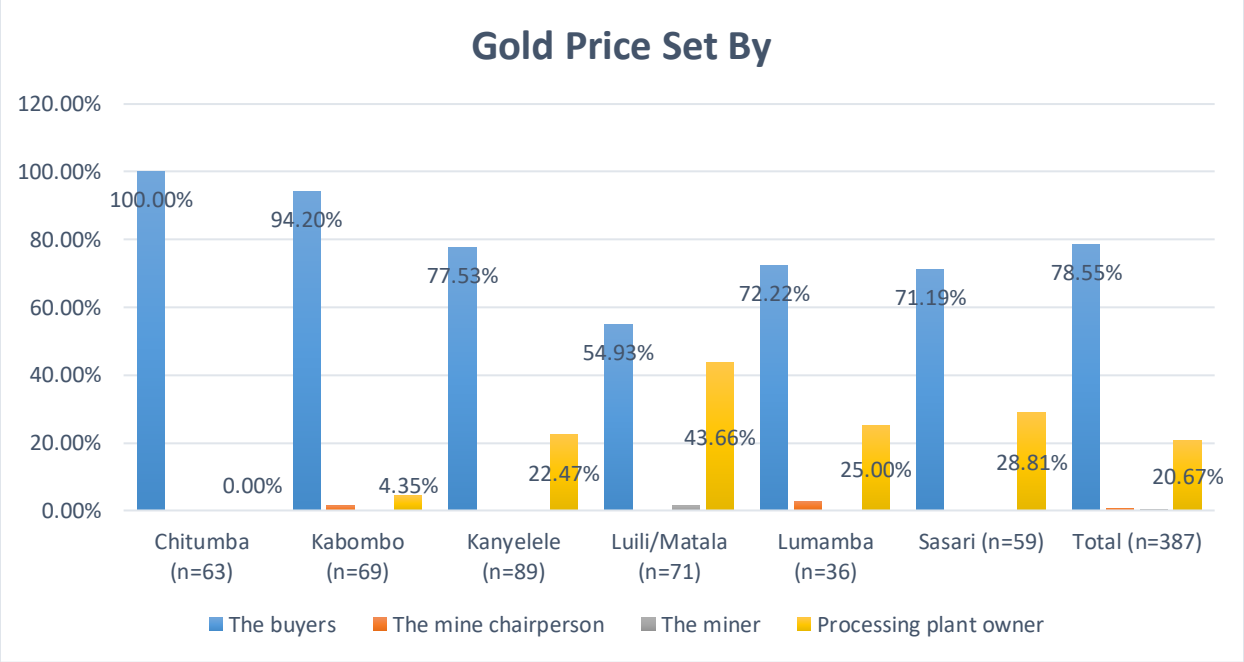


Figure 44: Gold price setters

Gold buyer types across mining sites; The analysis of gold buyer types reveals distinct patterns in market structures. Zambian individual buyers dominate the purchasing landscape, accounting for 53.1% of all transactions, with strong representation in Matipa (72.2%), Chitumba (66.7%), and Kabombo (57.4%) according to figure 45.

Processing plant owners emerge as the second most important buyer category, comprising 36.1% of total transactions. Their market share is especially prominent in Sasare (62.7%), Kanyelele (48.4%), and Luili/Matala (49.3%), suggesting these sites have more established processing infrastructure that facilitates direct purchases from miners. The concentration of plant owners as buyers in these areas may indicate slightly more formalized trading arrangements compared to other locations.

Foreign buyers play a limited but notable role, representing 8.3% of transactions collectively. Somali/Swahili/Zimbabwean traders are most active in Kabombo (17.6%) and Chitumba (3.20%), while Mozambican/Malawian buyers appear exclusively in Chitumba (25.4%). Chinese/Lebanese buyers show minimal presence (0.3%), appearing only in Kanyelele. This geographic specificity of foreign buyer activity suggests particular trade networks have developed in certain regions, potentially linked to cross-border smuggling routes or historical trading patterns.

Other buyer types have negligible market shares. Chemical suppliers and the Zambia Gold Company (ZGC) each account for just 0.3% of transactions, appearing only in Luili/Matala and Kabombo respectively. Local goldsmiths represent 2.1% of buyers, with their limited presence concentrated in Chitumba (4.8%), Kabombo (2.9%), and Sasare (5.1%).

The data reveals stark regional variations in buyer composition. Chitumba shows the most diverse buyer base, featuring four distinct types, while Luili/Matala and Matipa each have only two significant buyer categories. Sasare presents an interesting case where processing plant owners capture nearly two-thirds of the market, dwarfing other buyer types. These differences likely reflect variations in local mining regulations, proximity to borders, and the level of mechanization at different sites. The predominance of fragmented, informal buyers in most locations underscores the challenges in establishing transparent and equitable gold trading systems across Zambia's Artisanal mining sector.

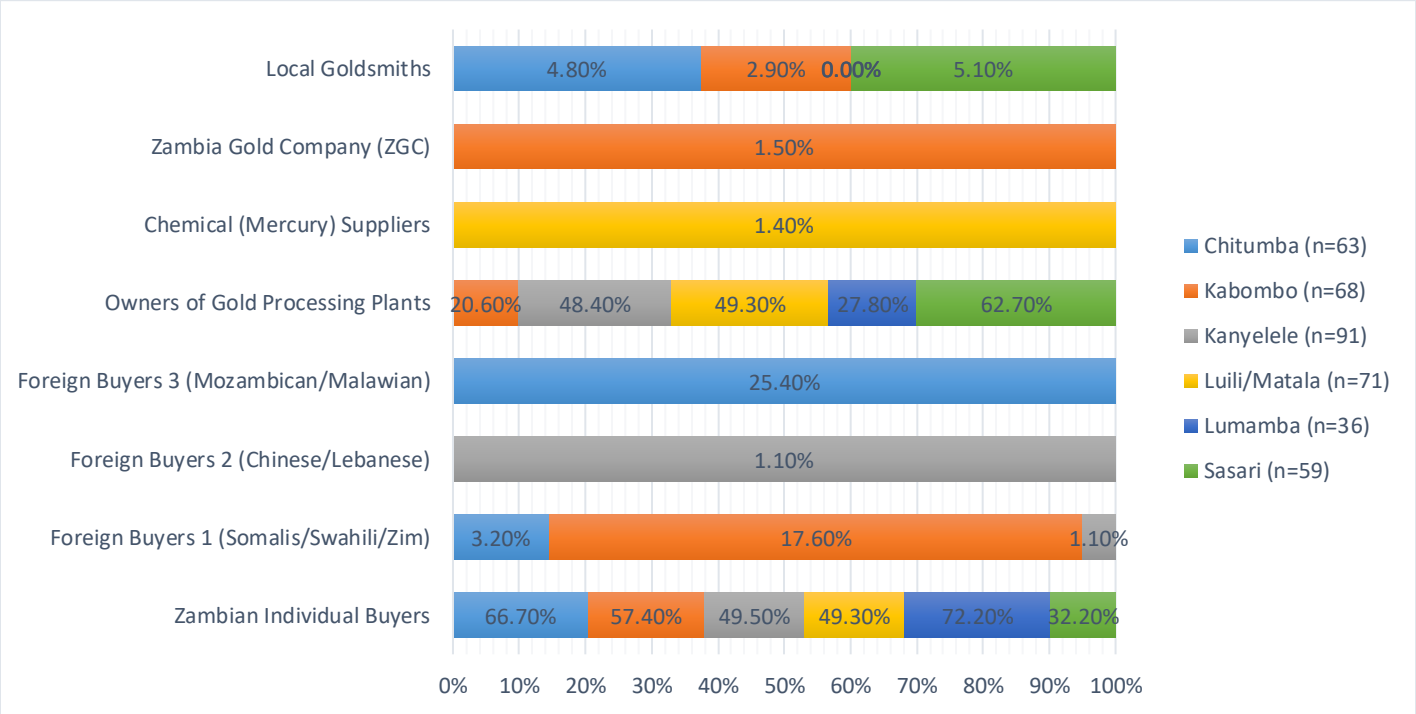


Figure 45: Zambia Gold Buyer Types

Zambia Gold Company: Despite the Zambian government's establishment of Zambia Gold Company Limited (ZGCL) to formalise gold trading and boost national reserves, baseline data reveals minimal engagement with Artisanal miners. Currently, ZGCL operates in three sites: Kasenseli (outside the scope of this study), Luili/Matala, and Kabombo, where the company has established camps and is building processing plants. However, even in these two sites under study i.e. Luili/Matala and Kabombo the results show limited interaction with miners.

According to figure 46, across six major mining sites surveyed, 93% of miners report never having sold gold to ZGCL, with only 0.26% regularly transacting with the state entity. This stark disconnects between policy objectives and on-the-ground realities highlights systemic challenges in formalising Zambia's Artisanal Gold sector, as most miners continue relying on informal buyers.

The near-total absence of engagement is particularly visible in Chitumba, Kanyelele, Matipa, and Sasare, where 100% of miners have never transacted with ZGCL. Even in ZGCL's operational sites, engagement remains low:

- Kabombo: Only 8.57% of miners report *rarely* selling to ZGCL.
- Luili/Matala: Shows marginally higher (but still negligible) interaction, with 28.17% rarely selling to ZGCL and just 1.41% doing so *"most of the time."*

These findings underscore ZGCL's limited success in establishing itself as a meaningful buyer in the ASGM sector, even in areas where it has set up operations. The fact that only 0.26% of miners overall transact with ZGCL regularly and that even in its most engaged site (Luili/Matala), fewer than 2% do so consistently suggests systemic barriers to formalisation, such as inaccessible purchasing points, unattractive pricing, or miners' reliance on entrenched informal networks.

While the minimal activity in Luili/Matala and Kabombo could reflect early-stage efforts given that ZGCL has only recently established a presence there, these cases remain exceptions rather than indicators of broader market penetration. Without significant policy reforms (e.g., competitive pricing, mobile buying units, or incentives for formal sales), ZGCL risks remaining irrelevant to most Artisanal miners, perpetuating the dominance of informal buyers. Importantly, however, the company's expansion is still underway, and its performance in Kasenseli (not covered in this study) may differ.

ZGCL's limited market penetration is attributed to several factors: the company only recently began buying directly from ASGM miners, and it paused operations for approximately 2–3 years following a change in government, disrupting early momentum and trust-building. This hiatus, combined with potentially uncompetitive pricing and miners' entrenched reliance on informal networks, has hindered its integration into the local gold economy.

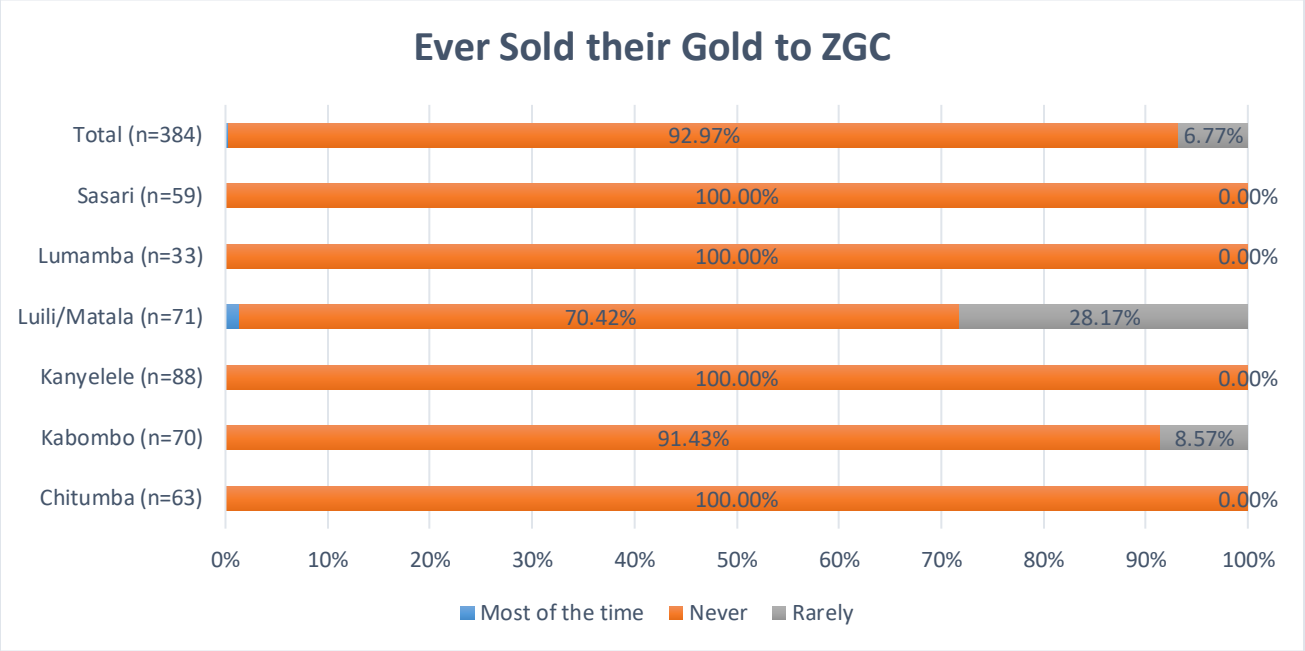


Figure 46: Miners who have Ever Sold Gold to Zambia Gold Company

4.5.4 Gold Transactional Records, Receipt Issuance, and Receipt Receiving in ASGM Formalisation

The data reveals significant gaps in transaction documentation across mining sites, which has profound implications for formalisation, revenue tracking, and financial trust.

Gold Sales Records: Record-keeping varies significantly by location. According to figure 47, miners in Kanyelele (62.2%) and Luili/Matala (28.6%) maintain some sales logs, most other sites especially Chitumba (98.41% no records) and Sasare (98.3%) operate without documentation. The small percentage of miners who keep records "sometimes" (2.3%) suggests inconsistent practices rather than systemic compliance. Reliable sales records are essential for profitability analysis, tax compliance, and attracting formal investors. Their absence leaves the sector vulnerable to revenue leaks and limits access to financing.

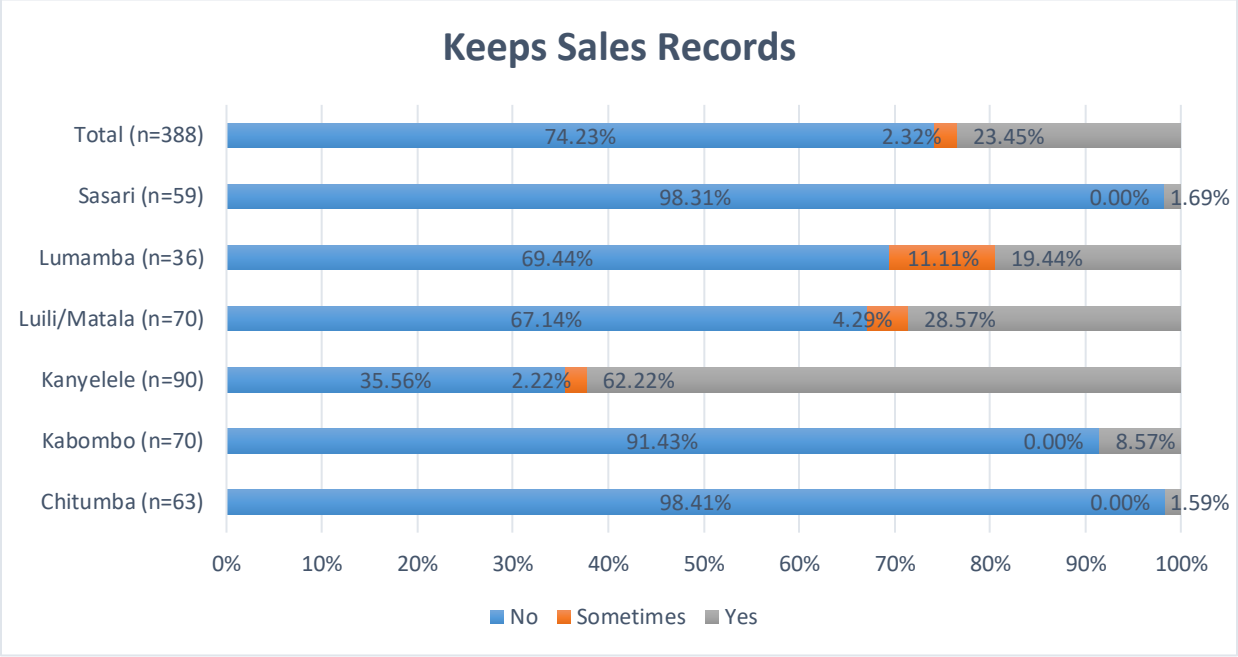


Figure 47: Record keeping for gold sales

Receipt Issuance and Receiving; The overwhelming majority (94.3%) of transactions do not involve issuing receipts to buyers, indicating a severe lack of formalized trade practices. Only Kabombo (12.9%) and Kanyelele (8.0%) show marginal compliance, while other sites particularly Sasare and Matipa have near-zero issuance. This absence of buyer receipts complicates financial tracking, making it difficult to verify sales volumes or ensure fair pricing. Without proper documentation, miners struggle to prove income, deterring banks and investors who require auditable records for financing. Even fewer sellers (1.3%) receive receipts, meaning transactions occur with almost no formal proof. Sites like Matipa and Sasare show no seller receipts at all, reinforcing an informal trade environment. The lack of seller documentation undermines accountability, as disputes over payments or quantities cannot be easily resolved. Furthermore, without receipts, miners cannot substantiate their earnings for tax purposes or secure loans, perpetuating financial exclusion.

Impact on ASGM Formalisation and Trust; The lack of transaction transparency and traceability hinders the transition from informal to formal mining. Financial institutions and other players who would want to support the operations of the ASGM sector will continue to hesitate to fund operations without verifiable records, while tax authorities struggle to enforce compliance thereby creating a revenue leak for the government of Zambia. Improving receipt issuance and sales logging through policy enforcement, digital tools, or incentives could enhance trust, support revenue tracking, and unlock formal financing opportunities. Sites like Kanyelele demonstrate that better documentation is possible, but widespread adoption is needed to drive sector-wide formalisation.

4.5.5 Government Support and Financing

The baseline data reveals a near-total absence of institutional support for ASM miners. *100%* of respondents across all sites (Chitumba, Kabombo, Kanyelele, Luili/Matala, Matipa, Sasare) reported *receiving no government assistance.* Similarly, *98.4% indicated no access to formal mining finance*, with only 1.6% (6 miners total, mostly from Kanyelele) reporting some financial support. This lack of institutional engagement perpetuates informality, leaving miners vulnerable to exploitative pricing and inefficiencies.

Funding Challenges in ASGM Operations; The study reveals profound structural barriers preventing Artisanal and Small-Scalegold miners from accessing financial services, with distinct patterns emerging across different mining sites.

According to figure 48, the most pervasive challenge is the lack of formal registration, affecting 38.9% of respondents overall. This issue reaches critical levels in Kanyelele (23%), Kabombo (20%), and Luili/ Matala (18%), where nearly half of miners operate without legal recognition. The prevalence of informality at these sites creates an insurmountable barrier to conventional financing, as financial institutions typically require formal business registration and compliance with regulatory frameworks before extending credit. This situation perpetuates a vicious cycle where miners cannot access the capital needed to improve operations and formalize their status.

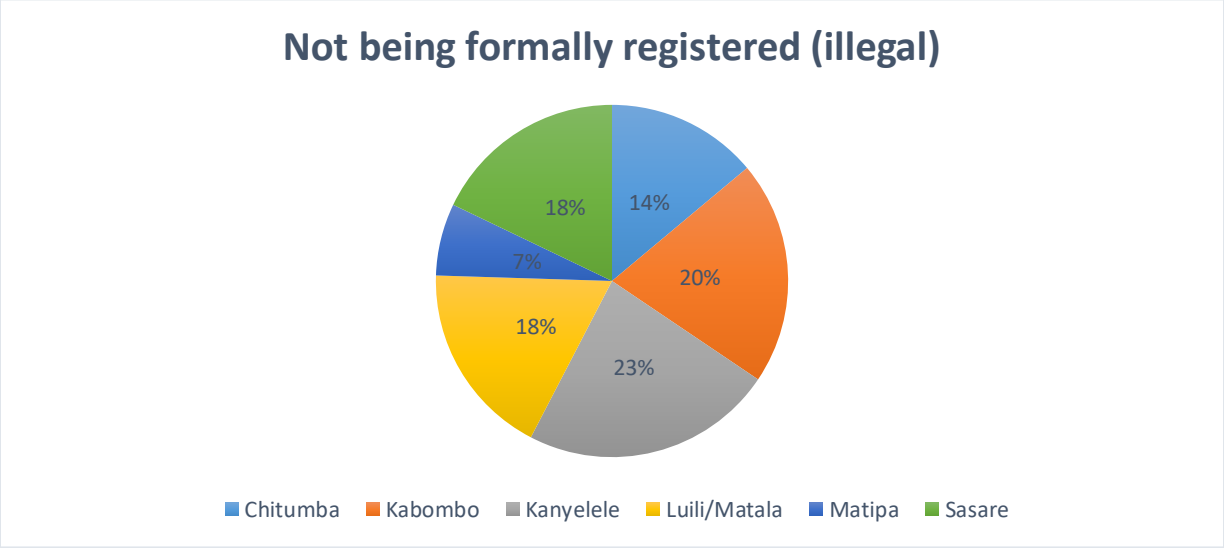


Figure 48: Not fully registered

According to figure 49, financial constraints extend beyond legal status, with the lack of *loan surety* emerging as the second most significant barrier, affecting 34.5% of respondents. The problem is particularly acute in Chitumba (25%) and Kanyelele (21%), suggesting these communities have underdeveloped systems for collateral or guarantor networks. This persistent challenge across sites with varying production levels indicates that operational success alone does not translate into financial access,

highlighting the need for alternative credit mechanisms tailored to the ASGM sector's unique circumstances.

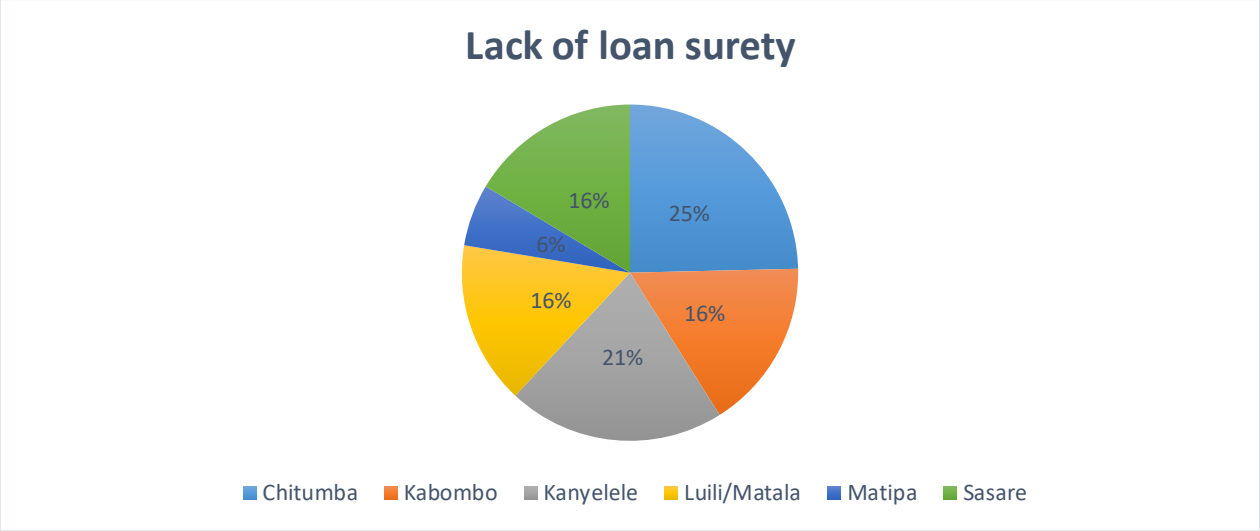


Figure 49: Lack of Loan Surety

According to figure 50, *production capacity limitations* present another critical barrier, though its impact varies significantly by location. While only 11.1% of miners overall cite this as their primary funding challenge, the problem is concentrated in specific sites like Kanyelele (30%), suggesting either inferior ore quality or inefficient extraction methods at these locations. The stark contrast with Sasare (5%), where few miners report capacity issues, underscores how geological and technical factors create site-specific financial constraints. These disparities indicate that solutions must be tailored to local conditions, combining financial support with technical assistance where needed.

