EAST, CENTRAL AND SOUTHERN AFRICA HEALTH COMMUNITY (ECSA-HC)

Population and Size Estimate of Artisanal and Small Scale miners (ASM) in Selected Southern Africa Development Community (SADC) Countries

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LIST OF ABBREVIATIONS

Abbreviations and Acronyms

ANC	Ante Natal Care
ASM	Artisanal Small Scale Miners
DMOs	District Mines Officers
DRC	Democratic Republic of Congo
ECSA-HC	East, Central and Southern African Health Community
EGP	Environmental Governance Programme
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
HSSS	health system strengthening strategy
KI	Key Informants Interviews
KII	Key Informants Interviews
KM	kilometre
MHS	Mine Health and Safety
ODK	Open Data Kit
OHS	Occupational Health and Safety
PMOs	Provincial Mines Officers
PPE	personal protective equipment
QGIS	Quantum Geographic Information System
RTGS	Real Time Gross Settlement

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SADC	Southern Africa Development Community
SHE	safety, health, and environment
SPSS	Statistical Package for the Social Sciences
STIs	Sexual Transmitted Infections
WASH	Water, Sanitation and Hygiene
WHO	World health Organisation
XML	eXtensible Markup Language

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dedication were key to the successful completion of this project. Thank you all for your support and collaboration.

EXCEUTIVE SUMMARY

This report narrates the distribution and size estimation of ASMs in eight countries of the SADC region namely the Democratic Republic of Congo (DRC), Madagascar, Malawi, Mozambique, Namibia, Tanzania, Zambia and Zimbabwe as a result of a mapping exercise that was undertaken by the East, Central and Southern Africa Health Community (ECSA-HC).

Four Questionnaires were designed and used by data collectors in gathering information and spatial data. Data was collected from a variety of targeted respondents, and these included the Key informants from Ministries of Mines and Energy, Ministries of Health, Heads of key departments and community development organizations, Representatives of Artisanal and Small-scale Miners (ASM) associations and the ASMs themselves. Open Data Kit was used for data collection using mobile devices and the system was adopted for data management.

For data processing, size estimation cleaning and analysis, a combination of Excel, SPSS and R software were used. For mapping and spatial analysis, ArcGIS and Quantum GIS were used. A novel script was developed, and it was used to detect all possible ASM mining sites. The customised script runs under Python environment using Jupiter notebooks. The script uses Geomidians of Sentinel 2 satellite-based images to detect all possible mining areas or sites. Using this technique, we were able to come up with all the possible active ASM mining sites in each country.

To generate estimates of the numbers of ASMs in each country, the number of active ASM sites were multiplied by the average number of persons from those counted in each of the ASMs sites visited by the study team in each country.

Results from the study, indicate that ASMs are distributed across many districts of the study countries. The study results show that there are 7,012,582 ASM in the study countries. For DRC, the ASM size population was noted to be 1,827,332 people followed by Tanzania with a sum of 1,495,223 ASMs. Madagascar was third with 1,177,460 ASMs followed by Zimbabwe with 855,848 ASMs. 708,470 ASMs in

Mozambique, however **229 680** ASMs were reported to be in Mozambique according to **CEMAM 2021**, while Zambia had 512,065 ASMs. Malawi and Namibia had the least ASM population sizes with Malawi having an estimated ASM population size of 397, 754 and Namibia 35,869.

The spatial distribution of ASMs in each country vary greatly across the regions and this is attributable to the presence of minerals and the type of minerals found in the different countries and regions. In some countries like DRC, Zambia, Namibia and Tanzania, ASM hotspots are localised in a few districts whilst in the other countries like Zimbabwe, Madagascar, Mozambique, Namibia and Malawi, the ASMs are found in many districts of the country.

In addition to size estimates of ASM population, legal and regulatory, socio-economic and cultural environment in which the miners operate were also examined. In terms of social services, the study found that there is poor road network in ASM locations, health facilities are geographically distant from the ASM sites in most countries. Most of the health facilities accessed by ASM population lack the required medical equipment and resources to offer Occupational health services. However, most health facilities that are accessed by ASM population can treat minor ailments. ASMs have to travel for long distances to the district/central hospitals in order to get screened for TB and other occupational lung diseases including silicosis mainly because the nearest health centre cannot offer such services. Despite the fact that the study Countries have made significant progress in terms of improving access to health services, gaps still remain when it comes to health services for the ASM population.