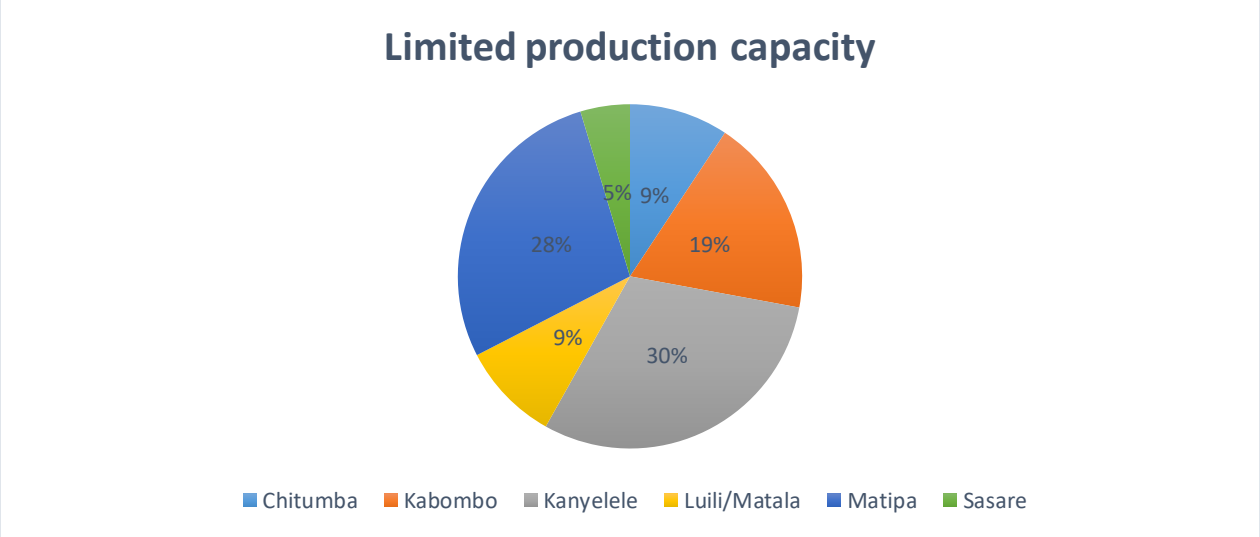


Figure 50: Production capacity limitations

According to figure 51, a notable minority of miners (10.8%) express *no interest in seeking formal funding*, with particularly high disengagement in Luili/Matala (27%) and Kanyelele (22%). This phenomenon may reflect either satisfaction with existing informal financing mechanisms or deep-seated distrust of formal financial institutions stemming from historical exclusion. The concentration of this attitude in specific locations suggests cultural or institutional factors may be at play, warranting further investigation to understand the root causes of financial disengagement in these communities.

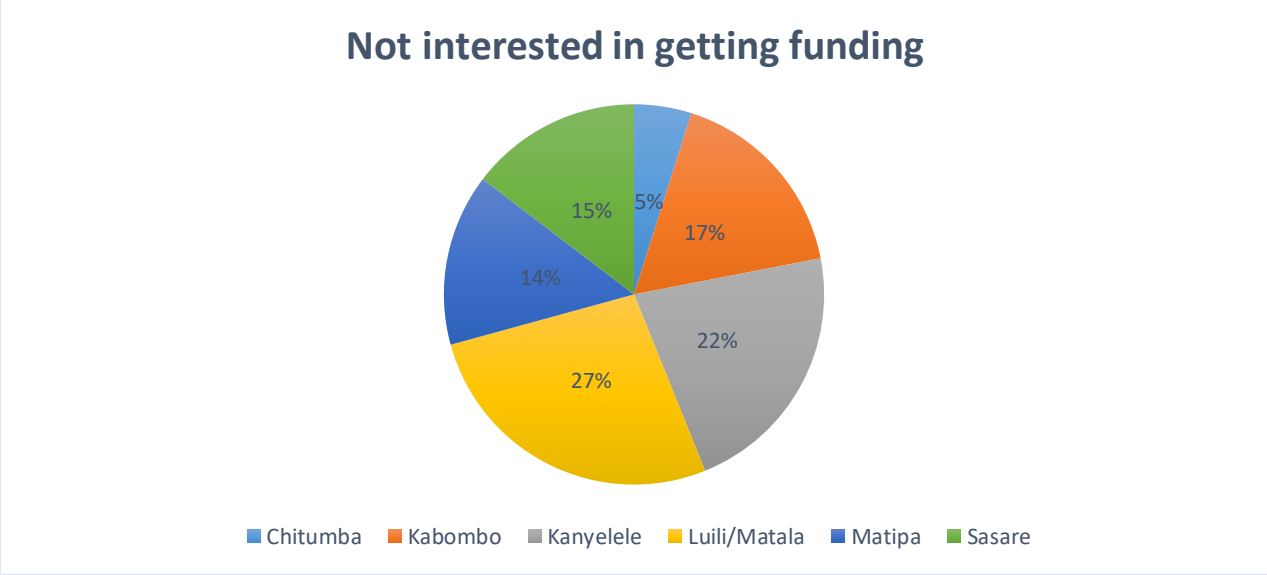


Figure 51: no interest in seeking formal funding

According to figure 52, *documentation gaps*, while affecting a smaller proportion of miners overall (4.9%), emerge as a significant localized challenge in Luili/Matala (42%) and Kanyelele (32%). This finding reveals that even in relatively productive mining areas, poor record-keeping practices can hinder miners' ability to demonstrate creditworthiness to potential lenders. The concentration of this issue in specific locations points to the need for financial literacy programs and simple record-keeping tools tailored to miners' needs and capabilities.

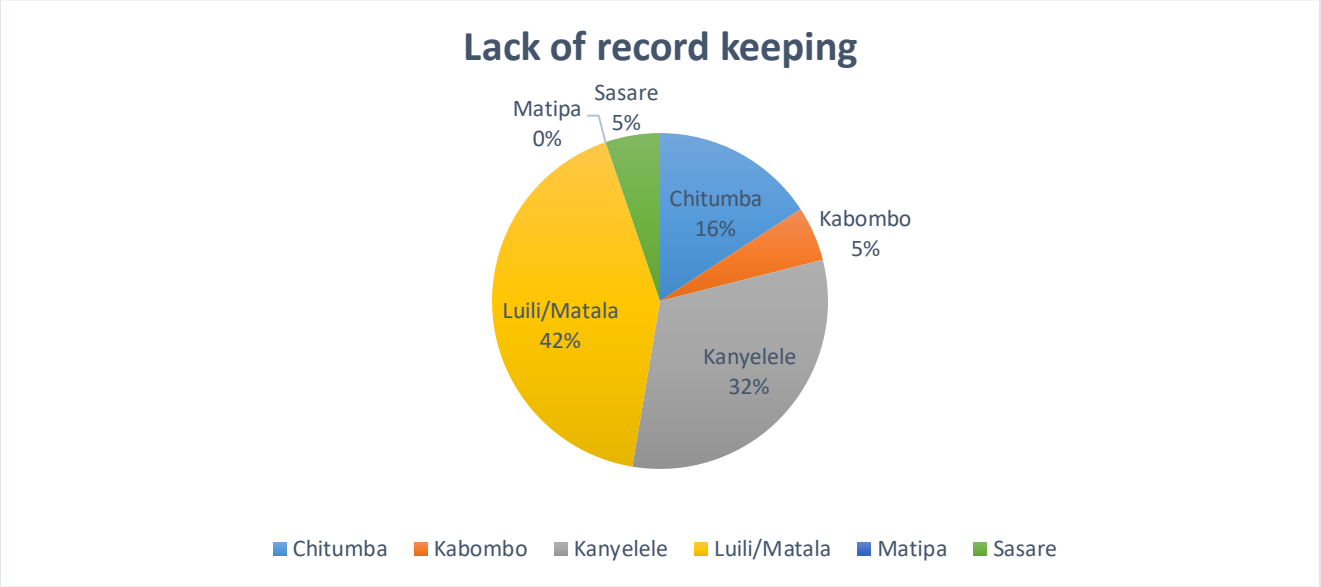


Figure 52: Documentation gaps

Policy Implications

1. Formalisation programs should be prioritized, especially in Kabombo and Sasare where illegality is most cited. This could include simplified registration processes and amnesty periods.
2. Alternative collateral systems are needed, particularly in Chitumba. Options could include equipment financing, gold purchase agreements as collateral, or group lending models.
3. Site-specific solutions are required - Matipa needs production support while Luili/Matala may benefit from record-keeping assistance. A blanket approach would likely fail.
4. Financial literacy programs could address the "not interested" cohort, helping miners understand how funding could improve their operations.

The data paints a picture of a sector trapped in informality, where even productive miners cannot access growth capital due to systemic barriers rather than lack of potential. Addressing these challenges requires nuanced, location-specific solutions that recognize the diverse needs across mining sites.

Site-Specific Gold Production & Sales Analysis

Chitumba (Vubwi District): Chitumba's miners operate at the margins of viability, with 33.9% extracting less than 0.5g per cycle and 43.6% producing only 0.5–1g. These meagre yields reflect reliance on manual techniques like panning, which cap productivity. Monthly sales are minimal, with 74.2% of miners selling under 10g, reinforcing subsistence-level operations. The market is entirely buyer-controlled, with no participation from the Zambian Gold Company (ZGC), leaving miners powerless in price negotiations. Informality is extreme: 98.4% lack sales records, and no receipts are issued, exposing miners to systematic underpayment. Without intervention, this cycle of low yields and exploitative pricing will persist.

Kabombo (Rufunsa District): Kabombo's production is middling, with 26.5% of miners yielding 0.5–1g per cycle and 38.2% reaching 1–5g. Yet 80.9% sell at depressed prices (~42–83 USD per gram), as 94.2% report no pricing autonomy. Foreign buyers such as Somali, Swahili, and Zimbabwean traders make up 17.7% of the market, hinting at informal cross-border trade, but their presence does not improve transparency. Only 12.9% of miners receive receipts, and ZGC engagement is rare (8.6%), suggesting most gold flows untracked into regional shadow markets.

Kanyelele (Mpika District): Kanyelele stands out for strong production, with 54.9% of miners extracting 1–5g per cycle and 12.1% achieving 10–15g. Sales volumes reflect this: 24.2% sell 100–200g monthly, and 91.9% command premium prices (~83–167 USD per gram). However, processing plant owners dominate pricing (22.5%), and while 62.2% keep sales records, only 8.0% receive receipts. ZGC's absence is glaring here despite this site's high output, making it ideal for formalisation, yet miners remain locked in semi-informal channels.

Luili/Matala (Mumbwa District): Luili/Matala's production is bifurcated: 42.3% yield 1–5g, but a significant 11.3% produce 25–50g, likely due to semi-mechanization. High-volume sales (15.5% sell 200–500g/month) and decent pricing (69.0% at ~83–167 USD per gram) underscore this advantage. Yet plant owners dictate terms (43.7%), and ZGC sales are rare (28.2%). Though 28.6% keep records, receipts are virtually non-existent. Without formal buyers, miners cannot leverage their output for better terms.

Matipa (Chisamba District): Matipa's miners are low-volume producers (52.8% yield 0.5–1g), yet 55.6% achieve favorable prices (~83–167 USD per gram), making it a rare bright spot. This may stem from localized demand or niche buyer networks, but the dominance of Zambian individual traders (34.3%) perpetuates cash-based informality. Documentation is weak (19.4% keep records; 97.4% lack receipts), and ZGC is absent. Understanding why prices defy trends here could inform strategies elsewhere.

Sasare (Lusangazi District): Sasare's miners face the harshest conditions: 50.9% produce just 0.5–1g, and 10.2% extract under 0.5g. A staggering 89.8% sell at rock-bottom prices (~42–83 USD per gram), with 71.2% reporting total buyer control. Processing plant owners (37.3% of buyers) exploit the lack of alternatives, and ZGC engagement is non-existent. Not a single miner receives receipts, and 98.3% lack records, creating a vacuum of accountability that demands urgent formalisation.

4.6 Chapter Conclusion

The analysis of Zambia's mining sector reveals a complex landscape where Artisanal and Small-Scale Gold Mining (ASGM) continues to operate with significant technical, economic, and environmental challenges. The predominance of manual extraction methods, coupled with widespread mercury use (averaging **2.56g Hg per (g) Au** mercury-to-gold ratio, highlights critical health and ecological risks that demand immediate intervention. While miners demonstrate strong work engagement (averaging 25 operational days monthly), their productivity remains constrained by inefficient processing (0.543 tonnes ore per cycle yielding 6.7g of gold) and reliance on informal markets where pricing remains buyer dominated.

The sector's fragmentation is evident in the varied deposit types (41% mixed alluvial/reef, 34% reef-only, 25% alluvial-only) and stark productivity differences between sites - from Kabombo's low-yield operations

(<0.5 tonnes of ore per cycle) to Luili/Matala's more productive semi-mechanized work (1-5 tonnes of ore per cycle). This diversity underscores that solutions cannot be one-size-fits-all. The near-total lack of formalisation (94% undocumented transactions, 98% lack of institutional support) perpetuates a cycle of exploitation and environmental degradation, while the legal aggregators minimal market penetration (0.26% regular engagement) represents a missed opportunity for sectoral transformation.

4.7 Chapter Recommendations

To drive meaningful reform in Zambia's ASGM sector, a multi-pronged approach must be implemented with urgency. Firstly, site-specific formalisation programmes should be developed to address the diverse operational realities across mining locations. For reef gold sites like Kanyelele and Luili/Matala, this means providing mechanization support through equipment leasing programmes and technical training on ore processing. Alluvial sites such as Chitumba require targeted mercury-free training programmes and the introduction of gravity separation technologies, while challenging terrains like Sasare need improved transport infrastructure to reduce production bottlenecks. Mobile registration units should be deployed to document miners and track production volumes, creating the foundation for a more transparent sector.

The mercury crisis demands immediate, decisive action through a phased elimination strategy. High-use sites including Kabombo and Sasare should be prioritized for enforcement of mercury bans, coupled with the introduction of practical alternatives. This includes establishing centralised processing facilities where miners can access Mercury Free Processing Systems (MFPS) and support, implementing gold premium incentives for mercury-free production, and conducting on-site demonstrations of safer techniques. Parallel efforts must focus on disrupting mercury supply chains through stricter border controls and monitoring of chemical traders, while health outreach programmes educate communities about the dangers of mercury exposure.

Market reforms and financial inclusion measures are equally critical to transform the sector's economic dynamics. The local legal aggregators must evolve from their current passive role to an active market participant by setting up buying centres at all major sites with transparent, competitive pricing. Digital receipt systems should be mandated for all transactions to create an auditable gold trail, while innovative financial products - such as advance purchasing agreements and receipt-based microloans - would provide miners with much-needed capital. These measures should be complemented by efforts to integrate ASGM gold into formal supply chains through partnerships with accredited refineries and responsible jewellery initiatives.

Productivity enhancement programmes represent the fourth pillar of reform. Mid-scale operators processing 1-5 tonnes daily should be prioritized for equipment leasing programmes, cooperative mining models, and advanced technical training in grade control. This "productive middle" demonstrates the greatest potential for scaling up operations. The government should work with technical institutes to develop localized solutions for ore processing challenges, particularly for sites struggling with low recovery rates. Infrastructure investments in water management, access roads, and processing centres would significantly reduce current productivity losses.

Finally, robust monitoring and enforcement systems must underpin all interventions. Mobile testing units should be deployed to regularly monitor mercury levels in water and soil, while also certifying mercury-free gold for premium markets. A digital documentation system for gold flows would enhance traceability and reduce leakages to informal channels. These technical measures must be paired with stronger regulatory oversight, including periodic site inspections and consequences for non-compliance with environmental standards. Crucially, all interventions should be implemented through collaborative partnerships between government agencies, miners' cooperatives, and technical experts, with clear benchmarks for reducing mercury use and increasing formal participation over defined timeframes. Only through such comprehensive, coordinated action can Zambia unlock the ASGM sector's potential as a driver of sustainable rural development.

Table 29: Finding, Conclusions and Recommendations for Mining Practices

Findings	Conclusions	Recommendations
- Widespread mercury use (2.56g Hg/ (g) Au; 2.56:1 mercury-gold ratio)	- There is health/ecological crisis requiring immediate intervention	1. Mercury Elimination Strategy:
		- Ban mercury at high-use sites and provide a phase out plan - Mobile mercury testing units
		- Create centralised Mercury Free Processing Systems (Centrifugal concentrators and gravity processing methodology that mining cooperatives can rent at a fee per day or month)
		- Implement gold premiums for mercury-free production by giving a 10% price boost for mercury-free gold.
		- Strengthen border controls on mercury supply
- Low productivity: 0.543 tonnes of ore yields 6.7g of gold	- Inefficient processing constrains economic viability – the use of manual methods results in ore wastage and low productivity. Semi-mechanised sites such as Luili/Matala showed 5x higher yields	**2. Site-Specific Formalisation:**
		- Mechanization leasing; creating an equipment leasing program to allow more miners to have access to mechanised mining technologies.
		- Mercury-free training for all sites
		- Improve transport infrastructure for remote sites so as to reduce on transport costs
- Market fragmentation: 94% undocumented transactions, 98% no institutional support	- Informal operations perpetuate exploitation, middlemen dominate pricing. The study concluded that miners lose 20-30% of gold value due to market failure.	**3. Market Reforms:**
		- The Government to establish buying centres to capture at least 90% of all gold produced in ASGM sites
		- Digital receipt systems for all transactions

		- There is need to create advance purchasing agreements/microloans
- Diverse deposit types: 41% mixed, 34% reef, 25% alluvial	- Solutions must be context-specific	**4. Productivity Enhancement:**
		- Equipment leasing for mid-scale operators (1-5t/day)
		- Cooperative mining models
		- Technical training in grade control
- Legal Aggregator engagement: Only 0.26% regular participation	- Missed institutional opportunity	**5. Monitoring & Enforcement:**
		Awareness and capacity building on legal markets and gold supply chains
		- Digital gold documentation system
		- Periodic site inspections
- Productivity variations: Kabombo (<0.5 tonnes per cycle) vs Luili/Matala (1-5 tonnes per cycle)	- "Productive middle" offers scaling potential	**6. Infrastructure Investment:**
		- Water management systems
		- Access road improvements
		- Centralized processing centres

5. Mining Safety, Occupational Health, and Environmental Standards

Chapter 5: Summary

This chapter examined mining safety, occupational health, and environmental standards, revealing severe systemic failures. Key findings include:

Safety Failures: 66.8% of pits lack structural support, 90.0% have no security measures, and 73.5% of miners do not use PPE. Safety awareness is critically low, with 72.8% of workers never receiving safety instructions.

OHS Gaps: Only 20.8% of miners strictly follow OHS protocols, and 76.4% of sites lack designated safety officers. Luili/Matala and Sasare report the highest observed risks (71.8% and 66.1%, respectively), indicating urgent need for intervention.

Environmental Neglect: 93.3% of sites have no rehabilitation plans, while improper waste disposal (e.g., bush dumping at 32.6% and stream discharge at 25.1%) exacerbates ecological harm. Only 1.3% of pits are properly buried post-mining.

The baseline results underscore an urgent need for regulatory reforms, enforcement of safety and environmental standards, and targeted training programmes. Without immediate action, miners will remain at high risk of injury or death, and ecosystems will suffer irreversible damage. Addressing these challenges requires collaboration between governments, mining companies, and communities to ensure safer, sustainable practices industry wide.

5.1 Mining Safety Standards

The findings on pit structure support materials reveal critical safety failures across the surveyed mining sites. A staggering 66.8% of miners work in completely unsupported pits, exposing them to extreme risks of collapses and fatalities. This dangerous practice according to table 30 and figure 53, is particularly prevalent in Chitumba (93.7%), Luili/Matala (90.1%), and Matipa (97.1%), where nearly all operations lack basic structural reinforcement. While wood is used in 20.2% of cases - primarily in Kabombo (55.8%) and Sasare (33.9%) - its limited strength makes it an inadequate solution compared to metal or combined supports. Alarmingly, only 2.9% of sites employ the safer wood-metal combination, highlighting a systemic failure to adopt best practices in mine safety.

Table 30: Pit Structure Support Materials by Mining Site

Support Type	Chitumba (Vubwi)	Kabombo (Rufunsa)	Kanyelele	Luili/Matala(Mumbwa)	Matipa (Chisamba)	Sasare (Lusangazi)	Total
No support used	93.7%	19.1%	65.6%	90.1%	97.1%	49.2%	258
Wood only	6.4%	55.9%	13.3%	4.2%	2.9%	(33.9	78
Metal only	0%	1.5%	0%	0%	0%	0%	1
Wood & metal combined	0%	5.9%	1.1%	4.2%	0%	5.1%	11
Other materials	0%	17.7%	15.6%	0%	0%	11.9%	33
Total	63	68	90	71	35	59	386

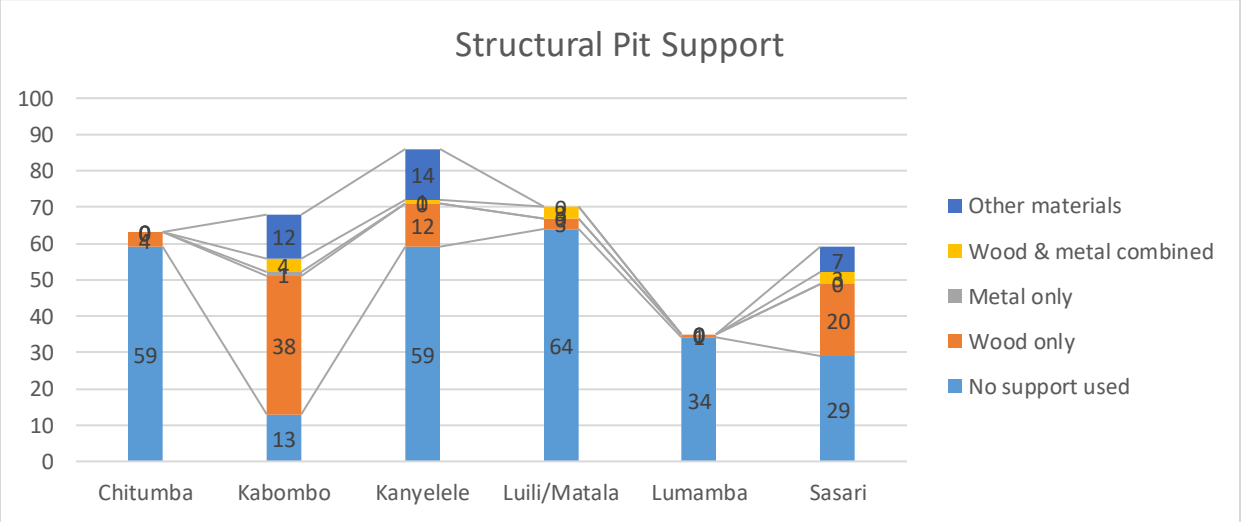


Figure 53: Structural Pit Support by site

The widespread absence of proper pit supports suggests multiple underlying issues, including lack of safety awareness, inadequate regulatory enforcement, and limited access to proper materials. The predominance of unsupported pits in certain locations may reflect either economic constraints preventing investment in safety measures or a cultural normalization of hazardous working conditions. The minimal use of metal supports (just 0.3%) points to potential supply chain challenges or cost barriers. These findings demand immediate action, starting with mandatory safety standards for all mining operations and targeted interventions in high-risk sites. Without urgent measures to improve pit support systems, miners will continue facing unacceptable and preventable dangers in their daily work.

Figure 54: Unsecured Mining Pits in Mumbwa

The data in table 31 on pit security measures reveals significant gaps in safety protocols across mining sites, with a staggering 90.0% of respondents reporting they "do not secure" their pits at all. This concerning trend is particularly prevalent in Kanyelele (92.2%), Luili/Matala (95.8%), and Matipa (100.0%), where nearly all operations lack basic protective measures. Only minimal efforts were recorded in pit security, with just 4.2% of sites using barriers and a mere 0.5% implementing pit covering systems - primarily in Kanyelele. Kabombo showed slightly better practices, accounting for 53.3% of the "other" security measures (15 cases total) and 43.8% of barrier placements (16 cases), suggesting some variation in safety implementation. The near-universal absence of warning signs (just 0.3% usage) and comprehensive security systems highlights a critical need for standardized safety protocols and enforcement across all mining operations to prevent accidents and protect workers.

Table 31: Pit Security Measures by Mining Site

Security Measure	Chitumba (Vubwi)	Kabombo (Rufunsa)	Kanyelele	Luili/Matala(Mumbwa)	Matipa (Chisamba)	Sasare (Lusangazi)	Total
No security	98.4%	75.0%	92.2%	95.8%	100%	80.4%	341
Barriers only	1.6%	10.9%	0%	0%	0%	14.3%	16
Pit covering	0%	0%	1.1%	1.4%	0%	0	2
Warning signs	0%	1.6%	0%	0%	0%	0	1
Other measures	0%	12.5%	3.3%	1.4%	0%	5.4%	15
Total	**63**	**64**	**90**	**71**	**35**	**56**	**379**

These findings suggest that current pit security measures are dangerously inadequate, leaving workers exposed to significant fall and collapse hazards. The concentration of minimal security efforts in specific sites like Kanyelele and Kabombo indicates that safety practices are inconsistent and often neglected. Given that most mines operate without any protective measures, regulatory intervention is urgently needed to mandate basic safeguards such as barriers, warning signs, and pit covers. Without immediate improvements, the high rate of unsecured pits (90.0%) will continue to pose severe risks to miner safety, potentially leading to preventable accidents and fatalities.

According to figure 55, the data reveals alarmingly low compliance with essential Personal Protective Equipment (PPE) usage across mining sites, with **73.5%** of workers reporting they do not use any protective gear at all. This widespread non-compliance exposes miners to preventable hazards that proper PPE – including hard hats (safety helmets), safety boots, protective work suits/vests with reflectors, face masks, gloves, ear protection, and eye protection (goggles) – is specifically designed to mitigate. Only a minimal 3.6% of workers consistently use this critical equipment, while 22.9% use it only sometimes, indicating that even basic, intermittent protection is rare.

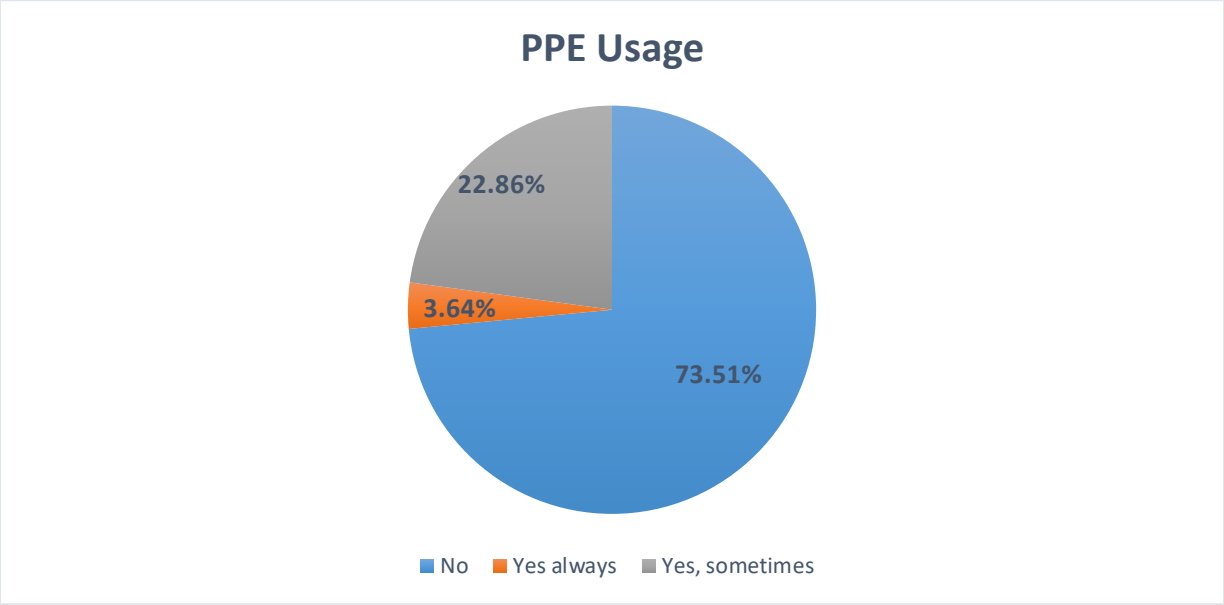


Figure 55: PPE Usage

According to table 32, the particularly poor performance in Chitumba (95.2% non-compliance), Kanyelele (79.8%), and Matipa (91.4%) suggests systemic safety failures in these locations, where workers routinely operate without this fundamental protective gear. These findings highlight a dangerous disregard for basic mining safety protocols that require immediate intervention to prevent occupational injuries, respiratory illnesses, hearing loss, and fatalities from falling objects or chemical exposures.

The variation between sites offers important insights, with Kabombo (20.3%) and Luili/Matala (62.9%) demonstrating relatively higher – though still inadequate – rates of occasional PPE use. This disparity suggests that while proper helmet, boot, glove, and eye protection practices are generally insufficient

across all sites, some locations have implemented marginally better access to or enforcement of these safety essentials. The fact that no site achieves even 25% consistent usage of this basic protective equipment underscores the need for standardized provision of PPE, coupled with training on its proper use for dust protection, impact prevention, and visibility. The high non-compliance rates particularly endanger miners working without hard hats (risk of head trauma), safety boots (crush injuries), or reflective vests (vehicle collisions). Addressing these gaps requires not just regulation but practical solutions like comfortable, climate-appropriate PPE designs and on-site enforcement to ensure workers are protected from the head to toe in these hazardous environments.

Table 32: ppe_usage mining_site

ppe_usage	mining_site					
	Chitumba (Vubwi)	**Kabombo (Rufunsa)**	**Kanyelele**	**Luili/Matala(Mumbwa)**	**Matipa (Chisamba)**	**Sasare (Lusangazi)**
No	95.2%	69.6%	79.8%	34.3%	91.4%	81.4%
Yes always	1.6%	10.1%	1.1%	2.9%	2.9%	3.4%
Yes, sometimes	3.2%	20.3%	19.1%	62.9%	5.7%	15.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

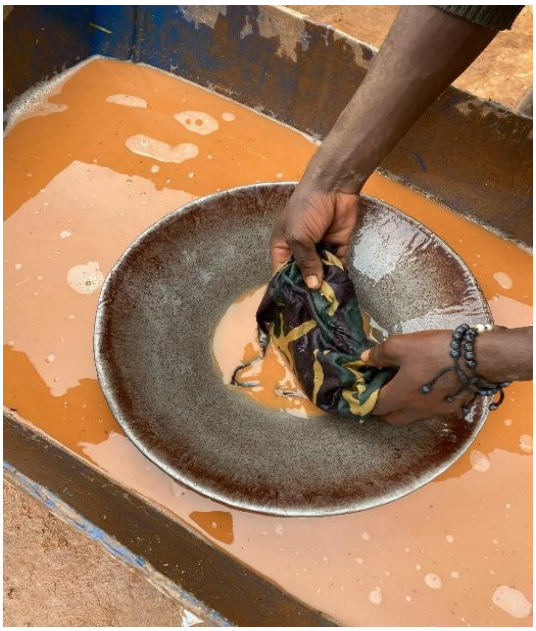
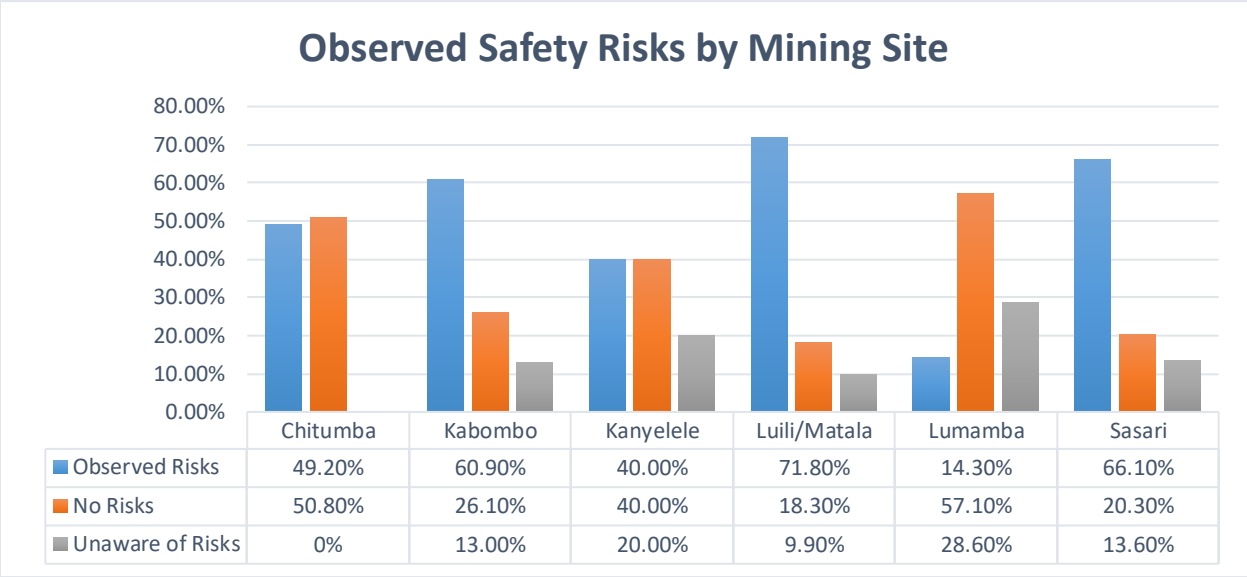


Figure 56: Miner handling Mercury Amalgam without any PPE

According to figure 57, the data reveals that 52.8% of miners reported observing safety risks in their workplaces, indicating that more than half of workers are exposed to hazardous conditions. Luili/Matala (71.9%) and Sasare (66.1%) stand out as the most concerning sites, with significantly higher risk observations compared to others—suggesting either greater hazards or better risk awareness in these locations. Meanwhile, 33.9% of miners claimed to see no risks, which could reflect either genuinely safer conditions or, more worryingly, a lack of hazard recognition due to insufficient training. Additionally, 13.4% were unaware of risks, highlighting gaps in safety education. These findings underscore the need for enhanced risk assessments, targeted safety training, and improved hazard reporting systems, particularly in high-risk sites like Luili/Matala and Sasare, to mitigate preventable accidents and ensure worker safety.



	Chitumba	Kabombo	Kanyelele	Luili/Matala	Lumamba	Sasari
Observed Risks	49.20%	60.90%	40.00%	71.80%	14.30%	66.10%
No Risks	50.80%	26.10%	40.00%	18.30%	57.10%	20.30%
Unaware of Risks	0%	13.00%	20.00%	9.90%	28.60%	13.60%

Figure 57: Observed Safety Risks by Mining Site

According to figure 58, the data reveals that lack of PPE is the most frequently reported safety risk across all mining sites (39.5% of total reports), with Chitumba (67.7%) and Kabombo (43.9%) being the most affected. Pit instability and collapses follow as critical hazards (17.3%), particularly in Kanyelele (22.9%) and Sasare (20.5%). Notably, open/unsecured pits are a major concern in Kanyelele (28.6%) and Luili/Matala (17.6%), while falling rocks disproportionately affect Kabombo (9.8%) and Sasare (12.8%). Luili/Matala reports the highest rate of general injuries (23.5%), often linked to unsafe tools or poor training.

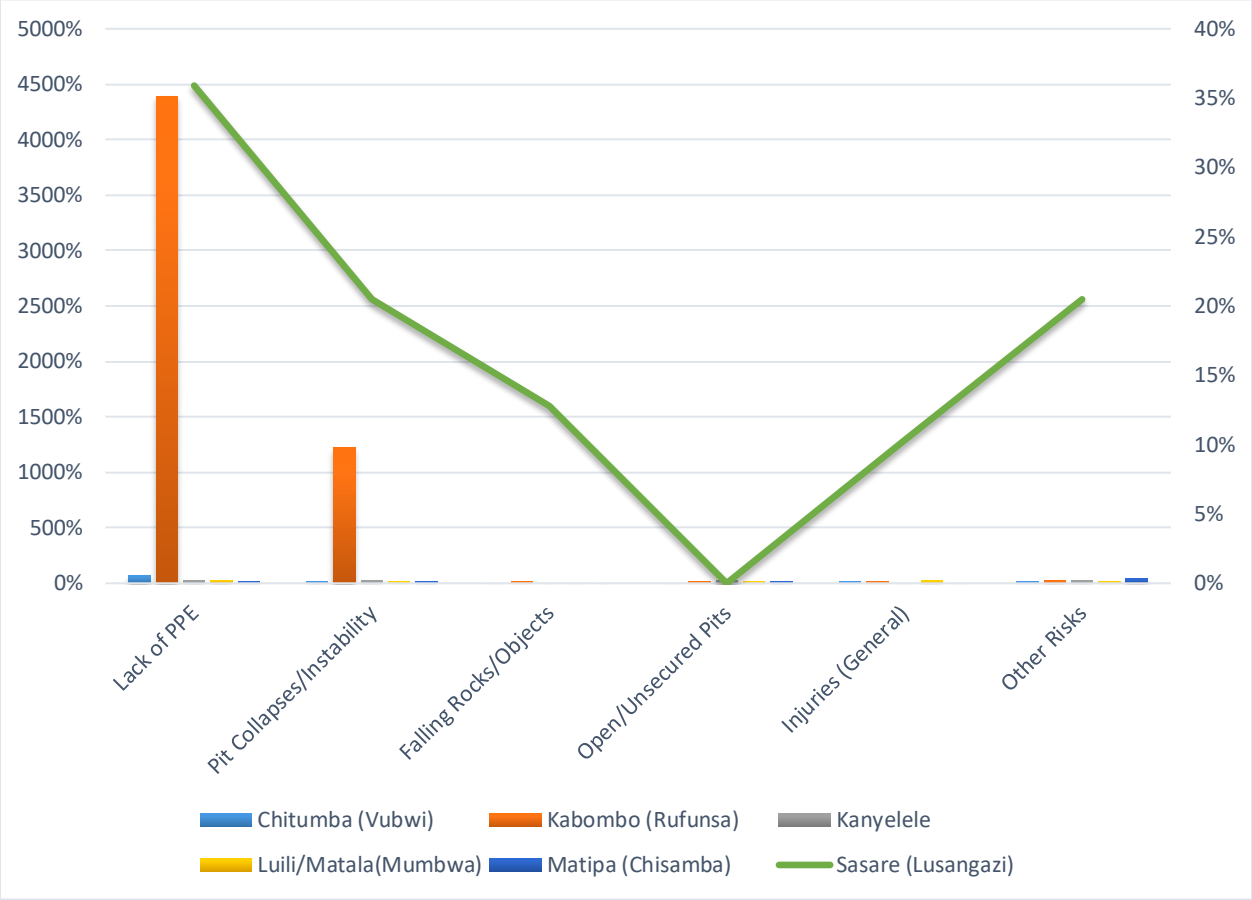


Figure 58: Reported Safety Risks by Mining Site

The findings underscore systemic gaps in PPE provision, pit structural integrity, and hazard monitoring. Sites like Chitumba and Kabombo urgently need PPE enforcement, while Kanyelele and Luili/Matala require focus on pit stabilization and safety protocols. The low reporting from Matipa (only 5 cases) may indicate underreporting rather than safer conditions. Addressing these risks demands site-specific interventions, including mandatory PPE, pit reinforcement, and worker training to mitigate preventable accidents.

5.1.1 Safety Awareness (Safety Tips)

According to figure 59, the data reveals a critical gap in safety awareness among miners, with 72.8% reporting they never received any safety tips. This widespread lack of training highlights a systemic failure in occupational safety education, leaving the majority of miners vulnerable to preventable hazards. A small fraction (19.1%) confirmed receiving safety instructions, with Luili/Matala (27.1%) and Kabombo (50.0%) performing relatively better though still insufficient. Additionally, 8.1% of miners were completely unaware of whether safety tips were provided, with Kanyelele (22.5%) having the highest proportion of uninformed workers. These findings suggest that safety communication is either inconsistent, poorly implemented, or entirely absent in most mining operations, increasing the risk of accidents and injuries.

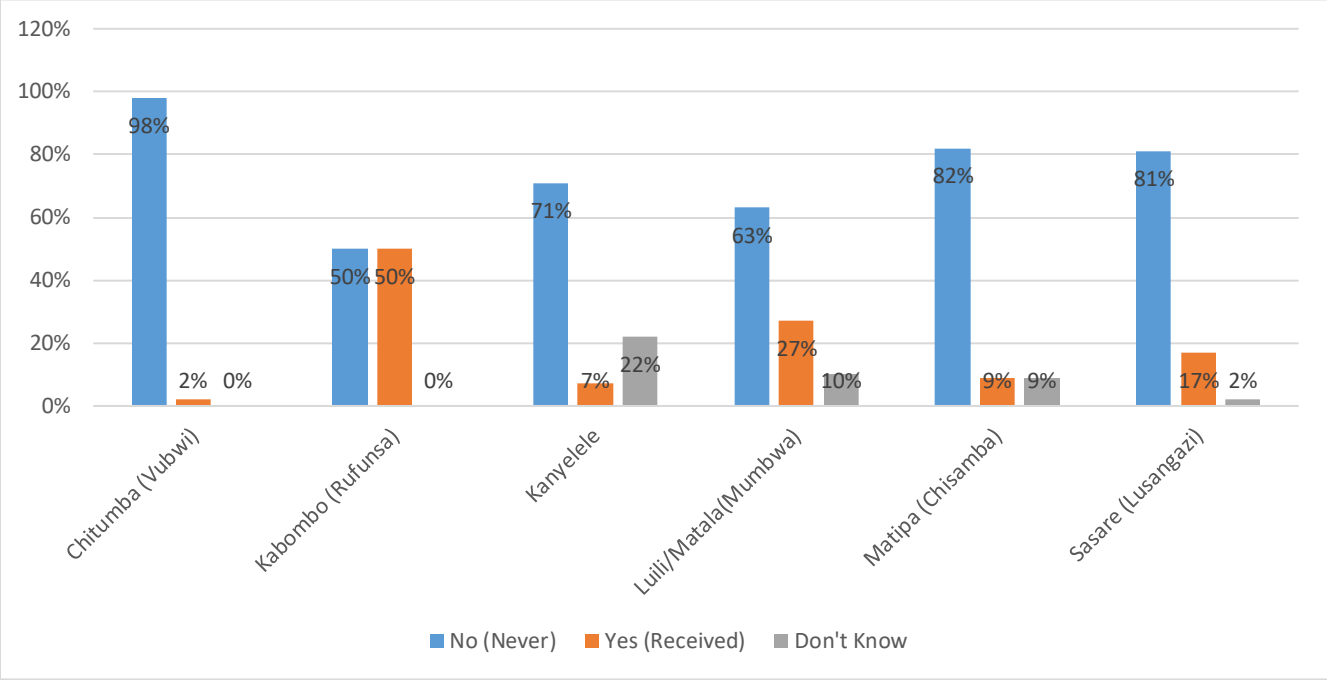


Figure 59: Safety Tips Awareness by Mining Site

5.1.2 Frequency of Safety Tips (When provided)

According to table 33, among the few miners who did receive safety tips, 77.8% stated that they were reminded less than 10 times a month, indicating that even when safety messaging exists, it is infrequent and likely ineffective. Kabombo (66.7%) and Luili/Matala (94.7%) were the only sites where safety reminders were provided more regularly, yet the overall low frequency suggests that safety training is not a consistent priority. Given that mining is a high-risk occupation, sporadic safety briefings are inadequate to instill proper hazard awareness and safe practices. The lack of structured, frequent safety communication further exacerbates workplace risks, reinforcing the need for mandatory, routine safety drills and training sessions across all mining sites to ensure workers are consistently informed and protected.

Table 33: Frequency of Safety Tips (When provided)

Frequency	Chitumba (Vubwi)	Kabombo (Rufunsa)	Kanyelele (Mpika)	Luili/Matala(Mumbwa)	Matipa (Chisamba)	Sasare (Lusangazi)	Total
<10 times/month	100%	67%	67%	95%	67%	90%	78%
10-15 times/month	0%	15%	33%	5%	0%	0%	11%
15-20 times/month	0%	6%	0%	0%	33%	10%	6%
20-25 times/month	0%	12%	0%	0%	0%	0%	6%
Total	**1**	**33**	**6**	**19**	**3**	**10**	**72**

5.2 Mining Occupational Health and Safety (OHS) Compliance

5.2.1 Analysis of Occupational Health and Safety (OHS) Compliance in Mining Sites

According to figure 60, the data reveals a concerning landscape of OHS compliance across mining operations, with significant variations between sites. While a majority of miners (76.4%) reported attempting to follow OHS guidelines, this suggests only partial or inconsistent adherence to safety protocols. The relatively low proportion of workers who strictly comply with standards (20.83%) highlights systemic challenges in safety implementation, with particularly strong performance only in Sasare (60.0% strict compliance) and moderate compliance in Kabombo (23.5%).

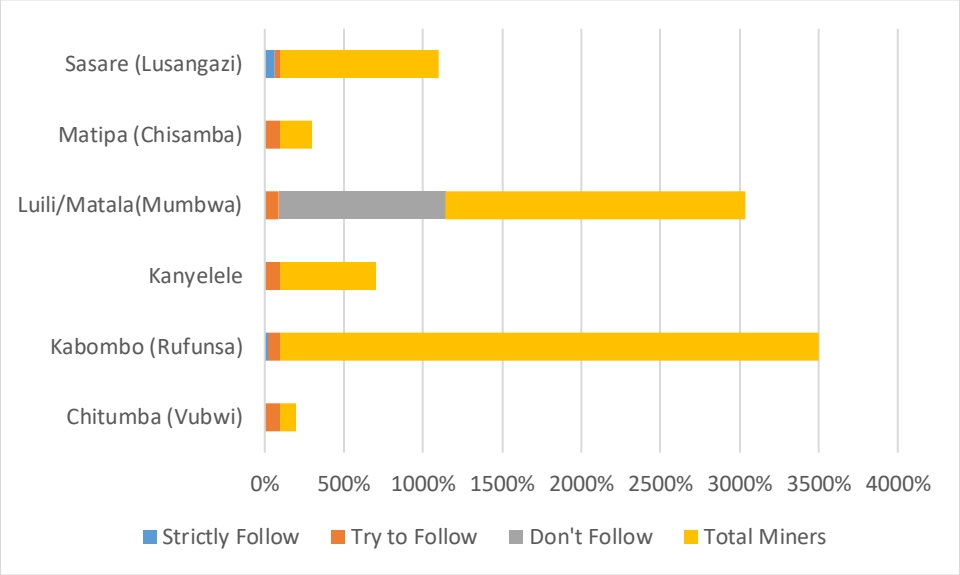


Figure 60: OHS Compliance by Mining Site

The findings indicate a troubling gap between awareness and actual practice, where most workers demonstrate willingness but potentially lack proper training, resources, or supervision to fully implement safety measures. The concentration of non-compliance in Luili/Matala (2.8%) suggests this site may require targeted interventions. The stark contrast between high-performing Sasare and other locations implies that effective OHS implementation is possible but not consistently achieved. These results underscore the need for standardized training programs, better safety supervision, and accountability mechanisms to bridge the gap between attempted and strict compliance, particularly in sites lagging behind the best performers.

According to table 34, the data reveals significant gaps in occupational health and safety (OHS) leadership across mining operations. A striking 76.4% of miners reported having no designated OHS officer, indicating a systemic lack of formal safety oversight at most sites. This absence of dedicated safety personnel likely contributes to the weak compliance and high-risk levels observed in other findings.

Table 34: OHS Responsible Person by Mining Site

Responsibility Status	Chitumba (Vubwi)	Kabombo (Rufunsa)	Kanyelele	Luili/Matala (Mumbwa)	Matipa (Chisamba)	Sasare (Lusangazi)	Total
Designated Officer	0%	53.6%	3.4%	20%	5.6%	11.9%	16.3%
No Officer	98.4%	44.9%	85.4%	65.7%	86.1%	83.1%	76.4%
Unaware	1.6%	1.4%	11.2%	14.3%	8.3%	5.1%	7.3%
Total Miners	**63**	**69**	**89**	**70**	**36**	**59**	**386**

Only 16.3% of operations had an identified OHS officer, with Kabombo standing out as relatively well-organized (53.6%). The concentration of designated officers in Kabombo suggests this site may serve as a model for other locations. Meanwhile, 7.3% of workers were unaware of who held OHS responsibilities, reflecting poor safety communication in these operations.

These findings highlight:

1. A widespread lack of safety leadership at most sites

2. Kabombo's comparatively stronger safety structure, possibly explaining its better compliance rates
3. Communication failures about safety roles at some sites
4. An urgent need for standardized OHS officer appointments across all operations

The data suggests that appointing and properly communicating about OHS officers could be a crucial first step in improving overall mine safety performance. The significant variation between sites indicates that while some locations have implemented this basic safety measure, most have not, creating inconsistent safety standards across the mining sector.