The water, sanitation and hygiene (WASH) situation among ASM communities was also found to be appalling, with limited access to portable water. Other findings were: that the ASMs in the all the countries use rudimentary tools, as most did not have access to basic equipment and machinery necessary in the mining arena. ASMs lack access to credit facilities, stringent legal and regulatory frameworks that discourage formalization of ASM activities, low participation of women due to social, economic,

cultural barriers including myths and beliefs like presence of women at mining sites making the minerals to disappear.

In conclusion, ASM remains a significant economic activity employing 7,012,582 in the study countries and remains a source of livelihood to large proportion of the population in Southern Africa. However, there is need to formalize this sector including addressing bottlenecks faced by persons wishing to operate legally. Such bottlenecks include corruption in the registration/licencing process, old or weak or absent legal and regulatory frameworks to guide the work of ASMs. Mining is associated with a number of occupational health catastrophes, including lung diseases such as TB, silicosis, etc. In particular, given the high burden of TB in the region, there is need to improve supply and demand sides to access to health services. On the demand side there is need to incorporate occupational lung diseases in the mining sector in the national TB and Lung diseases programs of Ministries of Health, improve physical accessibility of health facilities and availability of occupational health resources, strengthen regulatory enforcement capacity of responsible units in the ministries of mines and labour/employment especially on Mine Health and Safety (MHS). On the demand side, there is need for improved behavioural change communication to ASM population.

There is need also to address the negative socio-cultural issues that affects the full participation of women in the sub-sector through gender programs that target key stakeholders at national and community levels.

CHAPTER 1. INTRODUCTION

1.1 Background

According to Weldegiorgis (2018), artisanal small-scale mining (ASM) has grown significantly with approximately 40.5 million people directly involved, and an additional 150 million dependents on the sector for their livelihood. The role of women in artisanal small-scale mining is also becoming quite significant, as they make up around 30 per cent of the total workforce globally, and up to 50 per cent in some regions.

Literature indicates that the trade faces a number of challenges, including inadequate legal and regulatory frameworks, low productivity, and the application of rudimentary and inappropriate technology. The industry is also faced with problems such as isolation from mainstream economic development, adverse environmental factors, and frequent exposure to health and occupational hazards.

Artisanal small-scale miners (ASM) continue to play a crucial role in the development and improvement of the economic conditions of SADC countries as they contribute significantly towards the Gross Domestic Product (GDP) of member states. Artisanal small-scale mining also plays a very important role in improvement of livelihoods for individuals and family through providing an opportunity for generating income for communities.

A study conducted in 6 countries namely Malawi, Mozambique, South Africa, Tanzania, Zambia, and Zimbabwe, estimated that small scale miners were about 1.5 million in SADC (B Dreschler, 2002). The report also indicated an exponential growth with a likelihood of numbers tripling within the next decade.

A number of literature has been published on the nature of ASMs and how they operate but there is no recent data on the size of the ASM in the SADC region and the information around regulation and access to social services including health by this population. Yet such information is important for policy and regulatory reforms and designing and implementing appropriate and effective programs for the ASMs. In

addition, that kind of information is required by the ASM and other stakeholders as tools for advocacy.

Therefore, this mapping exercise seeks to provide recent estimates of the size and distribution of ASM, and access to healthcare including occupational health services by ASM in the SADC region. This informant will inform policy, legal reforms and programming for ASM in the region.

Furthermore, especially in recognition of the significant socio-economic contribution of the group, the information will inform a coordinated and well organised approach towards intervention efforts for ASM at national and regional level. The information will also contribute to better planning towards eradication of TB in the region as the mining sector, including artisanal and small mining, has been noted as one of the key drivers of TB burden in the region.

A coordinated and well organised approach gives room to plan for a healthy working environment, and it fosters accountability in doing business. If there is no clear documentation of the ASM and a cross-sectional view of their challenges with regards to access to occupational health services, providing them with targeted services shall remain difficult. Therefore, this assessment is timely in filling gaps in knowledge about ASM in the region.

It is anticipated that this mapping exercise shall provide evidence/data to inform country level strategies and regional level initiatives as well as inform the indicator(s) to be included in the regional TB dashboard.

1.2 Aim

Overall objective

The overall purpose of the assessment was to conduct a mapping and size estimation of artisanal and small mining (ASM) communities in eight countries of SADC to inform country and regional level policies and programmes. The targeted countries were: -

the Democratic Republic of Congo (DRC), Tanzania, Malawi, Madagascar, Mozambique, Namibia, Zambia and Zimbabwe.