5.3 Environmental Standards

5.3.1 Mine Rehabilitation Plans in Mining Sites

According to figure 61, the data reveals a severe lack of mine rehabilitation planning, with 93.3% of miners reporting no rehabilitation plans in place at their sites. This near-universal absence of environmental restoration strategies highlights a critical gap in sustainable mining practices, posing long-term risks of land degradation, water contamination, and ecosystem damage.

Only 2.3% of operations had rehabilitation plans, with minimal implementation in Kanyelele and Luili/Matala suggesting these sites may have marginally better environmental oversight, though still far below ideal standards. Additionally, 4.4% of workers were unaware of any plans, indicating poor communication or transparency regarding environmental management.

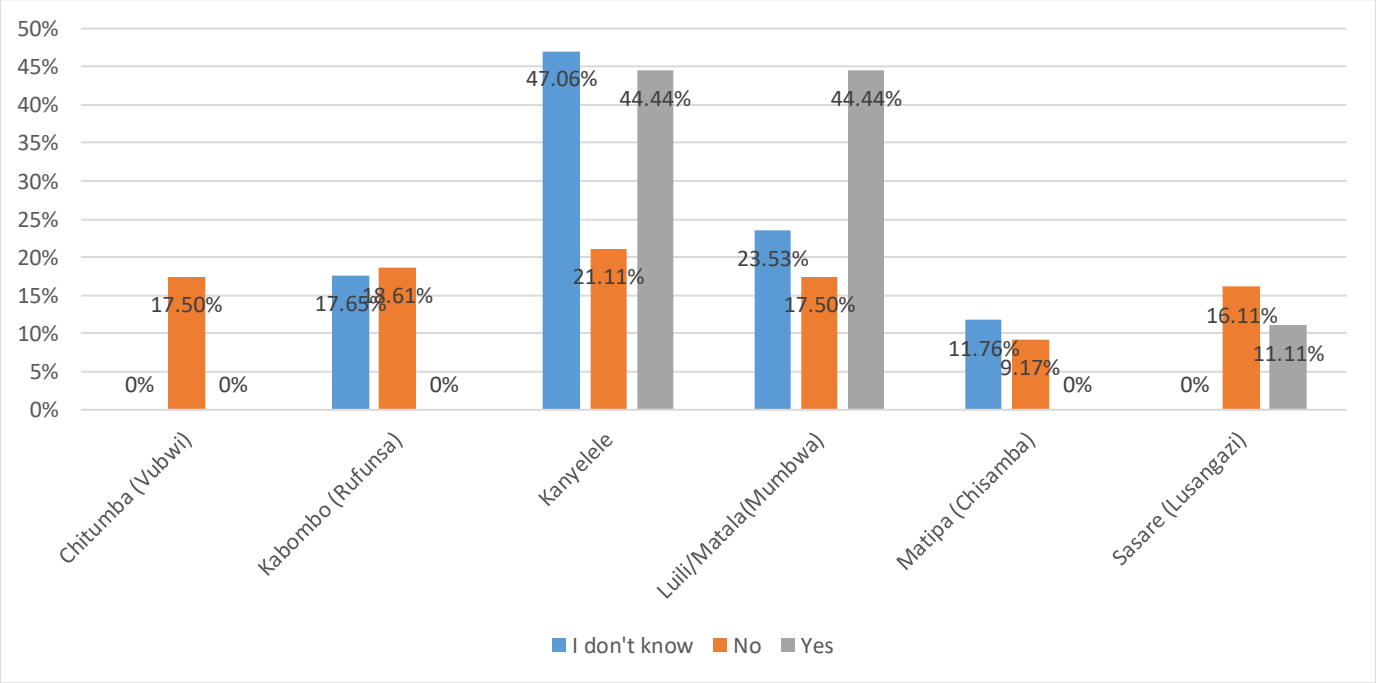


Figure 61: rehabilitation plan by mining site

Key Implications:

1. Environmental Risks: The lack of rehabilitation plans (93.3%) suggests widespread neglect of post-mining land restoration, increasing the risk of abandoned pits, soil erosion, and pollution.
2. Regulatory Gaps: The near-zero compliance (2.3%) implies weak enforcement of environmental regulations or a lack of policies mandating mine rehabilitation.
3. Worker Awareness Issues: The 4.4% unawareness rate indicates that even where plans might exist, they are not effectively communicated to workers.

The waste discharge data in figure 62 reveal alarming environmental practices across mining sites, with 32.6% of operations dumping waste directly into bushes and 25.1% discharging into water streams - particularly severe in Chitumba (93.7% water discharge) and Luili/Matala (71.8% bush dumping). These predominant methods pose critical risks of water contamination and land degradation, while proper disposal techniques like burying (1.8%) and burning (0.3%) are scarcely used. Site-specific patterns emerge clearly: Kabombo relies on undocumented "other" methods (82.9%), suggesting unregulated practices, while Kanyelele and Sasare show heavy reliance on bush dumping (35.2% and 37.9% respectively). The 2.3% unawareness rate among workers further indicates poor environmental oversight. These findings highlight systemic failures in waste management, demanding immediate interventions including enforced waste treatment systems, water discharge bans near sensitive areas like Chitumba, and standardized training programs. The near absence of sustainable disposal methods underscores the urgent need for regulatory reforms and environmental accountability measures across all mining operations to prevent irreversible ecological damage.

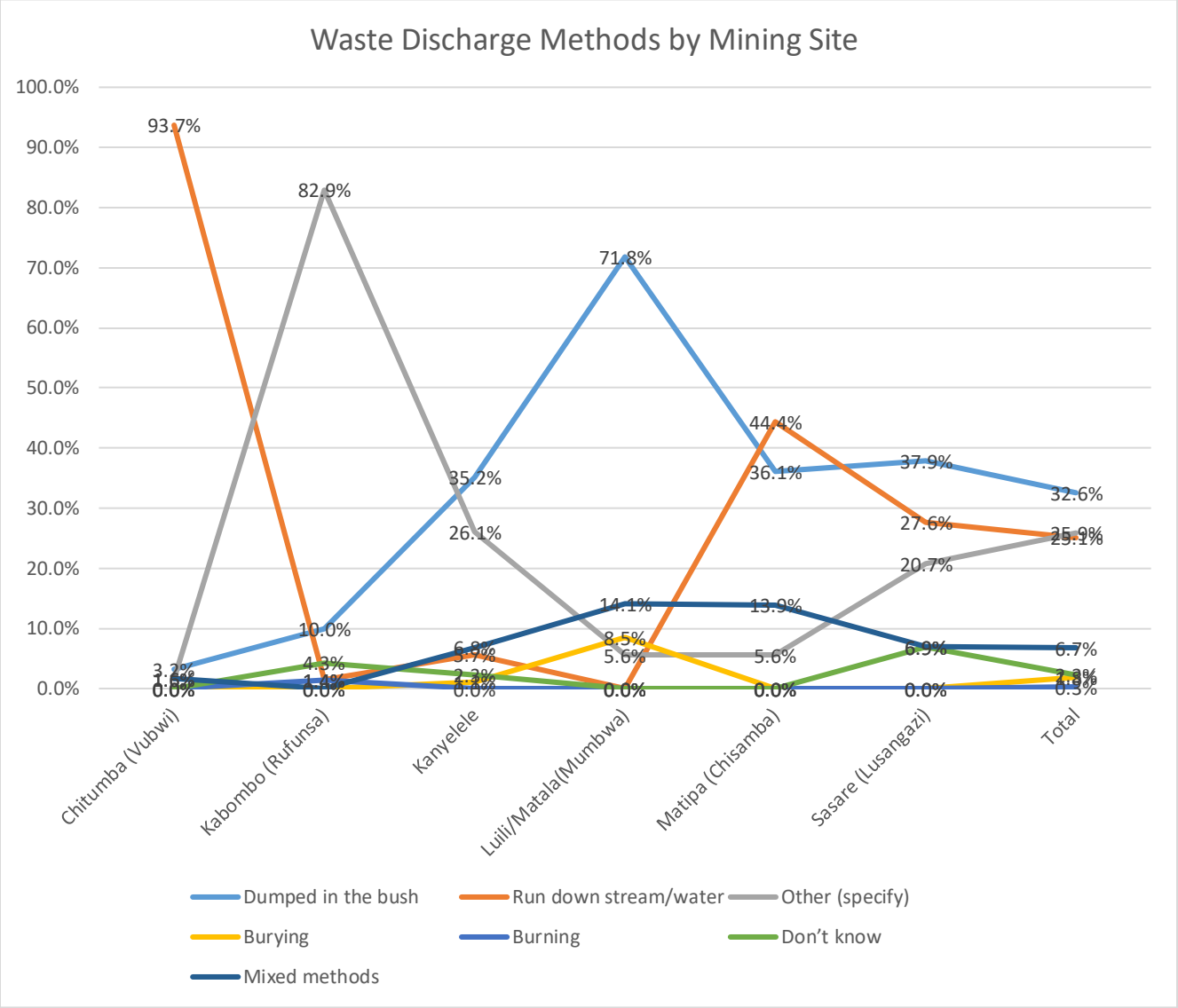


Figure 62: Waste Discharge Methods by Mining Site

The data in Table 35 reveals alarming deficiencies in mine rehabilitation practices across all surveyed mining sites. A staggering 72.1% of operations employ either complete abandonment (44.2%) or minimal effort approaches (27.9%) for pit rehabilitation, with only 1.3% implementing proper burial methods. This widespread neglect creates substantial environmental and safety hazards, including land degradation, water contamination risks, and physical dangers from open pits. The near-total absence of rehabilitation efforts suggests systemic failures in environmental stewardship and regulatory enforcement throughout the mining sector.

Significant variations emerge between sites, with Luili/Matala and Matipa showing particularly poor practices - half of their operations combine leaving pits open with other inadequate measures. Chitumba and Kabombo demonstrate the highest rates of complete abandonment (52.4% and 56.5% respectively), while Kanyelele stands out for its prevalent use of combined non-rehabilitation methods (46.7%). These

patterns indicate that while the problem is sector-wide, some locations require more urgent intervention than others. The minimal implementation of proper burial techniques (1.3% overall) underscores how basic environmental safeguards are being overlooked, with potentially severe consequences for local ecosystems and community safety.

Table 35: Pit Rehabilitation Methods by Mining Site

Rehabilitation Method	Chitumba (Vubwi)	Kabombo (Rufunsa)	Kanyelele (Mpika)	Luili/Matala (Mumbwa)	Matipa (Chisamba)	Sasare (Lusangazi)	Total
Leave pits open	52.4%	56.5%	41.1%	28.6%	36.1%	49.2%	44.2%
Leave pits open + Just leave	4.8%	2.9%	46.7%	50.0%	50.0%	13.6%	27.9%
Just leave	27.0%	33.3%	3.3%	10.0%	2.8%	23.7%	16.8%
Bury pits	0%	1.4%	2.2%	2.9%	0%	0%	1.3%
Other methods	15.9%	5.8%	6.7%	8.6%	11.1%	13.6%	9.8%
Total	**63**	**69**	**90**	**70**	**36**	**59**	**387**

These findings highlight three critical needs: immediate regulatory action to mandate rehabilitation standards, comprehensive training programs for miners on proper closure techniques, and establishment of monitoring systems for abandoned sites. The consistency of poor practices across nearly all locations suggests the problem stems from structural issues rather than isolated cases of non-compliance. Without swift intervention, the cumulative environmental damage from unrehabilitated mines will continue to escalate, creating long-term liabilities for both mining communities and operators.

5.4 Chapter Conclusion

The findings in this chapter reveal alarming deficiencies in mining safety, occupational health, and environmental standards across surveyed sites. The overwhelming lack of pit support structures (66.8% unsupported), minimal PPE usage (73.5% non-compliance), and near-total absence of mine rehabilitation plans (93.3%) underscore systemic failures in regulatory enforcement and safety culture. These shortcomings expose miners to severe occupational hazards, including pit collapses, respiratory illnesses, and environmental degradation. The variations between sites such as Kabombo's marginally better PPE usage and Sasare's relatively higher OHS compliance suggest that while some locations demonstrate partial adherence, overall practices remain dangerously inadequate. Without urgent intervention, these conditions will continue to endanger lives, degrade ecosystems, and perpetuate unsafe mining operations.

Furthermore, the lack of safety awareness (72.8% never receiving safety tips) and the absence of designated OHS officers (76.4% of sites) highlight critical gaps in safety leadership and worker training. The prevalent hazardous waste disposal methods such as dumping in bushes (32.6%) and discharging into

streams (25.1%) further illustrate the environmental negligence ingrained in current mining practices. These findings demand immediate regulatory reforms, standardized safety protocols, and site-specific interventions to mitigate risks. Addressing these issues is not only a matter of compliance but a moral and economic imperative to safeguard miners' lives and ensure sustainable mining practices.

5.5 Chapter Recommendations

To address the critical safety and environmental gaps identified, the following measures should be implemented:

1. *Mandate and Enforce Safety Standards:* Regulatory bodies must impose strict requirements for pit support structures (e.g., mandatory use of metal or combined supports), PPE provision, and routine safety training. High-risk sites like Chitumba and Matipa, where unsupported pits exceed 90%, should be prioritized for immediate inspections and enforcement. Additionally, penalties for non-compliance should be strengthened to deter negligence.
2. *Improve Occupational Health Systems:* Mining operations must appoint and train dedicated OHS officers in every site, following Kabombo's relatively better model (53.6% compliance). Regular safety drills, hazard awareness programs, and accessible reporting mechanisms should be institutionalized. Given that only 3.64% of workers consistently use PPE, companies should provide high-quality, climate-appropriate gear and enforce its use through supervision and incentives.

To mitigate environmental damage, the following actions are essential:

1. *Enforce Mine Rehabilitation and Waste Management:* Legislators should mandate rehabilitation plans for all mining sites, with clear guidelines on pit closure, waste treatment, and land restoration. Techniques such as pit burial (currently at just 1.3%) must become standard practice. Meanwhile, improper waste disposal methods particularly stream discharge (25.1%) and bush dumping (32.6%) should be banned, with alternatives like containment pits and recycling systems promoted.
2. *Launch Worker and Community Training Programs:* Miners' lack of awareness (e.g., 72.77% never receiving safety tips) underscores the need for compulsory safety and environmental training. Partnerships with NGOs and industry experts can help deliver targeted education on hazard recognition, PPE use, and sustainable practices. Community monitoring programs could also enhance accountability and reporting of violations.

Table 36: Findings, Conclusions, and Recommendations for Mining Safety, Occupational Health, and Environmental Standards

Findings	Conclusions	Recommendations
- 66.8% of pits lack support structures; 73.5% PPE non-compliance; 93.3% no rehabilitation plans.	- Systemic failures in safety and environmental standards expose miners to hazards (collapses, respiratory illnesses) and environmental degradation.	1. Mandate & Enforce Safety Standards: Regulatory bodies must impose strict pit support requirements, PPE provision, and safety training. Prioritize high-risk sites (e.g., Chitumba, Matipa).
- 72.8% of miners lacking information on safety; 76.4% of sites lacking OHS officers.	- Critical gaps in safety leadership and training perpetuate dangerous practices.	2. Improve Occupational Health Systems: Appoint trained OHS officers at every site (model Kabombo's 53.6% compliance). Implement safety drills, hazard awareness programs, and reporting mechanisms.
- 32.6% dump waste in bushes; 25.1% discharge into streams.	- Environmental negligence is widespread, harming ecosystems and communities.	3. Enforce Mine Rehabilitation & Waste Management: Mandate rehabilitation plans (pit closure, waste treatment). Ban stream discharge/bush dumping; promote containment pits/recycling.
- 3.6% consistently use PPE; Kabombo shows marginally better compliance.	- Partial adherence in some sites (e.g., Kabombo) proves improvement is possible but insufficient.	- Provide climate-appropriate PPE and enforce use via supervision/incentives.
- 1.3% pit burial rate for mine closure.	- Current practices are unsustainable, with minimal land restoration.	- Standardize pit burial and land restoration techniques.
- No standardized safety protocols across sites.	- Regulatory reforms are urgently needed to prevent fatalities and ecological harm.	4. Launch Worker & Community Training: Introduce compulsory safety/environmental training via NGOs/experts. Establish community monitoring programs for accountability.

6. Information and Training Needs

Chapter 6: Summary

This chapter assessed miner training participation, information needs, and communication preferences, uncovering severe systemic deficiencies. Key findings include:

Training Gaps: Only 1.6% of miners have received any training, with most programmes being informal, inconsistent, or irrelevant to miners' needs. High-priority topics like responsible mining (31 requests) and formalisation (19 requests) remain unaddressed, while site-specific demands (e.g., environmental training in Kanyelele) highlight the need for tailored programs.

Information Access Challenges: Miners rely heavily on personal networks (72.4%) rather than institutional sources, leaving critical knowledge gaps in safety (11.9%), market prices (15.7%), and environmental practices (16.3%). While 95.4% of miners are willing to receive information, preferred channels vary by location—SMS in Kabombo, face-to-face in Luili/Matala, and digital tools in Sasare.

The findings underscore an urgent need for structured training initiatives and localized information systems to improve miner safety, regulatory compliance, and operational efficiency. Addressing these gaps requires collaboration between governments, NGOs, and mining communities to deliver accessible, relevant, and trusted education and communication solutions. Without intervention, the current lack of training and information will continue to hinder progress toward safer and more sustainable mining practices.

6.1 Miner Training and Information Management Needs

The baseline study results below provide insights into training participation, topics, and providers across various mining sites, revealing significant gaps and opportunities for improvement in miner training and information management.

6.1.1 Training Participation and Gaps

According to figure 63, the study noted an extremely low participation in training programmes across all mining sites. Out of 387 miners surveyed, only 6 (1.6%) reported receiving any training, while 381 (98.5%) had no training. The highest non-participation rates were in Kanyelele (23.4%) and Chitumba (16.5%), while Matipa had the lowest (9.5%). The near-universal lack of training suggests systemic deficiencies in training accessibility, awareness, or availability. The few trained miners were concentrated in Luili/Matala

(5.8% of miners there), indicating that this site may have better training infrastructure or initiatives. However, the overall lack of training raises concerns about miners' safety, environmental compliance, and operational efficiency.

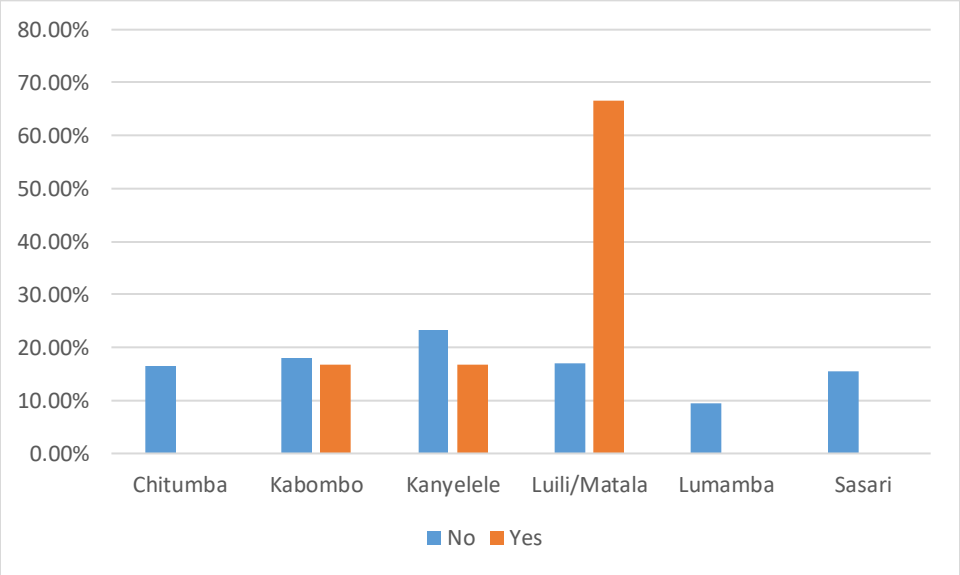


Figure 63: training participation by mining site

6.1.2 Training Topics and Relevance

According to figure 64, the study further notes that there was limited training provided across study sites. Only five miners reported specific training topics, with the most common being "Other training specify" (60%), followed by "Formalisation, Environmental management, Rehabilitation" and "Health" (20% each). The "Other training specify" responses included mechanics, safety, and "*how to follow the vein*", suggesting that miners value practical, skill-based training. However, the scarcity of structured programmes on critical topics like environmental management and health underscores a major gap in formalised training curricula. The absence of standardized topics across sites indicates a lack of coordinated training efforts, which could hinder regulatory compliance and best practices dissemination.

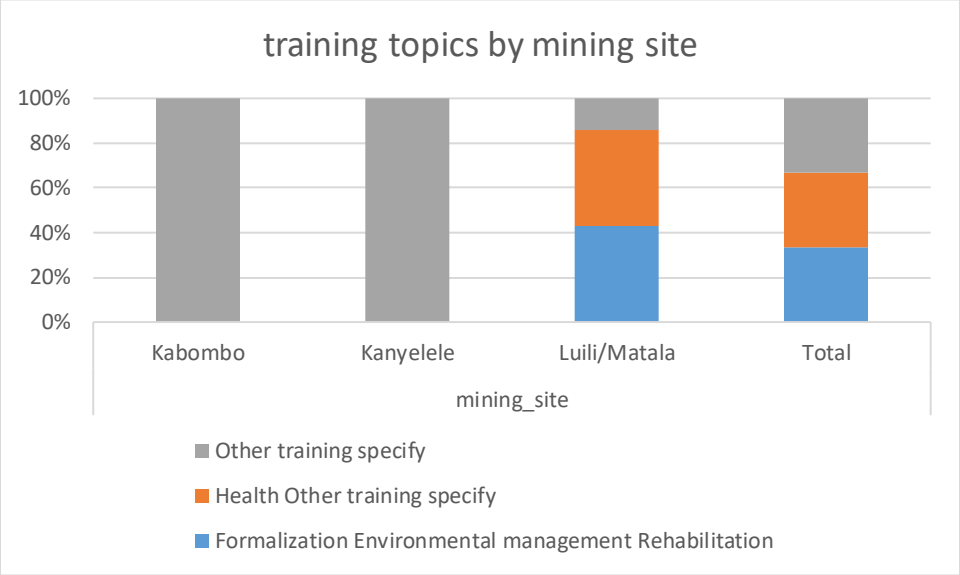


Figure 64: Training Topics by mining site

6.1.3 Training Providers and Their Implications

The final table reveals that training providers are highly fragmented. Among the six trained miners, providers included friends, Lusaka Trades, safety officers, community leaders, Zambia National Service (ZNS), and external geologists. This diversity suggests no centralized or institutionalized training system. While some providers (e.g., ZNS, geologists) imply formal or technical training, others (e.g., friends, community leaders) may lack expertise. The reliance on informal or ad-hoc providers raises concerns about training quality and consistency. Luili/Matala had the most varied providers (66.7% of trained miners), while other sites had minimal or no structured training sources.

Table 37: Training provider by mining site

Training Provider	Mining_Site (Percentage)			
	Kabombo	Kanyelele	Luili/Matala	Total
Friend	0.0%	0.0%	100.0%	100.0%
Lusaka trades	0.0%	0.0%	100.0%	100.0%
Safety officer	100.0%	0.0%	0.0%	100.0%
The community leaders	0.0%	0.0%	100.0%	100.0%
Zambia National service (ZNS)	0.0%	0.0%	100.0%	100.0%
some geologists were hired to train us at another mine were i worked at	0.0%	100.0%	0.0%	100.0%
Total	16.7%	16.7%	66.7%	100.0%

6.1.4 Miner Training Needs by Mining Site

The study highlighted key trends in the types of training desired by miners across different sites, with notable variations in priorities. The most frequently requested training topics were *responsible mining standards, formalisation, and business managemen*t. Responsible and better mining standards emerged as the top demand, with 31 responses, particularly in Sasare and Kabombo. This suggests miners in these areas prioritize ethical and sustainable practices, possibly due to community expectations or regulatory pressures. Formalisation followed closely with 19 responses, mainly from Luili/Matala and Kanyelele, indicating concerns around licensing and legal compliance. Business management, while requested less frequently, often appeared alongside financial or health training, pointing to interest in entrepreneurial skills.

Geographic differences in training demands were apparent. Luili/Matala showed the strongest interest in formalisation, likely reflecting stricter regulatory enforcement in the area. Sasare miners focused heavily on responsible mining standards, which may relate to environmental or safety concerns. Kabombo displayed mixed preferences, including technology and financial management, but also had three miners who explicitly rejected training. Kanyelele's diverse requests, spanning business skills and environmental rehabilitation, suggest a need for multifaceted training programs. Chitumba and Matipa had fewer responses, possibly due to lower awareness or fewer regulatory pressures in these locations.

Several challenges in implementing training programmes were evident. Over 80% of responses consisted of unique topic combinations, making it difficult to design standardized courses. Additionally, five miners, primarily in Kabombo and Sasare, stated they did not want any training, potentially due to perceived irrelevance or past negative experiences. This resistance, combined with the fragmented demand, indicates a need for better outreach and customized approaches. Miners may lack awareness of available training options, leading to vague or overly broad requests that complicate program development.

To address these issues, training initiatives should prioritize high-demand topics like formalisation and responsible mining while incorporating business and financial literacy components. Programs should be tailored to site-specific needs, with Luili/Matala focusing on compliance, Sasare on environmental standards, and Kabombo on technical skills. Awareness campaigns and incentives could help overcome resistance, while grouping similar training requests would streamline course design. Future surveys should use structured response options to reduce fragmentation and provide clearer data on miner preferences.

In conclusion, while miners demonstrate clear interest in key training areas, the variation in demands underscores the importance of flexible, location-specific programmes. Addressing participation barriers and improving outreach will be essential for successful implementation. A more structured approach to assessing training needs could enhance future program planning and ensure alignment with miner priorities.

6.1.5 Mining Information Needs and Communication Channels

The data reveals critical insights into how Artisanal miners currently access information, their preferred communication channels, and the specific types of mining knowledge they require. These findings carry significant implications for designing effective information dissemination strategies in mining communities.

Current Information Access Patterns show miners rely heavily on interpersonal networks, with 72.4% obtaining information through family, friends or mining contacts. This reliance on personal connections far outweighs institutional sources, as only 6.4% use government or NGO channels. Digital platforms remain marginal at just 5.7% adoption. Notable geographic variations emerge, with Kanyelele miners showing strongest dependence on mining business contacts (45% combine family and professional networks) while Kabombo stands out for SMS usage (18% of miners there use SMS exclusively). Luili/Matala demonstrates the most traditional pattern, with 71% preferring face-to-face meetings as their primary information source.

Information Content priorities vary significantly by location. Environmental protection information tops miners' needs at 16.3% of all requests, particularly in Kanyelele where it accounts for 31% of information demands. Safety practices follow at 11.9% overall, becoming the foremost concern in Kabombo (27% of requests). Market prices and buyer information collectively represent 15.7% of needs, especially crucial for Chitumba and Sasare miners. Surprisingly, new mining methods attract only 7.6% interest overall and no demand in Kanyelele, suggesting potential resistance to technological change in some communities.

Communication Channel preferences demonstrate overwhelming (95.4%) willingness to receive mining information, with Chitumba showing perfect 100% acceptance. However, Kanyelele's 12% refusal rate indicates trust issues that must be addressed. Traditional methods dominate preferences, with 82.8% favoring face-to-face or SMS communication compared to just 8.5% preferring social media-only channels. Sasare emerges as the most digitally progressive site, showing openness to blended communication approaches.

The critical need for mining information stems from multiple factors. Economically, knowledge about market prices and new mine locations helps miners avoid exploitation and diversify income sources. Safety concerns drive 11.9% of miners to explicitly request hazard prevention information. Regulatory pressures appear strongest in Luili/Matala, where health and safety information demands suggest awareness of compliance requirements. The significant interest in environmental protection (16.3%), particularly in high-risk Kanyelele, reflects growing recognition of sustainable practices' importance. Meanwhile, the minimal demand for new mining methods (7.6%) may indicate either satisfaction with current techniques or resistance to change, especially in traditional communities like Kanyelele.

Strategic recommendations should focus on channel optimization and content localization. SMS-based systems would likely succeed in Kabombo and Matipa given existing usage patterns, while community radio could expand in Kabombo where 10% already use broadcast media. WhatsApp groups show promise for Sasare and Kanyelele where digital foundations exist. Content must be hyper-localized - emphasizing environmental guidance in Kanyelele, equipment safety in Kabombo, and formalisation processes in

Luili/Matala. Building trust through existing networks is essential, particularly in Kanyelele where refusal rates are highest. A robust monitoring framework should track digital adoption in progressive sites while measuring environmental improvements in high-risk areas.

These findings underscore both the universal value miners place on mining information and the need for carefully tailored approaches that respect local communication ecosystems and address site-specific knowledge gaps. The near-universal willingness to receive information presents a valuable opportunity to enhance mining practices through targeted knowledge sharing initiatives.

6.2 Chapter Conclusion

The findings in this chapter reveal a critical gap in training and information access for miners across all surveyed sites. With only 1.6% of miners having received any formal training, the near-total lack of structured education poses severe risks to safety, environmental compliance, and operational efficiency. The few training programs that do exist are highly fragmented, with topics ranging from informal skill-sharing among friends to occasional formal sessions by Zambia National Service (ZNS) or geologists. This inconsistency suggests a systemic failure in training coordination, leaving miners ill-equipped to handle workplace hazards, legal formalisation, and sustainable practices. Furthermore, miners' information needs particularly regarding environmental protection (16.3%), safety practices (11.9%), and market prices (15.7%) remain largely unmet, forcing reliance on informal networks rather than institutional sources.

Despite these challenges, miners demonstrate a strong willingness (95.4%) to receive training and information, particularly through face-to-face interactions (82.8%) and SMS-based communication. However, resistance in some areas (e.g., Kanyelele's 12% refusal rate) highlights trust gaps that must be addressed. The variations in demand such as Luili/Matala's focus on formalisation and Kanyelele's emphasis on environmental training underscore the need for localized, context-specific education programs. Without immediate intervention, miners will continue operating with inadequate knowledge, perpetuating unsafe and unsustainable mining practices.

6.3 Chapter Recommendations

To address the severe training and information gaps, the following measures should be implemented:

1. *Establish Structured Training Programmes*: Governments, NGOs, and mining associations must develop standardized training curricula covering safety, environmental management, formalisation, and business skills. Given miners' strong interest in responsible mining (31 requests) and formalisation (19 requests), priority should be given to these topics. Training should be delivered through local workshops, mobile units, and partnerships with technical institutions (e.g., Zambia National Service) to ensure accessibility. Additionally, incentivizing participation (e.g., certification benefits) could improve engagement, especially in resistant areas like Kabombo and Sasare.

2. *Enhance Information Dissemination:* Mining stakeholders should leverage preferred communication channels, such as SMS (effective in Kabombo) and community radio, to deliver critical updates on market prices, safety regulations, and environmental best practices. Digital tools like WhatsApp groups (promising in Sasare and Kanyelele) should be piloted where feasible. To build trust, local leaders and respected miners should serve as information ambassadors, particularly in high-resistance zones. A centralized mining information hub that is accessible via basic mobile phones could streamline knowledge sharing and reduce reliance on unreliable informal networks.

Table 38: Findings, Conclusions, and Recommendations for ASGM Information and Training Needs

Findings	Conclusions	Recommendations
-1.6% of miners have received formal training on safety, environmental compliance, and technical operational efficiency.	- The near-total lack of structured training poses severe risks to safety, environmental compliance, and operational efficiency.	1. **Establish Structured Training Programmes:** Governments, NGOs, and mining associations should develop standardized training curricula covering safety, environmental management, formalisation, and business skills.
- Existing training is fragmented (informal skill-sharing, occasional ZNS/geologist sessions).	- The inconsistency reflects a systemic failure in training coordination, leaving miners unprepared for hazards, legal formalisation, and sustainability.	- Deliver training via local workshops, mobile units, and partnerships (e.g., Zambia National Service).
- Miners' unmet information needs: environmental protection (16.3%), safety (11.9%), market prices (15.7%).	- Miners rely on informal networks due to a lack of institutional support.	- Incentivize participation (e.g., certification benefits), especially in resistant areas like Kabombo and Sasare.
- 95.4% of miners express willingness to receive training.	- High demand exists, but trust gaps (e.g., Kanyelele's 12% refusal rate) must be addressed.	2. Enhance Information Dissemination: Use preferred channels like SMS (effective in Kabombo) and community radio for updates on market prices, safety, and environmental best practices.
- Preferred training methods: face-to-face (82.8%) and SMS-based communication.	- Localized, context-specific programs are needed due to varying demands (e.g., Luili/Matala prioritizes formalisation, Kanyelele focuses on environmental training).	- Pilot digital tools (e.g., WhatsApp groups in Sasare/Kanyelele) where feasible.
- Miners show strong interest in responsible mining (31 requests) and formalisation (19 requests).	- Without intervention, miners will continue unsafe and unsustainable	- Engage local leaders and respected miners as information ambassadors to build trust in high-resistance zones.

	practices due to knowledge gaps.	
- Resistance in some areas (e.g., Kanyelele 12% refusal rate).	- Trust deficits hinder training adoption in certain communities.	- Create a centralized mining information hub accessible via basic mobile phones to reduce reliance on informal networks.

7. Social and Gender Interplay in Mining Sites

Chapter 7: Summary

This chapter examined the **social and gender dynamics** in artisanal mining, revealing stark inequities in labour participation, domestic responsibilities, and workplace safety. Key findings include:

Occupational Segregation: Women dominate manual tasks like ore panning (100% in Matipa/Chitumba) but are excluded from technical roles (0% in blasting) and leadership (minimal in mine governance).

Dual Burden: Female miners perform the majority of domestic work (e.g., 92.9% daily in Sasare), while male participation remains low (e.g., 7.3% daily in Kanyelele).

Systemic Vulnerabilities: Women face harassment (22.4%), role restrictions (54.1%), and unsafe conditions (63.5%), with Kanyelele emerging as a high-risk site (86.7% role restrictions).

The data underscores the need for **gender-responsive policies** that empower women economically, redistribute domestic labour, and combat workplace discrimination. Site-specific interventions—such as leadership training in Luili/Matala or anti-harassment measures in Kanyelele—are critical to fostering equitable and sustainable mining communities. Without addressing these disparities, women will remain marginalized in a sector where their contributions are vital yet undervalued.

7.1 Mine Activity Participation and Gender Distribution

7.1.1 Female Participation in Ore Extraction Activities in Gold Mining

The baseline study evidenced a multifaceted view of women's roles in ASGM within mining communities, showcasing both active involvement and visible limitations in certain high-risk or technically demanding activities. Across the six sites, female miners contribute significantly to hands-on tasks, though their absence in activities such as blasting and tunnel construction points to structural or cultural barriers to deeper technical engagement.

The most commonly performed activity by women is *ore processing itself* which was reported 37 times across all sites. Matipa leads with 13 women involved, followed by Luili/Matala (8) and Sasare (6), indicating that women at these locations are actively engaged in digging, drilling, or removing ore from the ground. Similarly, sorting ore emerges as another major task, with 31 instances across sites. This work, often done manually to separate valuable material from waste, sees strong female participation especially in Luili/Matala (9), Sasare (8), and Chitumba (5).

Transporting ore, which requires physical stamina and coordination, is another area where women are notably present. It was reported 27 times, with Chitumba showing the highest involvement (8), and Sasare close behind (7). Though generally considered labour-intensive, this role seems more gender-integrated than others. Participation in *bagging ore* which involves packing unprocessed ore for sale or delivery was less widespread, with only 16 instances. However, women in Luili/Matala lead here again (6), suggesting this task may align with local production roles or workflows specific to the site. The niche roles of *going underground* (2 instances), *operating a winch* (1), and *dewatering/pumping* (2) reflect limited access to technically demanding or high-risk functions, possibly due to safety concerns, lack of training, or gender-based restrictions.

Notably, *blasting and tunnel construction* both requiring specialized training and often controlled by male-dominated teams reported *zero female participation* across all sites, reinforcing boundaries around women's engagement in hazardous or highly mechanized extraction processes. Lastly, 20 women across sites reported *no participation in ore extraction activities*, with Kabombo (5) and Kanyelele (4) showing higher exclusion rates. This could suggest differentiated labour roles where some women focus entirely on support tasks, domestic responsibilities, or peripheral activities within the mining economy.

The study affirmed that while women are indeed central to various ore-handling tasks, their roles are often limited to less physical, lower-risk processes. Their near absence from specialized and high-stakes functions like blasting or tunnel development raises questions around training access, safety policies, and cultural perceptions of capability. These insights are vital for any effort to increase gender equity and build technical capacity among women in mining communities.

7.1.2 Participation in Mining Supporting Activities

The study revealed a clear gendered patterns in supporting activities within mining environments, highlighting both traditional role expectations and degrees of involvement across critical non-extractive tasks. Female respondents, totalling 252 entries, showed dominant participation in domestic and caregiving roles. Their most reported activity was *food preparation* (27%), followed closely by *purchasing supplies* (25%), and *childcare* (21%). Together, these three categories accounted for nearly three-quarters of all female participation, reinforcing the notion that women remain central to nurturing and logistical functions even in labour-intensive settings like mining. *General cleaning* also features significantly among women (19%), while only 5% are involved in *safety/security*. Perhaps most notably, just 4% of female respondents fall into the *non-participant* category, suggesting a high engagement rate and an expansive role in maintaining operations and community cohesion.

Male participation, based on 468 responses, demonstrated a more diversified spread, though with notably lower involvement in *caregiving and cleaning tasks*. The largest share of male participation centred on *purchasing supplies* (27%), mirroring female involvement in logistical support. However, their role in *food preparation* (19%) and *general cleaning* (16%) was substantially less than that of their female counterparts. The most striking gender gap as expected appeared in *childcare*, where only *4%* of male participants were involved, compared to 21% of women, highlighting entrenched gender norms regarding reproductive labour. Interestingly, and as usual men were more engaged in *safety/security* activities (9%) compared to women (5%), possibly reflecting perceptions of physical protection as a male domain. Additionally, a quarter of male respondents (25%) fell under *non-participants*, a dramatic contrast to the 4% among women. This discrepancy may signal that a significant proportion of men do not take part in auxiliary community or household-supporting functions, or that their roles are more concentrated in core mining tasks.

Overall, the supporting activities data reveals a gendered division of labour, with women deeply embedded in caregiving, food, and logistical support, while men lean more toward procurement and security-related roles. These insights are critical for informing equitable labour practices, resource allocation, and gender-sensitive community development interventions within Artisanal mining contexts.

7.1.3 Female Participation in Gold Processing Activities

The study results on gold processing activities reveals significant variability in the roles women undertake across Artisanal mining sites, painting a nuanced picture of gendered labour segmentation within the sector. One of the most prominent trends is the high level of female participation in *panning and washing* which is a relatively accessible and manual task strongly associated with traditional Artisanal methods. Sites such as Matipa and Chitumba report full participation in this activity (100%), while Luili/Matala also demonstrated a strong presence with 92.3% of women involved. This suggests that panning serves as an entry point for many women into technical mining roles, possibly due to its perceived suitability for female workers or its informal nature within family units and local networks.

In contrast, female involvement in *grinding and crushing* activities, which are typically more labour-intensive, was far more inconsistent. Women in Kabombo showed the highest level of participation (83.3%), followed by moderate involvement in Matipa (50%) and Luili/Matala (46.2%). At the low end of the spectrum, only 13.3% of women in Chitumba reported performing these tasks. This disparity may reflect physical labour demands, equipment accessibility, or prevailing gender norms that shape role allocation within mining operations.

Figure 65: Female Artisanal Miner Talking to a Researcher in Vubwi District

Notably, participation dropped sharply when it came to *gold weighing* and *record keeping* basic tasks associated with accuracy, financial oversight, and trust. Only Matipa and Chitumba reported minimal female involvement in gold weighing (33.3% and 6.7%, respectively), and even fewer women were engaged in record keeping. This limited presence suggests that women are *often excluded from critical control points in the gold value chain, which can have implications for earnings transparency and income distribution. Mill cleaning* saw virtually no female participation across all sites, with the exception of Luili/Matala, where just one woman is involved (7.7%). This task may be considered menial or reserved for external labour, but its near-total absence of female involvement highlights a further dimension of task stratification as this is the main site will more mills (met pans).

In summary, the data demonstrated that while women are highly visible in certain hands-on gold processing activities particularly panning their representation diminishes in roles tied to financial control, oversight, and technical administration. These patterns reflect broader systemic dynamics in Artisanal mining that limit women's access to value-determining functions, reinforcing their subordinate position in the production hierarchy.

7.1.3 Female Participation in Management Activities

The data on female participation in management activities across Artisanal mining sites revealed notable patterns regarding leadership and financial involvement. Women were actively engaged in transactional and support roles, particularly in selling gold and handling accounting duties. However, their representation in strategic leadership remained limited, suggesting both progress in inclusion and persistent structural barriers to governance access. Selling gold consistently emerged as the dominant female management role, likely due to its proximity to household financial responsibilities and informal trade practices. Accounting and funds management showed moderate involvement, especially at sites like Kanyelele and Luili/Matala. Yet, positions associated with broader oversight such as mine leadership were nearly absent for women, apart from sporadic supervisory roles. These trends reflect a gendered hierarchy within mining operations, where commercial contribution is valued but leadership potential remains constrained.

A site-by-site breakdown further illustrates these dynamics. In Luili/Matala, women reported involvement across 17 management activities. Selling gold was the most prominent function (9), followed by accounting (3) and funds management (2). Leadership representation was modest two women serve as mine or operations supervisors, while only one holds a role involving overall oversight. This suggests that while women may be trusted with financial responsibilities, access to high-level decision-making remains

restricted. Kabombo presents a more limited profile, with only six roles reported. Female involvement focuses on selling gold (3) and capital investment search (2), plus one supervisory position. There is no presence in senior leadership, indicating minimal influence in mine governance.

In Matipa, 10 of the 12 reported roles centred on selling gold, reinforcing a pattern of transactional involvement. Only one woman each engages in accounting and funds management, and none appear in leadership capacities. This points to a narrow concentration of female roles with little strategic oversight. Sasare reflects similar characteristics. Of eight reported activities, seven relate to selling gold, and just one to funds management. Again, there is no presence in supervisory or leadership roles, implying that women's contributions are largely confined to trade rather than institutional authority.

Chitumba follows suit, with 11 out of 14 roles focused on gold selling, and limited involvement in capital investment and funds management (one and two respectively). No women occupy leadership or supervisory positions, signaling a persistent exclusion from governance roles despite commercial engagement. Kanyelele, by contrast, showcases the highest level of female engagement with 24 total activities. Women are involved in selling gold (10), accounting (6), and funds management (4). Three women report participation in capital investment efforts, and one holds a supervisory position. Though more inclusive in financial and administrative functions, this site still reflects the broader trend: women remain absent from top leadership, reinforcing systemic constraints on their advancement.

Taken together, these findings illustrated that while female miners play a central role in the economic engine of Artisanal mining, their path to leadership remains narrow and uneven across sites. These findings can inform gender-responsive strategies aimed at elevating women's voices within mining governance structures.

7.2 Gendered Division of Domestic Labour in Mining Sites/Communities

Overall Insights that were established here are.

1. *Cooking* is the most cross-cutting task, with men reporting relatively high involvement at several sites (especially Luili/Matala, Kabombo, and Chitumba). However, women still hold the majority in caregiving, water-fetching, and resource collection.
2. Tasks such as *childcare, elder care, and gathering firewood* remain overwhelmingly female-dominated.
3. Sites like Luili/Matala and Chitumba show slightly more male involvement in domestic work, but deep gender disparities persist.
4. The data underscores the persistent expectation that women, even as active miners, maintain primary responsibility for domestic and reproductive labour.

The following discussion offers a vivid portrayal of how domestic responsibilities are distributed between female and male workers at six Artisanal mining sites. Across all categories cooking, laundry, cleaning, care, and resource gathering women demonstrate consistently higher involvement, reinforcing the pattern of a dual burden: physically taxing mining work alongside dominant household roles. This dataset further strengthens the case for gender-responsive programming in mining communities targeting labour redistribution, recognition of invisible work, and structural support for female miners who carry these double roles.

Luili/Matala (Mumbwa District): According to figure 66, female involvement is particularly high in core household tasks, with 21% of women engaged in cooking, 21% in laundry, 20% in cleaning, and 22% in childcare. Tasks like gathering firewood/charcoal (20%) and fetching water (17%) also see notable female participation. In contrast, male involvement is proportionately much lower, despite higher raw numbers due to a larger male workforce. While 30% of men report cooking, only 17% engage in childcare and 0% in elder care. Cleaning (41%) and laundry (45%) see relatively higher male participation, suggesting that men at this site may share some domestic responsibilities more than at others.

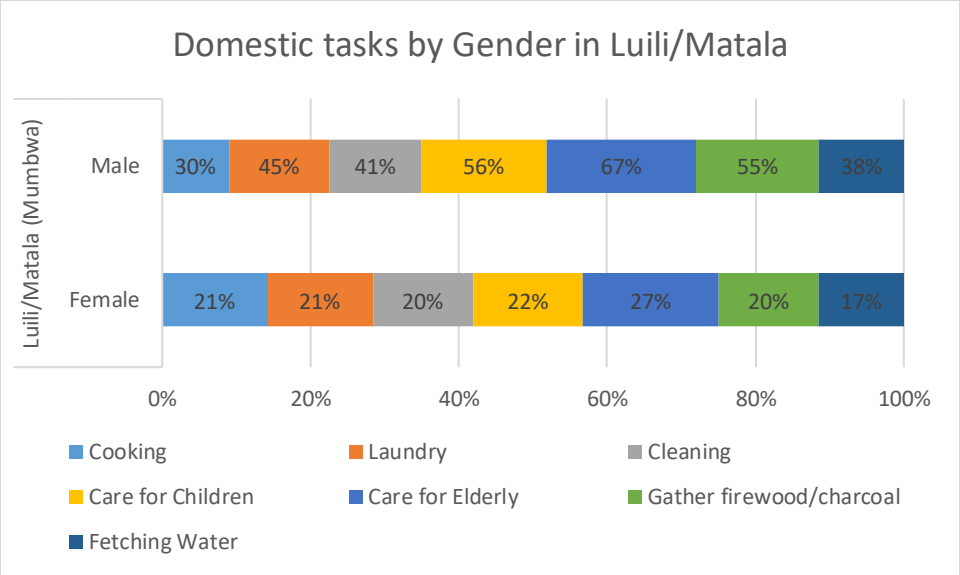


Figure 66: Domestic tasks by Gender in Luili/Matala

Kabombo (Rufunsa District): According to figure 67, this site reveals the starkest gender gap. Female participation in domestic tasks is low, with 9% cooking, 11% cleaning, and 11% doing laundry, while firewood gathering (8%) and water fetching (7%) are also minimal. Male participation in cooking is notably high (25%), but other domestic tasks show limited involvement, particularly elder care (6%). This raises questions about whether male cooking reflects traditional food preparation roles rather than equitable task-sharing.

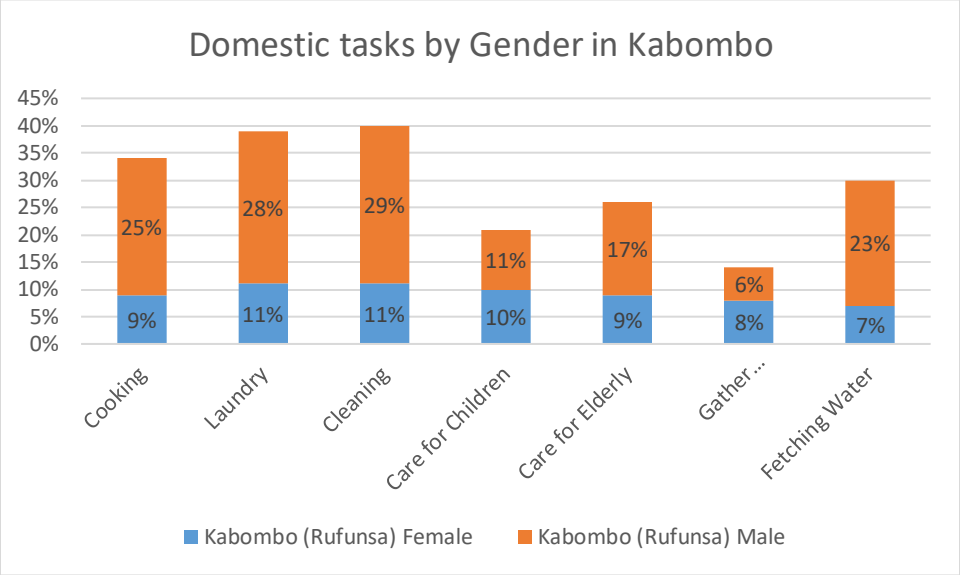


Figure 67: Domestic tasks by Gender in Kabombo

Matipa (Chisamba District): According to figure 68, women dominate household tasks, with 16% cooking and 18% involved in childcare, while men show very low engagement (4% in cooking, 4% in laundry, and 1% in cleaning). The absence of female elder care (0%) and low figures for gathering firewood (5%) and water-fetching (13%) suggest a narrow distribution of tasks even among women.