Specific objectives were:

- **ii).** Geospatial Mapping and size estimation of ASM population in 8 SADC countries.
- **iii).** Describing ASM communities' demographic and socio-economic characteristics.
- **iiii).** Geospatial mapping of health facilities providing services to ASM.
- **ivi).** Identifying structural and legal challenges faced by women and migrant workers in ASM and their access to TB and OHS services.
- **vi).** Conducting a needs analysis for the eight countries to support creation of country specific interventions and regional interventions.
- **vii).** Identifying gaps in implementation of ASM interventions
- **viii).** Proposing a standard definition of ASM for the SADC region
- **viiii).** Recommending regional initiatives that will reduce ASM vulnerabilities and improve access to TB and OHS services.
- **ixi).** Recommend indicators for monitoring the ASM population access to TB and OHS services

1.3 Methodology

A combination of qualitative and quantitative techniques was used in this assessment. An extensive desk review combined with primary data collection through field visits in selected 8 countries of the SADC region were the main methodological approaches in this assessment. Geospatial mapping methods including GIS and Remote sensing techniques played a key role in identifying ASM sites, mapping them and performing ASM size estimation in the selected countries.

1.3.1 Settings

The assessment was conducted in 8 countries namely: Democratic Republic of Congo (DRC), Tanzania, Malawi, Madagascar, Mozambique, Namibia, and Zambia.

1.3.3 Approach to the assessment

This assessment was done through a three-stage process. Firstly, a generic regional assessment protocol was developed and customised to for each of the eight countries. Secondly, ASM sites were mapped per country and thirdly, Key Informant interviews were conducted with key stakeholders.

The assessment was structured in a manner that allowed for uniformity between all selected countries, utilising the same methodology and research tools. The core of the assessment was the desire to utilise GIS and Remote sensing techniques to come up with estimates of ASM population and map the ASM sites in each country and region to inform policy, programming, service delivery and advocacy. This was achieved and these are deliberated in the following sections and chapters reporting on the findings from each country.

Assessment protocol development

A detailed assessment protocol was developed and customised to the individual country. Research leads for each of the eight countries who had expertise in research, GIS and statistical application to coordinate assessment in the country were recruited. As part of development and pilot-testing of the assessment protocol, ECSA-HC organized a regional protocol development workshop in Dar es Salaam. From the workshop, a final generic and country specific protocol was developed.

The assessment protocols were submitted to relevant offices (especially the Ministries responsible for mines, as they needed to provide preliminary geo-codes of the mines) and Ministries of Health in the countries for their review and endorsement.

Mapping of the artisanal and small-scale mines

Various GIS and remote sensing techniques and Machine learning models were used. A custom script that runs under Python environment using Jupiter notebooks were used. The script developed for this assessment used geo-medians of sentinel 2

satellite-based images to detect all possible mining areas or sites. As a proxy, all areas where vegetation loss coincidental with water loss beyond a certain threshold were detected as a mining sites/zone. All areas below 250m in length were considered possible ASM sites. The script used a timeframe range to assess the mine status and check if it was active or not. In this case we selected a one-year time range from June 2022 to July 2023. If a site was active in this period, it was detected. The algorithm used a combination of satellite imagery analysis and machine learning between ASM sites and other land use types, such as agricultural, construction sites and other non-mining sites. Relevant features or characteristics are extracted from the satellite imagery to capture the unique signatures of ASM mining sites. These features include spectral bands, vegetation indices, texture analyses, or spatial Patterns. The algorithm used was trained and tested for the African region for the detection using the above-mentioned parameters.

Suffice to note shape files of large-scale mines and medium scale mines were acquired from the ministry of mines and these were used to filter out all the large to medium small scale mines thus we remained with only ASM for the analysis. In countries where the shape files for medium to large scale mines were not up to date and sometimes not readily available, we had to rely on the average size of ASM mines based on the ones that were visited in order to filter out big mines from our final mapping of ASM.

In the third phase of the assessment, for the selected sites of ASM activities for key informant interviews with local leaders and ASMs, mobile based GPS technology was used to triangulate remote sensing data with real-world location. As a validation technique, the visited ASM sites were super-imposed on the sites that were generated using the script and results speak one thing.

Key Informant Interviews

The third aspect of the assessment involved key informant interviews and review of records from Mines and Health departments. The key informant interviews were used to support population size estimation process and demographic characteristics of

ASMs. It was also the approach used to gather data on ASM legal and regulation frameworks and operations, the major type of minerals mined by the ASM and access to social services especially health services.

1.3.4 Sampling and Data Collection Procedures

Mapping of the ASM sites were undertaken as described above and in all the eight countries. Based on the information from the remote sensing procedure, geological units and deliberations with key Informants (Senior government officials form mines, ASM association leaders) samples or ASM sites were chosen either randomly of purposely depending on the country's context. These are noted under selection of ASM sites for KII in the individual country case report. In some context, such as DRC, aspects of security issues were also taken into count.