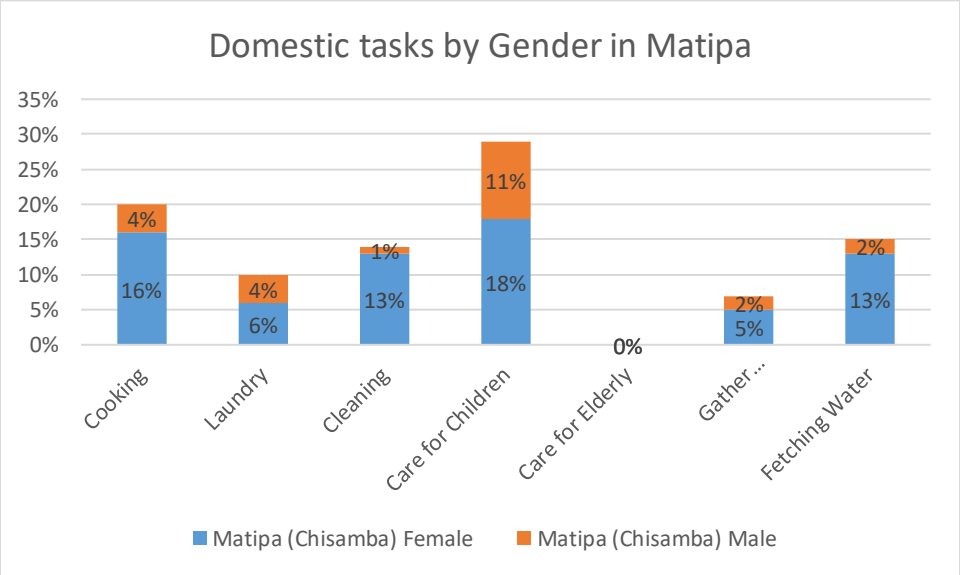


Figure 68: Domestic tasks by Gender in Matipa

Sasare (Lusangazi District): According to figure 69, female participants are more evenly spread across activities, with 17% cooking, 25% doing laundry, and 28% gathering firewood. Water-fetching (28%) and cleaning (19%) also show relatively high female involvement. However, among men, the divide is clear—17% cook, but only 4% do laundry, 11% clean, and 15% fetch water. The gendered discrepancy remains visible despite slightly higher male participation than in Matipa.

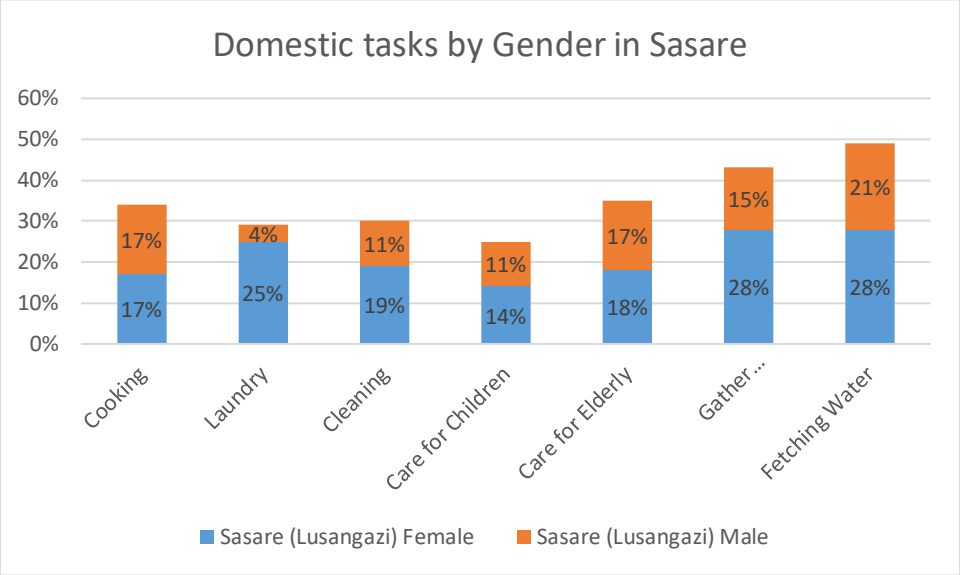


Figure 69: Domestic tasks by Gender in Sasare

Chitumba (Vubwi District): According to figure 70, women show the most balanced engagement across all categories, with 24% cooking, 23% doing laundry, 22% cleaning, and 25% in childcare. Men, while more active in cooking (20%), show minimal engagement in caregiving—0% in both child and elder care.

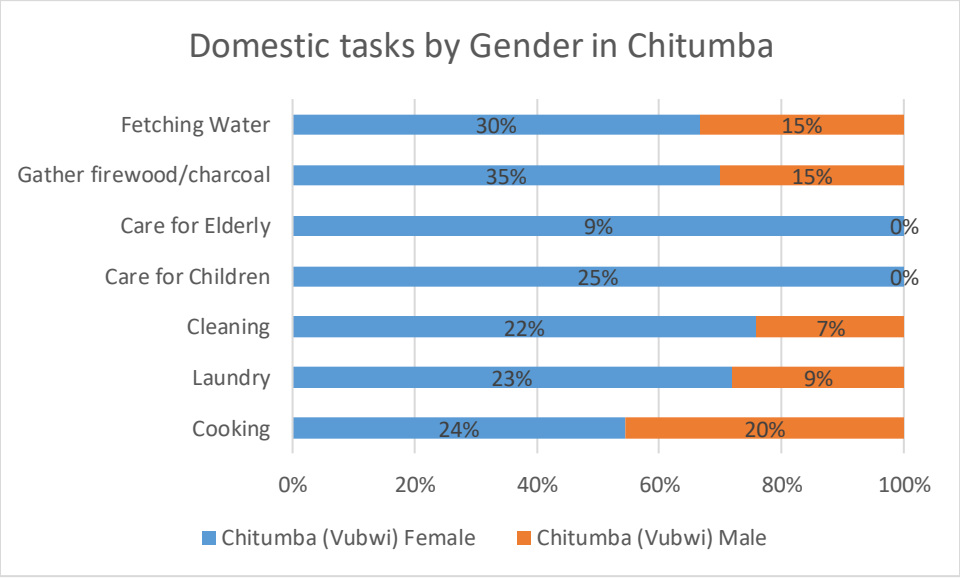


Figure 70: Domestic tasks by Gender in Chitumba

Kanyelele (Mpika District): According to figure 71, female participation is modest but consistent, with 13% cooking, 16% cleaning, and 12% in childcare. Men's involvement is marginal in nearly every category, with the highest being 9% in cleaning and 4% in cooking. Elder care (0%), firewood gathering (6%), and water-fetching (2%) remain largely women-led tasks.

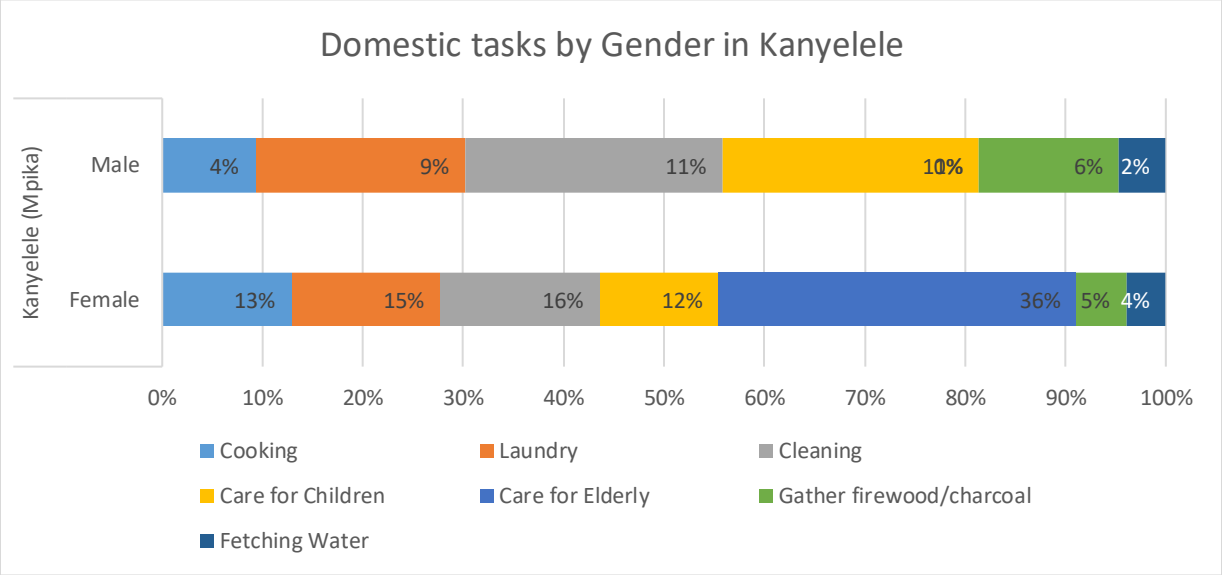


Figure 71: Domestic tasks by Gender in Kanyelele

7.3 Decision-Making Participation by Area and Site

The study results offered a window into the extent to which *Female and Youth* miners are involved in various mining related decision-making processes, ranging from technical activities like ore extraction and processing to more strategic areas such as selling and profit distribution. Overall, participation rates vary widely across sites and decision areas, suggesting that women's roles in governance and technical control of the mining process are often limited but not altogether absent.

Kabombo; With 9 respondents, Kabombo reflects generally low female involvement across all decision areas. Participation is highest in selling (33%) but drops to 22% for both ore processing and extraction and falls further to just 11% for administrative decisions and access to deposits. This pattern implies that while a few women take part in operations-related decisions, they are largely excluded from administrative and strategic control. **Luili/Matala;** The data from Luili/Matala (15 respondents) shows relatively improved engagement. Ore processing sees the highest female involvement (47%), followed by selling (40%) and ore extraction (33%). Participation in more strategic areas like profit distribution and access to deposits dropped to 27% and 20%, respectively. Though modest, these figures indicated that women here may be slowly breaking into spaces traditionally dominated by men.

Sasare; Female workers in Sasare demonstrated a balanced but still limited participation across multiple domains. Selling leads at 47%, with ore processing (40%) and extraction (33%) closely following. Engagement in administrative decisions, access to deposits, and profit distribution each hover around 20–27%, suggesting a broader distribution of involvement, albeit still in the minority. **Chitumba;** Chitumba showed stronger female participation in ore processing (56%) and selling (44%), with minimal involvement in administrative, ore extraction, and profit distribution decisions ranging from 11% to 17%. This site reflects a clear divide between operational and strategic participation, pointing to women's greater access to hands-on roles rather than power-related functions.

Matipa; Female decision making is strongest at Matipa, particularly in selling (75%), ore extraction (69%), and ore processing (63%). These are the highest rates among all sites. However, participation drops to 38% in profit distribution and 19% in access to deposits. This pattern reveals that women in Matipa are active in production and commerce but still underrepresented in the allocation and control of resources. **Kanyelele;** Kanyelele exhibits the lowest rates of female involvement. Decision-making in selling, ore processing, waste disposal, and profit distribution each stands at 17–25%, while ore extraction involvement drops to just 8%. This suggests significant exclusion of women from mining decision structures in this site.

7.3.1 Daily purchases decision by Mining Site (Female miners)

The data on daily purchases decision-making offers key insights into the degree of autonomy exercised by female Artisanal miners in managing routine household expenditures. Although the site of Sasare is missing from the dataset, trends from the remaining five mining communities highlight distinct patterns of female agency and household collaboration.

Figure 72 below indicates that:

In **Kabombo** *(Rufunsa District),* more than half of the respondents (5 out of 9) report making daily purchase decisions alone, signalling a considerable level of independence in managing everyday expenses. *Joint decision-making* is also present (3 women), while just one respondent defers these decisions to her spouse, and none report influence from the *extended family*. **Luili/Matala** *(Mumbwa District)* demonstrates a similar trend, but with a slightly stronger tilt toward autonomy: 9 out of 16 women independently handle daily purchases, while 6 do so jointly, and only 1 relies on a spouse. This suggests that personal control over routine finances may be more normalized among women in this site.

In **Chitumba** *(Vubwi District)*, joint decision-making is notably dominant, with 11 out of 18 women sharing purchasing choices with another household member. However, 6 women still make these decisions independently, and 1 reports influence from extended family a rare occurrence across all sites surveyed. The collaborative nature here could reflect broader familial roles in decision-making or stronger household integration.

Matipa *(Chisamba District)* follows a similar joint-led model, with 9 out of 15 women managing purchases together with another household member, while 5 maintain personal control and 1 relies on her spouse. This distribution underscores a balanced approach between autonomy and shared responsibility.

Kanyelele *(Mpika District)* leans more toward independence, with 8 out of 15 female respondents making daily purchasing decisions alone and 6 managing them jointly. Only one woman reports spousal involvement, and extended family does not feature. This pattern suggests a relatively empowered financial role for women in this locality. Taken collectively, the data affirms that female miners not only engage heavily in domestic and income-generating labour but also play a central role in managing daily household expenditures. Independent and joint decision-making dominate across sites, with spousal and extended family influence largely minimal. These patterns reflect growing economic agency among women, though the balance of autonomy versus collaboration may vary with cultural norms, household compositions, or the economic structure of each community.

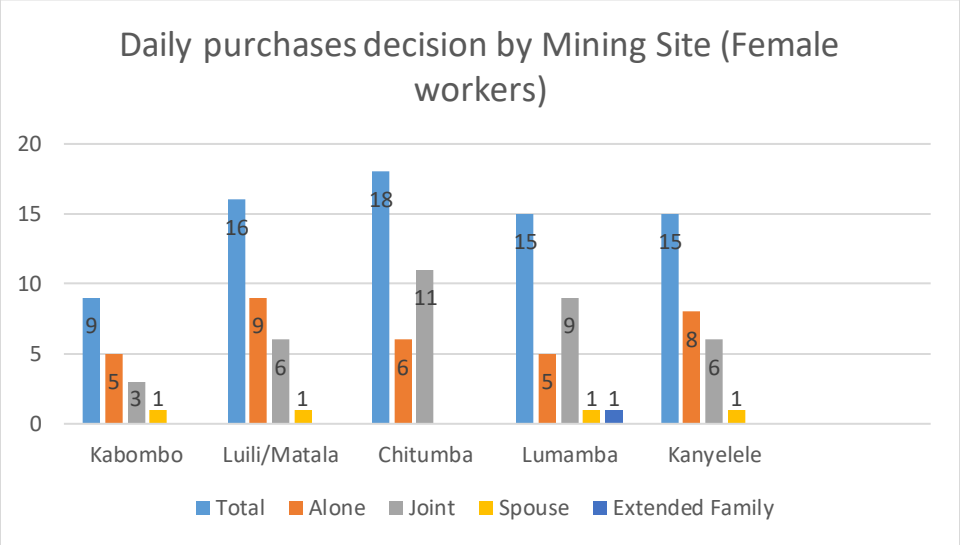


Figure 72: Daily purchases decision by Mining Site (Female workers)

7.3.2 Household Expense Decision-Making

The data on household expense decision making among female mining workers across six sites offers a nuanced view of women's economic agency within Artisanal mining communities. Patterns of financial autonomy, shared decision-making, and familial influence vary markedly across locations, highlighting the interplay between social norms, household structures, and gender roles.

Figure 73 below shows that in Kabombo, decision-making is evenly split between women acting alone (44.4%) and in joint arrangements (44.4%), with a minimal proportion (11.1%) reporting their spouse as the sole decision-maker. This balance suggests a relatively high level of female agency, where women are active participants in household financial decisions, either independently or collaboratively. Luili/Matala mirrors this general pattern, though the share of women deciding jointly (46.7%) slightly outweighs those deciding alone (33.3%). Notably, 20% of women defer financial decisions to their spouse, indicating a modest but visible reliance on partner-led decision-making. The absence of extended family involvement across most sites suggests that decisions about household expenses are predominantly confined to the nuclear unit.

In Sasare, a more pronounced tendency toward independent female decision-making emerges, with 53.3% of women managing household expenses alone the highest rate among all sites. While joint decisions are reported by 33.3%, this site also uniquely features extended family influence (13.3%), a reminder that kinship structures may still play a role in some households. Chitumba and Matipa are the strongest examples of joint decision-making dominance. In Chitumba, 61.1% of respondents make financial decisions jointly, while Matipa exhibits an even higher proportion at 68.8%. This trend points toward collaborative dynamics in financial management, possibly reflecting community-based norms or shared household labour structures.

Finally, in Kanyelele, women show a diverse decision-making spread: 33.3% decide alone, 50.0% jointly, and 16.7% with spouse involvement. The fairly balanced distribution implies a mix of independence and

interdependence, offering a midpoint between the extremes of Sasare's autonomy and Matipa's joint-dominant model.

Across all sites, there is minimal presence of extended family involvement, and in several communities (Kabombo, Luili/Matala, Matipa, Kanyelele), it's entirely absent. This pattern reinforces the notion that economic decision-making is increasingly concentrated between women and their immediate partners, with varying degrees of autonomy depending on the site. Taken together, the data paints a complex picture of female miners who are not only labouring intensively both domestically and professionally, but also actively shaping their households' financial landscape often in collaborative or independent roles. If you're interested, we can build on this with a comparative analysis on how these decision-making roles might influence or intersect with domestic labour burdens across sites.

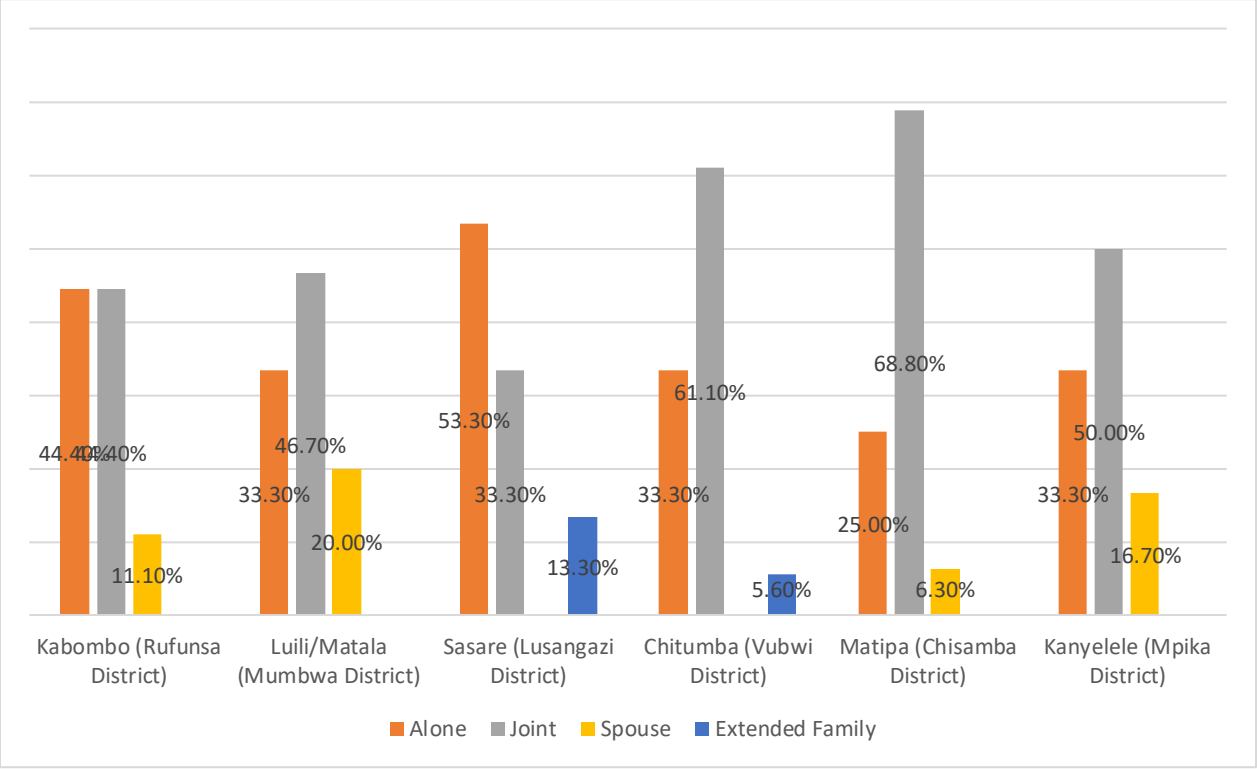


Figure 73: Household Expense Decision-Making by Mining Site (Female workers)

7.3.2 Frequency of Male Vs Female Miner Participation in Domestic Work by Mining Site

The data in figure 74 reveals pronounced gender disparities in domestic work participation among Artisanal mining workers across six mining sites. Female workers consistently report significantly higher involvement in daily domestic chores compared to their male counterparts. Sasare exhibits the most extreme imbalance, with 92.9% of women performing domestic tasks every day, followed closely by Chitumba (77.8%) and Kabombo (70%). These figures reflect a pervasive trend: women, despite their involvement in physically demanding mining activities, continue to shoulder the bulk of household responsibilities.

In contrast, male daily participation rates remain substantially lower. Kabombo (25.4%), Chitumba (29.2%), and Sasare (26.7%) represent the highest male engagement, yet these rates are dwarfed by those of female workers. Kanyelele and Matipa further underscore the gender gap, with male daily participation at just 7.3% and 21.1%, respectively, compared to 45.5% and 42.9% among women. Across most sites, male respondents are more likely to report infrequent participation in domestic work. For instance, over half of Kabombo's male workforce contribute to household chores fewer than 10 days per month, reinforcing the pattern of male disengagement.

Luili/Matala presents a slightly more moderate dynamic. While 40% of female workers report daily domestic engagement, an additional 26.7% participate frequently (15–25 days/month) and only 13.3% occasionally. On the male side, just 8.5% report daily involvement, while a substantial proportion (23.7%) engage frequently and 22% moderately. However, 42.4% of men still report participating fewer than 10 days a month an indication of limited contribution.

Overall, the data paints a clear picture of gendered labour divisions within mining communities: women manage a dual burden of strenuous mining tasks and disproportionate domestic responsibilities, while men remain far less engaged in the domestic sphere across all sites. This systemic imbalance highlights the need for policies and interventions that promote gender equity in both formal and informal labour domains.

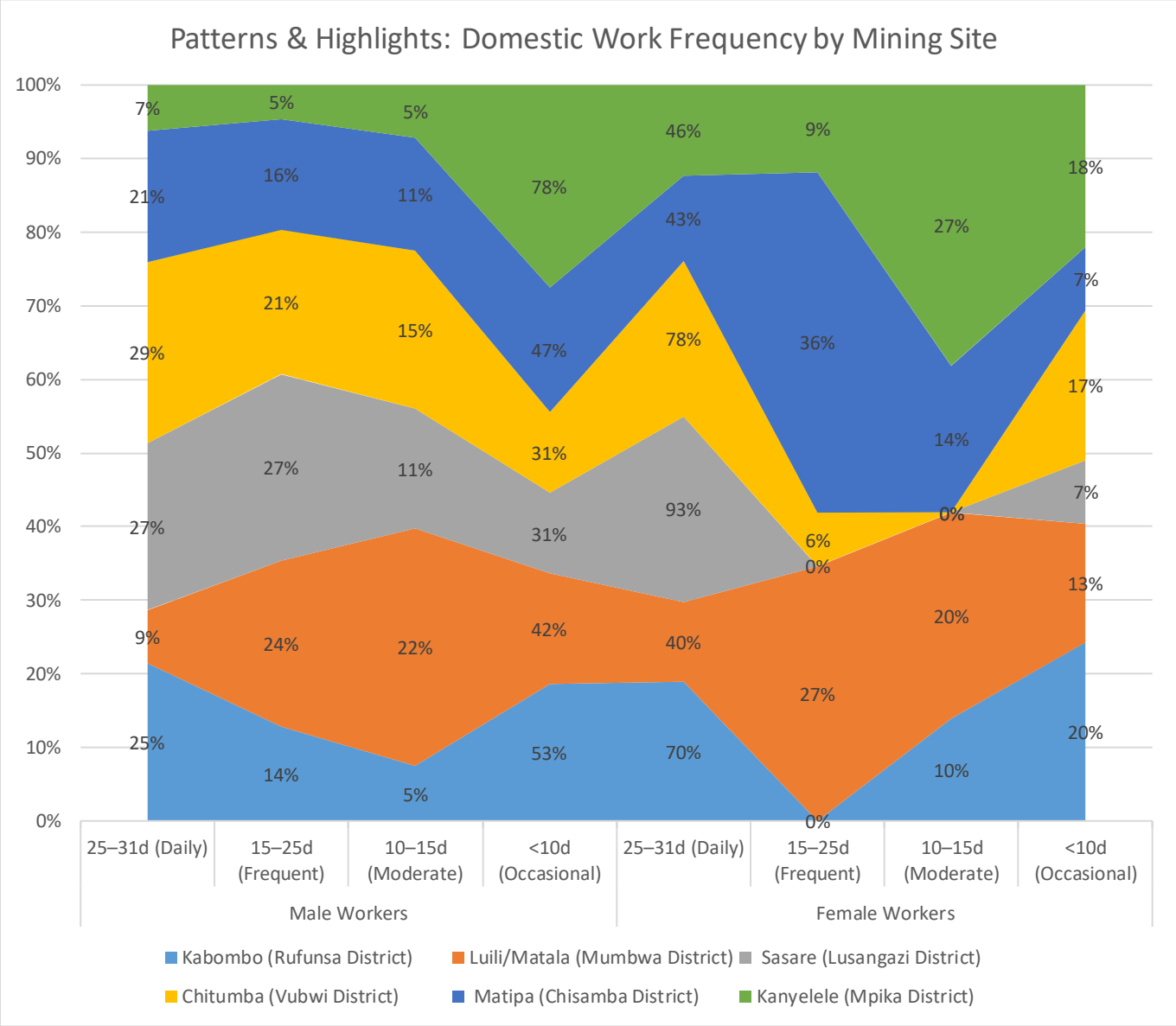


Figure 74: Patterns & Highlights: Domestic Work Frequency by Mining Site

7.4 Social and Gender Related Problems Faced by Female Workers in Artisanal Mining Sites

The study found social and gender-related problems faced by female mine workers in Artisanal mining sites that paints a sobering picture of multidimensional vulnerabilities. Across the six surveyed locations, women report a spectrum of operational challenges, gender-based discrimination, and social harms that collectively underscore the deeply gendered risks within mining environments.

Among the most common issues are poor work conditions, affecting 63.5% of respondents overall. These concerns ranging from inadequate protective equipment to exploitative labour demands are prevalent across every site as depicted in figure 75 below, with Chitumba (Vubwi District) registering the highest rate (83.3%) and Kanyelele (Mpika District) close behind (80%). Safety-related complaints are also widespread (44.7%), including physical risks on-site and lack of emergency protocols. Luili/Matala (Mumbwa District), Matipa (Chisamba District), and Kanyelele (Mpika District) stand out in this category, suggesting recurring systemic neglect of worker welfare.

Gender-specific challenges are a consistent theme. Over half of the women surveyed (54.1%) cite restricted roles, indicating limited access to decision-making or high-value tasks due to entrenched gender norms. Kanyelele (Mpika District) is especially concerning, with 86.7% of respondents reporting this issue. Luili/Matala and Matipa also show elevated rates of role restriction, compounded by significant levels of harassment reported by 22.4% of women, with sexual harassment affecting 16.5%. Feelings of lack of appreciation (34.1%) further highlight emotional and cultural marginalization within the workforce.

Social problems further compound these challenges. Violence, both on and off the worksite, affects 41.2% of respondents, and alcohol abuse is cited by 36.5% most notably in Kanyelele (Mpika District) (66.7%) and Luili/Matala (Mumbwa District) (50%). These issues not only endanger women physically but also foster environments of instability and insecurity. Crimes (10.6%) and income insecurity (21.2%) suggest deeper economic and safety precariat, particularly in Chitumba (Vubwi District), Matipa (Chisamba District), and Sasare (Lusangazi District).

Site-specific patterns reveal crisis points where interventions may be most urgently needed. Kanyelele (Mpika District) emerges as a critical hotspot, with female workers facing an average of 5.3 issues each—from severe role restrictions and safety threats to rampant alcohol and violence-related problems. Luili/Matala ranks high in chemical poisoning reports and gender-specific discrimination, while Chitumba (Vubwi District) leads in complaints about work conditions and shows signs of emerging crime risk. Kabombo (Rufunsa), though showing fewer issues overall, still reflects substantial gender constraints and harassment.

Together, these findings underscore the need for gender-responsive labour protections, psychosocial support programs, and inclusive governance structures to address the layered challenges facing female Artisanal miners. If you'd like, I can help summarize this into policy recommendations or frame it for an advocacy report.

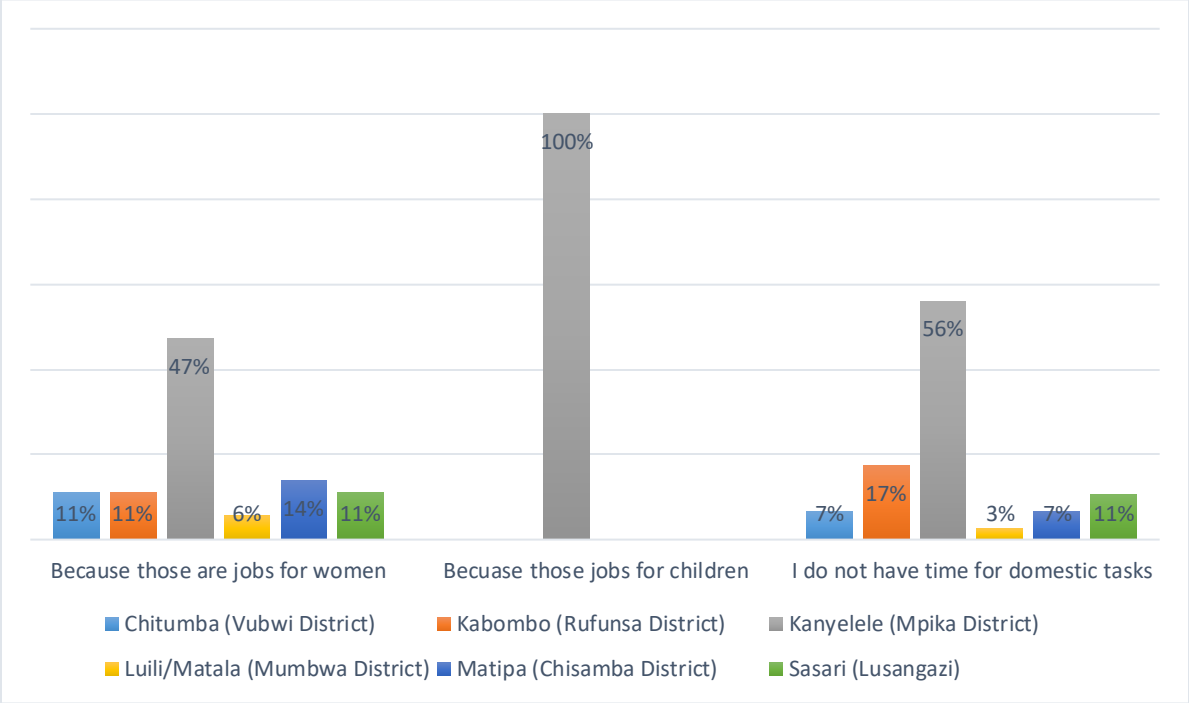


Figure 75: Reasons while male miners do not participate in domestic work

7.5 Chapter Conclusion

The findings in this chapter reveal entrenched gender disparities in Artisanal and Small-ScaleGold Mining communities, where women face systemic barriers to equitable participation in both mining and domestic spheres. While women are actively engaged in Artisanal gold mining and gold processing (100% participation in panning at Matipa and Chitumba), their roles remain concentrated in lower-risk, manual tasks, with near-total exclusion from high-value activities like blasting (0% female participation) and leadership (minimal representation in mine governance). This occupational segregation is compounded by a persistent gendered division of domestic labour, where women shoulder the majority of household responsibilities 92.9% of female miners in Sasare perform daily domestic work, compared to just 26.7% of men. Such disparities highlight how cultural norms and structural inequities limit women's economic and social mobility, reinforcing their dual burden as both income earners and primary caregivers.

Beyond labour divisions, female miners confront severe gender-specific challenges, including harassment (reported by 22.4% of women), restricted roles (54.1%), and unsafe working conditions (63.5%). Sites like Kanyelele emerge as critical hotspots, with 86.7% of women reporting role restrictions and 66.7% citing alcohol abuse as a pervasive issue. These vulnerabilities are exacerbated by limited decision-making power, particularly in strategic areas like profit distribution (20–27% female participation) and mine leadership (near-absence). The data underscores an urgent need for interventions that address not only economic inclusion but also the socio-cultural norms perpetuating gender inequality. Without targeted action, women will continue to face disproportionate risks and marginalization in Artisanal mining.

7.6 Chapter Recommendations

To promote gender equity in Artisanal mining, the following measures should be prioritized:

1. **Economic Empowerment and Leadership Training:** Implement programmes to advance women's participation in high-value mining activities (e.g., blasting, machinery operation) and leadership roles. Site-specific initiatives should target areas with the lowest female representation, such as Kanyelele (8% involvement in ore extraction decisions). Training should pair technical skills with financial literacy and business management, aligning with women expressed interest in selling gold (dominant in management roles) and formalisation (19 requests). Additionally, establish quotas or incentives for female representation in mine governance to dismantle barriers to decision-making.
2. **Addressing Structural and Cultural Barriers:** Launch community-based campaigns to challenge gendered norms, particularly men's justification for avoiding domestic work (31.86% believe it's "jobs for women"). Partner with local leaders to promote shared household responsibilities, reducing women's dual burden. Simultaneously, enforce zero-tolerance policies for harassment (reported by 16.5% as sexual harassment) and improve workplace safety through mandatory PPE provision and gender-sensitive risk assessments. Sites like Luili/Matala, where 50% report alcohol-related issues, should integrate psychosocial support services.

Table 39: Findings, Conclusions, and Recommendations for Social and Gender Interplay in Mining Sites

Findings	Conclusions	Recommendations
- Women are engaged in ASGM and gold processing (100% participation in panning at Matipa and Chitumba).	- Gender disparities in Artisanal mining are entrenched, with women concentrated in lower-risk, manual tasks and excluded from high-value activities.	1. ***Economic Empowerment & Leadership Training:*** Implement programmes to advance women's participation in high-value activities (blasting, machinery operation) and leadership roles.
- Near-total exclusion of women from blasting (0%) and leadership (minimal representation in mine governance).	- Occupational segregation is reinforced by cultural norms and structural inequities.	- Establish quotas/incentives for female representation in mine governance.
- 92.9% of female miners in Sasare perform daily domestic work vs. 26.7% of men.	- The gendered division of labour reinforces women's dual burden as income earners and primary caregivers.	2. ***Addressing Structural & Cultural Barriers:*** Launch community campaigns to challenge gendered norms (e.g., 31.86% of men believe domestic work is "jobs for women").
- 22.4% of women report harassment, 54.1% face restricted roles, and 63.5% work in unsafe conditions.	- Women face severe gender-specific challenges, limiting economic and social mobility.	- Partner with local leaders to promote women inclusion across the mining value chain.
- Kanyelele is a hotspot: 86.7% of women report role restrictions, 66.7% cite alcohol abuse.	- Limited decision-making power (20–27% in profit distribution, near-absence in leadership) exacerbates vulnerabilities.	- Enforce zero-tolerance policies for harassment (16.5% report sexual harassment).
- Low female participation in ore mining roles (8% in Kanyelele).	- Without intervention, women will remain marginalized in ASGM.	- Support awareness campaigns targeted towards diversity, equity and inclusivity.

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Appendices

Key Informant Interview (KII) Question Guide

*KII Guide for **Mine Leaders (ASGM Operators, Site Managers, & Cooperative Leaders)***

***Objective**: To understand miners' perspectives on **mining practices, mercury use, formalisation challenges, access to finance, health/safety risks, and gender/social dynamics** to inform policy and intervention strategies.*

Profile of KII participants

Interview Number	e.g KII_M_01 or KII_C_01 or KII_S_01
Gender	
Age	
Name of Entity Affiliated to	
Role in the Entity	
Interview Location	
Date of Interview	
Start Time	
End Time	
Name of Interviewer	

Q1. Demographic Information & Mining Background
(Understand motivations and local context.)

a. What is your position at this mine? How do you oversee work?
b. Do you own equipment/land, or do you manage labourers?
c. Why did you start mining? (motivation factors could be poverty, family tradition, lack of alternatives?)

Q2. Mining Practices

a. Please explain to me how your daily mining workday looks like? (*Walk me through a typical day—from digging to gold extraction.)*
b. Do you use machines (crushers, excavators)? If yes, who owns them? If not, tell me more on gold extraction methods you use?
c. Do you process ore on-site or you take it elsewhere e.g. to a processing plant nearby? Tell me more about the gold processing methods you use.
d. Do you use any chemicals to process your gold faster? If yes, what chemicals do you use? (Mercury, cyanide, borax?)
e. If mercury, how much mercury per processing cycle do you use? (Observe if possible—use checklist.)

Note: Ask if they can run you through the entire process so that you can observe what they do; should they allow you to observe use the checklist below.

- *Weigh the quantity of the ore they are adding in a mixing bowl*
- *Count the number of times ore is added to the mixture*

- *Weigh the amount and frequency of mercury being added to the ore mixture per processing cycle*
- *Weigh the amount of gold extracted at the end of a processing cycle*

f. Is the mining practice you have described above used by everyone here on this mine or others do it differently? What are they doing differently?
g. Are you aware of mercury-free methods? Why not use them? (Cost, training, efficiency?)
h. Would you switch if given training/equipment? Or *if you could get the same gold yield without mercury, would you switch? What's stopping you?*

Q3. Formalisation & Licensing
(Probe barriers to legality and collective action.)

a. Is this site individual-run or part of a cooperative/association?
b. If organized: What benefits does the group provide? (Negotiation power, shared costs?)
c. Is your group registered? If not, why? (Cost, bureaucracy, distrust?)
d. Do you have a mining license? If not, why? (Cost, bureaucracy, distrust?)
e. How much does a license cost? Is the process clear?
f. Do you have legal land access? Conflicts with chiefs/communities?

Q4. Access to Finance
(Explore funding gaps and solutions.)

a. How do you finance your mining operation? (Personal savings, loans, middlemen, buyers?)
b. Have you tried getting a formal finance option such as a loan, credit or grant? What blocked you? (Collateral, interest rates?)
c. What would you fund with a loan/grant? (Machines, safety gear, mercury alternatives?)
d. *Would a community loan fund help? How should it work?*

Q5. Environmental and Health Practices
(Assess risks and mitigation efforts.)

a. Where do you dump tailings? Any water/soil contamination?
b. Do miners know mercury is toxic? Any visible health effects?
c. Do you use protective gear? (Gloves, masks?)
d. Do you replant trees or refill pits (rehabs)? Who enforces this?

Q6. Safety and Training
(Gauge awareness and accident rates.)

a. What safety measures exist? (First aid, pit supports?)
b. How often do accidents occur? Any deaths recently?
c. Who trains miners on mining safety? (Government, NGOs, peers?)
d. What topics are needed most? (Mercury-free methods, business skills?)
e. *What's one change that would make this mine safer tomorrow?*

Q7. Gender and Social Issues
(Explore inclusion and exploitation.)

a. Do women work here? In what roles? (Digging, processing, catering?)

b. Are children/youth (<18) present? What tasks do they do?
c. Do women/youth get equal ore access? Less pay?
d. Any reports of GBV or teen pregnancies linked to mining?
e. Are clinics/schools accessible? How does mining affect them?
f. *How could women miners here be better supported?*

Note: Please observe for the presence of (child labourers) and explore why they are doing what they are doing from the respondent. Do not engage the children in any of the conversation while on the mine.

Q8. Recommendations for Improvement
(Prioritize miner-driven solutions.)

a. What would help reduce mercury use and increase profits? (e.g., cheaper alternatives, better gold prices?)

b. What would a safe, legal, and sustainable mine look like here?

c. What support is needed? (Policy changes, financing, training?)

KII Guide for Community Leaders and District Officers (Chiefs, Indunas, Community Chairpersons, District officers)

Objective: To assess community perceptions of ASGM impacts, mercury risks, gender dynamics, and socio-economic effects while identifying local solutions.

Profile of KII participants

Interview Number	e.g KII_M_01 or KII_C_01 or KII_S_01
Gender	
Age	
Name of Entity Affiliated to	
Role in the Entity	
Interview Location	
Date of Interview	
Start Time	
End Time	
Name of Interviewer	

Q1. Demographic Information and Local Context
(Establish rapport and understand the leader's perspective.)

a. What is your role in the community/district? How do you engage with miners?
b. Are you involved in resolving mining disputes or regulating activities?
c. How long have you lived here? How has gold mining evolved?
d. When did ASGM become significant here? Who controls mining areas (chiefs, cooperatives, outsiders)?

Q2. Mining Impacts (Employment, Health, Environment)
(Probe for tangible examples and community priorities.)

a. Has mining improved employment/income? For whom? (Men/women/youth?)
b. Are there conflicts over land or resources due to mining?
c. Which areas are most degraded (water sources, farmland, forests)?
d. Do miners reclaim/rehab land after digging?
e. Have you seen mercury use? Any visible health effects (e.g., skin rashes, stillbirths)?
f. Do miners understand the dangers? Are clinics aware of mercury poisoning?
g. What benefits has mining brought? (Schools, roads, jobs?)
h. What are the biggest problems? (Crime, pollution, child labour?)
i. What would reduce environmental harm? (e.g., land rehab funds?)
j. Who should hold miners accountable for environmental damage?

Q3. Awareness & Participation in Mining Practices
(Gauge local knowledge gaps and engagement.)

a. How do miners here extract gold? (Digging, crushing, mercury/cyanide use?)
b. Where do they buy mercury? Are suppliers known to authorities?
c. Are there trainings/workshops on safer mining? Who organizes them?
d. Would the community support a mercury ban? What alternatives exist?
e. Are leaders consulted in mining decisions?
f. Do miners follow traditional/civic rules (e.g., chief's directives or DC/Council)?
g. Should mercury be banned? What support would miners need?
h. How can profits stay in the community? (e.g., cooperatives, local taxes?)
i. Should chief's/district offices have more oversight?

Q4. Gender, Youth & Social Issues
(Explore inequalities, exploitation, and community responses.)

a. What roles do women play (e.g., digging, processing, selling food)?
b. Do they face barriers (e.g., land access, harassment)?
c. How could women miners be better protected and supported?
d. Do you know if women are also involved in mining gold? What roles do they play if they are involved?
e. Are children (<18) working in mines? What tasks do they do?
f. Are schools affected by child labour?
g. Would alternative livelihoods (e.g., vocational training) reduce child labour?
h. Are there reports of GBV or teen pregnancies linked to mining?
i. How does the community respond? (Chiefs, police, social workers?)

j. Has mining improved livelihoods? Or increased alcoholism/conflicts?

k. Do you know if children and young people are also involved in gold mining? What role do they play? What are the age groups for children and young people are involved in gold mining?
l. Do women, children and young people face different challenges as compared to male adult miners? Does everyone on the mine have equal access to the gold ore?
m. Have you heard or received any reports of gender-based violence stemming from gold mining? What are the reasons? What have you done when such reports reached you?
n. Have you observed or received reports of child pregnancies due to goldmining activities in the community or district? please explain.
o. What social benefits have you observed in the communities due to gold mining activities?

Q5. Recommendations

a. What interventions would improve mining practices in your community?
b. What training topics would benefit miners?
c. What key recommendations would you suggest ensuring the local community benefits from the gold mining?
d. What about the legal and policy reforms what would you suggest being changed?

KII Guide for Key Stakeholders (National Level)

Objective: To gather in-depth insights from key stakeholders on ASGM formalisation, coordination, mercury reduction, environmental management, gold supply chains, financial inclusion, gender dynamics, and child labour issues.

Profile of KII participants

Interview Number	e.g KII_M_01 or KII_C_01 or KII_S_01
Gender	
Age	
Name of Entity Affiliated to	
Role in the Entity	
Interview Location	
Date of Interview	
Start Time	
End Time	
Name of Interviewer	

Q1. Stakeholder Information & General ASGM Context
(Clarify stakeholder's position and familiarity with ASGM.)

a. Can you describe your role and how your organization interacts with ASGM?
b. Does your organization directly regulate, support, or research ASGM?
c. How long have you worked in/with ASGM? What changes have you observed in ASGM practices over time?
d. In your view, what does "responsible" or "sustainable" ASGM look like?
e. What are the biggest gaps between current practices and ideal practices?

Q2. Formalisation, Coordination, and Policy

(*Probe deeper on licensing, policy gaps, and stakeholder engagement.)*

a. What licenses/permits are required for ASGM miners?
b. Are these requirements well-communicated to miners?
c. Based on your experience and knowledge, why do many miners operate informally? (Cost, bureaucracy, lack of awareness?)
d. Are there alternative models (e.g., cooperatives) that could improve formalisation?
e. What would accelerate formalisation (e.g., simplified licensing, incentives)?

f. Do you think the current policies we have as a country sufficient, friendly, and supportive of the ASGM formalisation? If yes, please explain.
g. If not, what policies are missing (e.g., environmental, safety, gender-inclusive)?

h. Who are the key players in ASGM (govt, NGOs, traders, traditional leaders) in Zambia? Is there meaningful collaboration among them?

i. Do you think there is proper coordination of ASGM in Zambia or is it fragmented? Who should lead the coordination? Do you think there is any form of coordination at various levels of governance, like national provincial, district and community level?

Q3. Mercury Reduction
(Explore mercury sources, alternatives, and barriers to elimination.)

It is a common knowledge that ASGM miners use mercury in their gold extraction process, despite the effects of mercury on health and environment.

a. Do you have data on which mine sites have high-mercury-use? How is mercury exposure monitored?
b. What do you think is the reason why we have these miners continue using mercury in their operation? Is it due to lack of alternatives, cost, or tradition?
c. Are there any campaigns, plans or strategies that relevant authority, or stakeholder have come up with in sensitizing miners about the use of mercury in gold mining? Are miners aware of the health/environmental risks?
d. What mercury-free technologies (e.g., borax, cyanide-leaching) are promoted?
e. Who supplies mercury? Is it smuggled or legally imported? How much is the market price for mercury?
f. What would happen if mercury were banned? What needs to be done to do so?
g. What prevents adoption of mercury-free methods (training, cost, enforcement)?
h. If you were to design a mercury phase-out plan, what would it include?

Q4. Environmental and Rehabilitation
(Assess damage, enforcement, and funding for rehab.)

a. Is there data on land degradation from ASGM?
b. Do miners contribute to rehab funds? Who manages them?
c. Are environmental plans enforced?
d. Do miners follow environmental regulations? If not, why?
e. How can Zambia's NAP on ASGM be more effective?

Q5. Gold Supply Chain and Financial Inclusion

(Trace gold flows, pricing, and financing barriers.)

a. Who sets gold prices (traders, Zambia Gold Company, global markets)?
b. Are miners exploited by middlemen? The so-called gold buyers? Tell us more on what you know.
c. When we talk to ASGM miners, they say they lack capital to finance their operations, based on your experience and expert knowledge what affects their lack of access to finance? *Why do miners struggle to get loans (collateral, informality)?*
d. What financial models (e.g., cooperatives, microfinance) could help?
e. How would a gold-buying scheme by the government improve miners' incomes? (how best can ZGC be more effective?)

Q6. Gender, Youth & Child Labour
(Explore inequalities and interventions.)

a. What roles do women play? Are they in decision-making?
b. How could ASGM policies better support women miners?
c. Are youth engaged, or do they face exploitation?
d. What challenges do women/youth miners face?
e. Is child labour prevalent? What interventions exist to stop this act?

Q7. Recommendations

a. What interventions would you recommend improving the ASGM sector?
b. How can the NAP be implemented more effectively?