Purposeful sampling was also used for national level relevant officials from mines, labour and health and ASM association leaders were these were recognized.

Interviews with ASMs from the visited sites led to purposeful sampling of health facilities where their leaders or delegated staff provided information on the health services.

As part of the protocol, four KII guides were developed. The first guide (questionnaire) was directed to the Key Informants (KI) in the government officials, category (Ministry of Mines, Provincial Mines Officers (PMOs) and the District Mines Officers (DMOs)). They provided information on their knowledge about the laws governing ASM in country, health services for ASM, types of minerals mined by ASM among other. The second and third questionnaires targeted ASM and ASM leaders respectively. While a fourth questionnaire was on Health Facilities that offer services to ASMs and their surrounding catchment. This was administered to Health officials in charge at the facilities. This particular questionnaire solicited information on the current state and preparedness of health facilities to offer Occupational Health services including TB screening and testing services and related illnesses like HIV and STIs.

1.3.6 ASM population Size Estimation

For the purposes of estimating the population sizes of ASMs in the individual districts and countries visited, the following simple statistical method was used. Firstly, all active ASM sites were detected, identified and mapped using Hyperspectral remote sensing techniques as stated in the above paragraphs. Thus the number of active ASM sites per district were listed and known. Secondly, a Key informant interview questionnaire was administered that captured the number of ASMs per each and every visited site across the country(s). The number of ASMs per site was averaged per country and that average was then Multiplied by the number of all the active sites in the selected area to come up with the ASM size estimates per specific unit area i.e. (district and country).

The equation for estimating ASM size was as follows:

Number of Active ASM sites (*N*) detected using Remote sensing and GIS multiplied by the average Number of ASMs per site ($\bar{x}$)= Total number of ASMs per area (country or District).

1.3.5 Training of Data Collectors and data collection

Short term data collectors with skills, knowledge and previous experience in undertaking research that included aspects of using GIS and smart gadgets were recruited for this assignment. This was a technically demanding survey and only qualified data collectors with previous experience in using smart gadgets and GPS technology were recruited for data collection in each country. The data collectors were trained on the relevant data collection tools and on the process of entry of data into the ODK software. The ODK application were installed on the data collectors' mobile gadgets. The training period was 2 days, and it included sessions for peer interviewing to internalise the questionnaires, practice data entry using ODK, recording GPS coordinates submission of the data to the central server.

In addition to the KIIs, data collection by trained data collectors were focussed on confirming the remote sensed location.

1.3.6 Data management and quality control

Four ODK based - server hosted questionnaires were developed specifically for this assessment. The electronic questionnaires used were developed using XML and were accessible by smart phones and tablet. The digital data collection tools with the relevant questionnaires were deployed on data collector's individual mobile devices and once data were entered, it was uploaded onto a server immediately to avoid data loss. In instances where the data collector was offline during administration of the questionnaire, responses were uploaded to the server at the end of the day as the application could work on-and-offline during administration of the questionnaires.

1.3.7 Data Analysis

The collected data were exported from ODK server XML platform to SPSS in order to run frequency tables. The data was cleaned, and attributes were checked before enhancing the data with other datasets such as from the provinces and districts.

The data was imported into ArcGIS, QGIS and SPSS for analysis. In ArcGIS, data was checked for accuracy and consistency by overlaying the collected data with recently updated base maps. Data was cleaned and attributes were checked before enhancing the data with other datasets with information from the Mines departments.

The SPSS software was used to perform most of the analysis. Quantum GIS and ArcGIS software were also used for producing maps showing the spatial distribution of the ASM sites. R statistical computing tool was used to perform advanced mapping and interactive analytics found in this report.

Using the remote sensing and the filtering off large and medium scale mines, all the possible active ASM mining sites in a region or country were detected. Based on the information recorded from ASM sites and key informant interviews, the numbers given

were used to generate the estimated population of ASM in each country by multiplying the number of active ASM sites by the average number of ASMs per each site as obtained from the research study in each country form the sites visited.

The ODK application used for data collection were enabled for spatial data collection. It linked the data collected for each mine visited with its actual real-world location using mobile-based GPS technology. This provided confirmation to the remote sensing as 100% of such sites were detected through remote sensing earlier in the process.

The Remote sensing base maps were also used to plan routes and to do rough estimates of locations where data were to be collected. As part of quality control, various Google Earth images were used for reconnaissance and give a brief background of the areas and to note areas of interests.

1.3.8 Ethical considerations

The assessment protocol was submitted to relevant officials of review, enrichment and concurrence before the assessment. For each KII, informed consent was administered by data collectors. The KII were anonymised by not using name identifiers.