SURVEY QUESTIONNAIRE

Survey Questionnaire					
No.	**Question**	**Answers**			**Comments**
	Enumerator Information				
		Enumerator No:			
		Questionnaire No:			
		GPS Coordinates			
Section 1: Mining Type and Location					
1	What type of gold do you mine?	Hard		1	
		Reef		2	
		Both		3	
2	In what district is the current Artisanal gold mining site locates in?				Pick one only
		Rufunsa		1	
		Chisamba		2	
		Mumbwa		3	
		Vumbwi		4	
		Lusangazi		5	
		Mpika		6	
3	What is the name of the Mining Site?				Pick one only
		Kabombo		1	
		Matipa		2	
		Mushima		3	
		Chilandikwa		4	
		Munaka		5	
		Lungusungu		6	

Section 2: Background Information					
4	What your gender?				Pick one only
		Male		1	
		Female		2	
5	What is your age?				Pick one only
		18 – 25		1	
		26 – 35		2	
		36 – 45		3	
		46+		4	
6	In which district do you live in permanently	…….			
7	What is your marital status?				Pick one only
		Single		1	
		Married		2	
		Cohabiting		3	
		Separated		4	
		Divorced		5	
		Widow		6	
8	How many family members do you have?				
		Members			
9	What is your level of education?				Pick one only
		No formal education		1	
		Primary		2	
		Secondary		3	
		Tertiary		4	
Section 3: Employment					
10	What is your main employment?				Pick one only
		Gold miner		1	
		Civil servant		2	

		Self employed		3	
		Farmer		4	
		Unemployed		5	
		Retired		6	
		Student		7	
		Business man		8	
		Other (Specify)		9	
		Gold miner		10	
11	What mining organisation do you below to?				Pick one only
		ASGM Company		1	
		ASGM Cooperative		2	
		ASGM Association		3	
		Unstructured group		4	
		Individual operator		5	
		None (piece worker)		6	
12	What role do you play in that organisation?				Pick one only
		Owner		1	
		Manager		2	
		Leader		3	
		Chairperson		4	
		Supervisor		5	
		Member		6	
		Employee		7	
13	How many members are in your entity?				Pick one only
		Total		1	
		Male		2	
		Female		3	
14	How many members are considered active?				
		Total		1	
		Male		2	
		Female		3	

15	What kind of work do you do in the ASGM?				Please select 1 -3 choices. No more than 3 choices
		Miner		A	
		Shaft owner		B	
		Support worker		C	
		Panner		D	
		Own processing plant		E	
		Transporter		F	
		Crusher		G	
		Security		H	
		Supervisor		I	
16	How long have you been mining at this gold mine?				Pick one only
		Less than 1 Month		1	
		1 -3 months		2	
		4 - 9 months		3	
		1-3 years		4	
		2- 3 years		5	
		3 - 5 years		6	
		6 - 9 years		7	
		More than 10 years		8	
17	Which month(s) of the year do you usually work in at this gold mine?				Select as many choices as you can
		January		A	
		February		B	
		March		C	
		April		D	
		May		E	
		June		F	
		July		G	
		August		H	
		September		I	
		October		J	
		November		K	

		December		L	
Section 4: Income					
18	What is you main source of income?				
		Gold mining		1	Pick one only
		Private business		2	
		Farming		3	
		Salary wages (employed somewhere)		4	
		Retirement package		5	
		Livestock		6	
		Other		7	
19	How often do you get paid for the work you do at this gold mine?				Pick one only
		Hourly		1	
		Daily		2	
		Weekly		3	
		Monthly		4	
20	How much money do you make from what you do on this gold mine per month?				Pick one only
		Less than ZMW 500		1	
		ZMW 500 - ZMW 1500		2	
		ZMW 1500 - ZMW 2500		3	
		ZMW 2500 - ZMW 5000		4	
		ZMW 5000 - ZMW 10000		5	
		ZMW 10000 - ZMW 20000		6	
		ZMW 20000 - ZMW 50000		7	
		ZMW 50000 - 100000		8	
		ZMW 100000 - ZMW 200000		9	
		ZMW 200000 and above		10	
21	Does the money (income) you make from this gold mine help you provide for your family's livelihood?				Pick one only
		Yes		1	
		No		2	
		sometimes		3	

		Not all family requirements		4	
22	Do you pay for NAPSA				Pick one only
		Yes		1	
		No		2	
		sometimes		3	
23	Do you pay for NHIMA				Pick one only
		Yes		1	
		No		2	
		sometimes		3	
24	Do you have access to medical health services nearby?				Pick one only
		Yes		1	
		No		2	
25	Where do you go for medical attention? (state approximate distance)	……			
Section 5: Formalisation					
26	What is the land ownership status for the entity you belong to?				Pick one only
		Renting land		1	
		Land allocated by Chief/headman		2	
		Own land (Council Offer letter)		3	
		Own land (Ministry of Lands)		4	
		No ownership (illegal)		5	
27	Does the entity you belong to have a PACRA/Cooperative registration?				Pick one only
		Yes		1	
		No		2	
		I don't know		3	
		I don't want to say		4	
28	If not, why?				

		We have applied waiting to receive PACRA/cooperative registration		1	
		We do not know the process		2	
		They do not give registration, so we have not tried to register		3	
		We can't afford one		4	
		The procedure is too long and delays		5	
		It is not important to have one		6	
29	Does the entity you belong to have gold mining license (legal) to operate as an ASGM?				Pick one only
		Yes, for this site		1	
		Yes, but not for this site		2	
		No		3	
		I don’t know		4	
		I don’t want to say		5	
30	If not, why?				
		We have applied waiting to receive the license		1	
		We do not know the process		2	
		They do not give license		3	
		We can't afford one		4	
		The procedure is too long and delays		5	
		It is not important to have one		6	
		We are just here temporary		7	
31	Does the entity you belong to have a gold panning license for ASGM?				Pick one only
		Yes, for this site		1	
		Yes, but not for this site		2	
		No		3	
32	If not, why?				

		We have applied waiting to receive the license		1	
		We do not know the process		2	
		They do not give license		3	
		We can't afford one		4	
		The procedure is too long and delays		5	
		We don't know that we have to get one		6	
		We are just here temporary		7	
33	Does the entity you belong to have an environmental compliance certificate/license (from ZEMA) for ASGM?				Pick one only
		Yes, for this site		1	
		Yes but not for this site		2	
		No		3	
34	If not, why?				
		We have applied waiting to receive the license		1	
		We do not know the process		2	
		They do not give license		3	
		We can't afford one		4	
		The procedure is too long and delays		5	
		We don't know that we have to get one		6	
		We are just here temporary		7	
35	Have you or other miners ever faced difficulties in obtaining mining related permits or licenses we have mentioned above?				Pick one only
		Yes		1	
		No		2	
		I don't know		3	
36	If so, what were the difficulties?				
37					Pick one only

	Are you aware that you need a gold mining license for you to be mining gold?	Yes		1	
		No		2	
38	Do you know where to obtain the license and the procedure?				
		Yes		1	
		No		2	
		I don't know		3	
Section 6: Ore Extraction					
39	What is the total amount of gold bearing materials (ore) do you extract/mine on average per day?				
		Less than 500 Kgs per day		1	
		500kg to 1 ton per day		2	
		1 ton to 5 ton per day		3	
		5 ton to 10 ton per day		4	
		10 ton to 20 ton per day		5	
		20 ton to 30 ton per day		6	
		30 ton and above per day		7	
40	How often do you extract/mine gold bearing materials (ore) for processing?				
		Every day of a month		1	
		Less than 10 days per month		2	
		10 to 15 days per month		3	
		15 to 20 days per month		4	
		20 to 25 days per month		5	
		25 to 31 days per month		6	
41	Do you have a book where you record the amount of gold bearing materials (ore) you have extracted and transported for processing?				
		Yes		1	
		No		2	
		I don't know		3	
42	What are your biggest gold extraction challenges?				
		Dewatering (e.g., waterlogged pits)		1	
		Lack of access to water for washing		2	

		Lack of basic tools (e.g., shovels, pans)		3	
		Poor access to mining sites		4	
		Weather conditions (e.g., flooding, drought)		5	
		Land permission issues		6	
		Lack of finance/funding		7	
		Competition for mining sites		8	
		Low gold recovery rates		9	
		Other (Specify)		10	
Section 7: Transportation					
43	How do you transport extracted gold-bearing material (ore) to the processing plant/station?				Please select 1 -3 choices. No more than 3 choices
		Manual carrying (e.g., buckets, sacks)		A	
		Wheelbarrows		B	
		Ox- Carts		C	
		Bicycles		D	
		Small trucks or Vehicles		E	
		Other		F	
44	Do you have challenges with transporting gold bearing materials (ore)? If yes, state the challenges.				
		The distance to the processing plant/site is too much		A	
		It is difficult to transport the ore over the mountains		B	
		The terrain is bad, so vehicles don't reach		C	
		We have little manpower		D	

		No proper means of transportation		E	
		No challenges		F	
		Other specify		G	
45	How often is gold bearing materials (ore) transported from mining site to processing plant/site?				
		Every day of a month		1	
		Less than 10 days per month		2	
		10 to 15 days per month		3	
		15 to 20 days per month		4	
		20 to 25 days per month		5	
		25 to 31 days per month		6	
		Less than 500 ZMW		1	
		500 to 1000 ZMW		2	
		1000 to 5000 ZMW		3	
		5000 to 10000 ZMW		4	
		10000 to 20000 ZMW		5	
		20000 to 50000 ZMW		6	
		50000 ZMW and above		7	
Section 8. Gold ore processing					
47	How is your gold bearing materials (ore) processed into gold?				
		Manual panning using a panning bowl under running water		1	
		Taken to processing plants (machine crushers and wet pans)		2	
		Simple wooded or metal sluices under running water		3	

		Other		4	
48	Apart from water what other thing do you or others add to the gold bearing materials (ore) to extract gold?				
		Dish washing soap (liquid)		1	
		Chemical (mercury)		2	
		Other		3	
49	Do you own a processing plant or equipment?				
		Yes		1	
		No		2	
50	How many times in a month do you process your gold bearing materials (ore)?				
		Every day of a month		1	
		1 to 10 days per month		2	
		10 to 15 days per month		3	
		15 to 20 days per month		4	
		20 to 25 days per month		5	
		25 to 31 days per month		6	
51	What is the total amount of gold bearing materials (ore) do you use per processing cycle?				
		Less than 10 Kg of ore		1	
		10 to 20 Kg of ore		2	
		20 to 50 Kg of ore		3	
		50 to 100 Kg of ore		4	
		100 to 250 Kg of ore		5	
		250 to 500 Kg of ore		6	
		500 to 1000 Kg of ore		7	
		1000 to 5000 Kg of ore		8	
		Above 5000 Kg of ore		9	
52	What amount of gold on average do you obtain from the gold bearing materials (ore) per processing cycle?				
		Less than 0.5g of gold per processing cycle		1	
		0.5g to 1g of gold per processing cycle		2	

		1g to 5g of gold per processing cycle		3	
		5g to 10g of gold per processing cycle		4	
		10g to 15g of gold per processing cycle		5	
		15g to 25g of gold per processing cycle		6	
		25g to 50g of gold per processing cycle		7	
		50g to 100g of gold per processing cycle		8	
		100g to 200g of gold per processing cycle		9	
		200g and above of gold per processing cycle		10	
53	What amount of chemical (mercury) is added to the gold bearing material (ore) per processing cycle?				
		Less than 0.5g of chemical per processing cycle		1	
		0.5g to 1g of chemical per processing cycle		2	
		1g to 5g of chemical per processing cycle		3	
		5g to 15g of chemical per processing cycle		4	
		15g to 30g of chemical per processing cycle		5	
		30g to 60g of chemical per processing cycle		6	
		60g to 120g of chemical per processing cycle		7	

		120g to 240g of chemical per processing cycle		8	
Section 9: Gold Production and Supply Chains					
54	Do you keep records of your gold transactions?				Pick one only
		Yes		1	
		No		2	
		Sometimes		3	
55	Who determines how much you will sale your gold?				
		The buyers		1	
		The miner		2	
		The mine chairperson		3	
		The mine owner		4	
		The owner of the processing plant		5	
56	Where do you sale your gold (who are your buyers)?				
		Zambian Individual buyers		A	
		Owners of gold processing plants		B	
		Somalians/Swahili/Zimbabwean		C	
		Zambia Gold Company (ZGC)		D	
		Chinese buyers		E	
		Lebanese buyers		F	
		Local goldsmith		G	
		Chemical (mercury) suppliers		H	
		Other specify		I	
57	Have you ever sold your gold to Zambia Gold Company (ZGC)?				
		Every time		1	
		Most of the time		2	
		Rarely		3	
		Never		4	
58	If never or rarely, why not?				
		I don't know them		A	
		I don't understand their process		B	

		I don't meet their requirements		C	
		I don't like their price usually lower than the others		D	
		Zambia Gold Company take too long to pay		E	
		Zambia Gold Company asks for too much information		F	
		I have to fill out too many forms		G	
		Other specify		H	
59	Does your gold buyer give you receipts or proof of transactions?				
		Yes		1	
		No		2	
		I don't know		3	
60	Do you give the buyer any receipt or proof transaction?				
		Yes		1	
		No		2	
		I don't know		3	
61	What is the total amount of gold do you sale per month?				
		Less than 10g per month		1	
		10 to 50g per month		2	
		50 to 100g per month		3	
		100 to 200g per month		4	
		200 to 500g per month		5	
		500 to 1000g per month		6	
		1000 to 2000g per month		7	
		2000g and above per month		8	
		Every day of a month		9	
62	How many times do you sale gold in a month?				Pick one only
		Less than 10 days per month		1	
		10 to 15 days per month		2	
		15 to 20 days per month		3	

		20 to 25 days per month		4	
		25 to 31 days per month		5	
63	How much do you sale your gold per gram on average?				
		Less than 1000 ZMW		1	
		1000 to 2000 ZMW		2	
		2000 to 4000 ZMW		3	
		4000 to 6000 ZMW		4	
		6000 ZMW and above		5	
64	Have you ever received any support from the government?				Pick one only
		Yes		1	
		No		2	
65	If yes, what kind of support did you receive from government				Pick one only
		Introduced us to Zambia Gold Company		A	
		Bought gold processing equipment		B	
		Gave us land to mine		C	
		Obtain funding through CDF		D	
		Other specify		E	
66	Have you ever received a form of funding to finance your gold mine operations?				Pick one only
		Yes		1	
		No		2	
67	If yes, from where?				
		Loan from a non-bank financial institution		A	
		Loan from commercial bank		B	
		Chinese gold buyer		C	
		Zambian gold buyer		D	
		Processing plants		E	
		Fellow miners		F	
		Friends and Families		G	

		Barter of goods and services (e.g. mercury suppliers)		H	
68	What challenges do you face in getting funding to finance your mine operations?				Pick one only
		Not being formally registered (illegal)		1	
		Lack of records to prove what we make		2	
		Lack of loan surety		3	
		Limited production capacity (low output to warrant funding)		4	
		Not interested in getting funding		5	
69	(For women) Are there challenges specific for women in getting finance?				
		Yes (Specify)		1	
		No		2	
		I don't know		3	
70	If yes, specify women's finance challenges	……..			
Section 10: Occupational and Health Safety					
71	What structural support to you use on this mine to support the strength of your pits/trenches as you extract gold ore (gold bearing materials)				
		Wood		A	
		Metal		B	
		Both wood and metal		C	
		We do not use any		D	
		Other specify		E	
72	How do you secure your mining pits/trenches do avoid anyone to accidentally falling in them?				Select only applicable choices
		Cover the pit		A	
		Use warning signs/tapes		B	
		Place barriers around the pits		C	
		Do not secure them		D	

		Other (specify)		E	
73	Do you wear any personal protective equipment (PPE) while mining at this site?				Pick one only
		Yes, always		1	
		Yes, sometimes		2	
		No		3	
74	Can you tell me the PPE that you wear while working on this mine?				Select only applicable choices
		Face mask		A	
		Gloves		B	
		Hard hats (safety helmet)		C	
		Safety boots		D	
		Ear protection		E	
		Eye protection (googles)		F	
		Protective work suit or vest with reflectors		G	
75	Why don't you wear any PPE while working on this mine?				Pick one only
		There is no real risk for wearing a PPE every time		1	
		PPE is expensive to buy		2	
		Don't know the importance of wearing one		3	
		No one has told them to wear one		4	
		The boss doesn't care		5	
		Where I borrow, they may be using it		6	
76	Do you receive any health and safety tips on how to work safely on this mine?				Pick one only
		Yes		1	
		No		2	
		I don't follow		3	
		I don’t want to say		4	
77	If yes, how many often do you receive tips on health and safety mine operations per month?				
		Less than 10 times a month		1	

		10 to 15 times a month		2	
		15 to 20 times a month		3	
		20 to 25 times a month		4	
		25 to 31 times a month		5	
78	How well do you follow Health and Safety tips that are given to you?				Pick one only
		I strictly follow		1	
		I try to follow		2	
		I don't follow		3	
		I don't know about it		4	
79	Is there someone responsible for providing health and safety tips at this mine?				Pick one only
		Yes		1	
		No		2	
		I don't know		3	
80	Have you observed any safety risks?				Pick one only
		Yes		1	
		No		2	
		I don't know		3	
81	If yes, what risks?	…….			
Section 11: Environment					
82	What type of water source do you have at this mine site?				
		Nearby river		A	
		Own a borehole		B	
		Rainwater		C	
		Water dam		D	
		No water at this site		E	
83	How do you dispose off any gold mining waste or tailings?				
		Burning		A	
		Burying		B	
		Dumped in the bush		C	
		Run down the stream or the water		D	
		I don't know		E	

		Other specify		F	
84	Do you have an environmental rehabilitation plan? (or anything similar)				Pick one only
		Yes		1	
		No		2	
		I don't know		3	
85	How do you rehabilitate mining pits (when you are done (gold is finished) mining in that site e.g. pits what do you do)?				Select only applicable choices
		Burry the pits		A	
		Leave the pits open		B	
		Clean the operation site		C	
		Plant some trees		D	
		Just leave		E	
		Other Specify		F	
Section 12: Training					
86	Have you participated in training in the last 2 years?				Pick one only
		Yes		1	
		No		2	
87	What type of training did you participate in?				Select only applicable choices
		Formalisation		A	
		Responsible and better mining standards		B	
		Supply chain		C	
		Business Management		D	
		Financial management		E	
		Health		F	
		Environment		G	
		Rehabilitation		H	
		Technology		I	
		Gender and human rights		J	
		Organization management		K	
		Personal development and leadership		L	

		I don't want to receive any		M	
88	Who conducted the trainings?	……			
89	Would you like to receive some training in the near future? If yes, what kind of training would you like to receive?				Select only applicable choices
		Formalisation		A	
		Responsible and better mining standards		B	
		Supply chain		C	
		Business Management		D	
		Financial management		E	
		Health		F	
		Environment		G	
		Rehabilitation		H	
		Technology		I	
		Gender and human rights		J	
		Organization management		K	
		Personal development and leadership		L	
		I don't want to receive any		M	
Section 13: Work, Roles, Decision Making (Gender)					
90	What kind of work do you perform at the mine?				Select 1 - 2 applicable choices in each of the three categories
		Extraction Activities			
		operating a winch		A	
		Going underground		B	
		Ore extraction		C	
		Sorting ore		D	
		Bagging ore		E	
		Transporting ore		F	
		Blasting		G	
		Dewatering/pumping		H	

		Tunnel construction		I	
		Exploration		J	
		Other Specify		K	
		Supporting Activities			
		Purchasing food and other items		A	
		Childcare		B	
		Preparing food		C	
		Safety and security		D	
		Dish washing		E	
		Cleaning		F	
		Other Specify		G	
		Processing Mining Activities			
		Crushing ore		A	
		panning /washing ore		B	
		Grinding gold ore		C	
		Smelling		D	
		Chemical processing		E	
		Gold weighing		F	
		Gold record keeping/data logging		G	
		Clean the mills at the processing plant		H	
		Other Specify		I	
		Management Activities			
		Securing finance		A	
		Equipment/Supplies purchaser		B	
		Managing funds/money		C	
		Accounting		D	
		Selling gold		E	
		Safety and security		F	
		Mine/Operations supervisor		G	
		Process plant Liaison		H	
		Legal (permits, registration etc.)		I	

		Other specify		J	
91	Which domestic tasks do you perform while at this mine?				Select only applicable choices
		Cooking		A	
		Laundry		B	
		Cleaning		C	
		Care for children		D	
		care for the elderly		E	
		Gather fire wood, charcoal		F	
		Fetching water		G	
		I do not perform any domestic task		H	
92	If you do not perform any domestic task, why?				Select only applicable choices
		Because those are jobs for women		A	
		Because those jobs for children		B	
		I do not have time for domestic tasks		C	
		I don't know		D	
93	How many times do you perform domestic tasks while at the mine?				Pick one only
		Less than 10 days a month		1	
		10 to 15 days a month		2	
		15 to 25 days a month		3	
		25 to 31 days a month		4	
94	Who decides major household expenses?				Pick one only
		I decide alone		1	
		My spouse		2	
		My spouse and I jointly		3	
		Children		4	
		My extended family		5	
95	Who decides daily purchases?				Pick one only
		I decide alone		1	
		My spouse		2	

		My spouse and I jointly		3	
		Children		4	
		My extended family		5	
96	Are women or youths involved in mine decision-making? If yes which ones?				Select only up to three most appropriate choices
		Access to mineral deposits		A	
		Administrative management/coordination		B	
		Ore extraction (mining)		C	
		Ore processing		D	
		Profit distribution		E	
		Selling		F	
		Waste dispose		G	
		Not involved		H	
97	What social and gender problems do you regularly face at this site?				
		Women and youths are restricted on what they can do		A	
		Work conditions are not good		B	
		Workers are not valued (appreciated)		C	
		Violence (fights for access to gold)		D	
		Harassment (in general)		E	
		Sexual harassment		F	
		Alcohol abuse		G	
		Chemical poisoning (too much mercury)		H	
		Safety at work (accidents and injuries)		I	
		Crimes		J	
		Income insecurity		K	
		Other (specify)		L	
Section 14: Information Sources					

98	Where do you information about gold mining such as where gold has been discovered, prices, practices, chemicals, tools to use etc.?				
		Family and friends		A	
		Public organizations/government		B	
		NGOs		C	
		Someone in the mining business (e.g. miners)		D	
		Social Media		E	
		Other		F	
99	What communication tools do you use to gain access to this information?				
		Television		A	
		Radio		B	
		Facebook		C	
		X (twitter)		D	
		WhatsApp		E	
		SMS		F	
		Group meeting (face to face)		G	
		Google on internet		H	
100	Would you like to be receiving more information about gold mining from organization like ours?				
		Yes		1	
		No		2	
101	What type of information would you like to be receiving from us				
		New gold mines		A	
		Environmental protection tips		B	
		Safe mining tips		C	
		New gold mining practices (mining methods)		D	
		Health tips		E	
		Market prices for gold		F	
		Gold buyers		G	
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	How would you like to be receiving this information about gold?	Facebook		A	
		X (Twitter)		B	
		WhatsApp		C	
		Radio		D	
		Television		E	
		SMS		F	
		Group meetings (Face to face)		G	
14. Mercury Questions					
103	Have you seen/used (observed) any chemicals (mercury) being used during gold processing (during your site visit) in the past 1 week?				Pick one only
		Yes		1	
		No		2	
		I don't know		3	
		I don't to say		4	
104	If yes, how much mercury do they add to the ore (gold bearing material) per cycle of processing gold?				Pick one only
		0.5g to 1g per cycle of processing gold		1	
		1g to 3g per cycle of processing gold		2	
		3g to 10g per cycle of processing gold		3	
		10g to 20g per cycle of processing gold		4	
		20g to 50g per cycle of processing gold		5	
		100g to 200g per cycle of processing gold		6	
105	Do you know where the chemical (mercury) is sold?				Pick one only
		Yes		1	
		No		2	
		I don't know		3	
		I don't want to say		4	

106	Do you know how much is the chemical (mercury) sold per lid (135.34 gram)?				Pick one only
		Less than ZMW 2,000		1	
		ZMW 2,000 - ZMW 5,000		2	
		ZMW 5,000 - ZMW 10,000		3	
		ZMW 10,000 - ZMW 15,000		4	
		Above ZMW 15,000		5	
107	Do you know that the chemical (mercury) is harmful to human beings?				Pick one only
		Yes		1	
		No		2	
108	If yes, in what way is the chemical (mercury) harmful to human beings?				
		Causes brain damage (Neurological system)		A	
		Causes kidney problems		B	
		Causes heart problem (cardiovascular system)		C	
		Cause abnormal development of unborn children		D	
		Other Specify		E	
109	If you know that the chemical (mercury) is harmful why do you (or other people) continue to use it?				
		It is cheaper		A	
		It is fast		B	
		It is easy to use		C	
		Lack of knowledge about other alternatives		D	
		Because everyone at the mine is using it		E	
110	Are you aware of any chemical (mercury)-free technologies (methods)?				Pick one only
		Yes		1	
		No		2	

111	If yes, mention any methods that you know (describe)				
112	Have you tried any of these chemical (mercury)-free technologies (methods)?				Pick one only
		Yes		1	
		No		2	
113	What barriers prevent adopting mercury-free tech?				Pick one only
		Cost		1	
		Lack of knowledge		2	
		Lack of access		3	
		Other		4	
End					

planetGOLD Zambia

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