1.3.9 Study limitations

Limitations of the Algorithm

For the GIS and remote sensing, the algorithm used was not able determine the type of mining taking place. However, it was able to identify the exitance of a mining activity at a location. Using the geological information and data provided during the KII, help in corroborating of information form the GIS and remote sensing.

KII limitation

These relates mainly to recall bias and in instances there might have been withholding of information. However, given that a number of people from various stakeholders' groups the information provided would suffice.

The findings did not map out the health facilities, as this would require additional resources in terms of time and funding. However, information on health services provision for the ASM were collected form health facilities servicing ASM sites visited by data collectors.

2. Findings

Overview

In line with the objectives, this assessment:

- Mapped out and estimated the ASM population in eight targeted countries.
- Described the demographic characteristics of ASM population.
- Described the situation of access to Health services including occupational health services by the ASM.
- Reports on the challenges faced by women and children, and
- Identified gaps in the implementation of ASM interventions.

A total of 5226 interviews were conducted in the 8 countries. The table below presents the KII per country and the category of the KI.

Table 1: KII Per country and category of KI

Country	Malawi	Namibia	Zambia	Zimbabwe	Madagascar	Mozambique	DRC	Tanzania
Total Number of people Interviewed	407	167	519	413	875	1028	1297	520

No. Government officials from Ministries of health, mines and labour	7	8	42	9	27	12	32	9
No. ASM Leaders/ owners of ASM sites	24	60	19	34	99	17	71	22
ASMs	365	94	439	363	720	994	1175	475
Health Facility Workers	11	5	19	7	29	5	19	14

2.1 Socio Demographic characteristics of respondents.

A majority (44%) of respondents were in the age-group 18-29 years, followed by the age-group 30-34 (17%). The study also found that three % (3%) were in the age-group 13-17 years, whilst 5% were above the age of 55 years. Worth noting is that Madagascar has the largest number (6.5%) of ASMs in the age-group 13-17 years, whilst in Namibia there were no reported cases of persons in this age-group within the ASMs. The table below shows the age distribution per study country.

Table 2: Age Distribution of ASM Interviewees

Age group	MADAGASCAR		MALAWI		NAMIBIA		TANZANIA		ZAMBIA		ZIMBABWE		DRC		Mozambique	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
13-17	47	6.5	6	1.6	.	.	12	2.5	15	3.4	1	0.3	23	1.95	40	4.0
18-24	126	17.5	93	25.5	7	7.4	99	20.8	99	22.6	90	24.8	286	24.3	234	23.5
25-29	120	16.6	67	18.4	25	26.6	103	21.7	123	28	75	20.7	269	22.9	120	12.07
30-34	121	16.8	52	14.2	27	28.7	87	18.3	75	17.1	68	18.7	197	16.8	119	11.97
35-39	107	14.8	32	8.8	8	8.5	53	11.2	68	15.5	52	14.3	150	12.8	233	23.4
40-44	70	9.7	32	8.8	6	6.4	40	8.4	27	6.2	40	11	98	8.3	195	19.6
45-49	52	7.2	31	8.5	8	8.5	32	6.7	16	3.6	20	5.5	68	5.6	29	2.9
50-54	42	5.8	19	5.2	5	5.3	22	4.6	10	2.3	8	2.2	37	3.1	22	2.2
55+	36	5	33	9	8	8.5	27	5.7	6	1.4	9	2.5	48	4.1	2	0.2
Total	721	100	365	100	94	100	475	100	439	100	363	100	1175	100	994	100

A majority of respondents were male (73%), whilst females were 27%. Of note is that DRC had the largest number of female ASMs (42.6%), followed by Madagascar (32.7%). Zimbabwe recorded the least female respondents (2.5%). The table below shows the sex distribution per study country.

Table 3: Sex Distribution of ASM Interviewees in the 8 study countries

Sex of ASM	MADAGASCAR		MALAWI		NAMIBIA		TANZANIA		ZAMBIA		ZIMBABWE		DRC		Mozambique	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Male	485	67.3	264	72.3	82	87.2	418	88	385	87.7	354	97.5	675	57.4	730	73.4
Female	236	32.7	101	27.7	12	12.8	57	12	54	12.3	9	2.5	500	42.6	264	26.5
Total	721	100	365	100	94	100	475	100	439	100	363	100	1175	100	994	100

A majority of the respondents are largely Christian (64%), followed by African traditional religion (22%). Islam only constitutes 4% whilst 10% indicated that they don't follow any religion. Mozambique has the highest number of ASM belonging to African Traditional religion (62%) followed by Namibia (37%). Madagascar had the highest proportion of ASM who are non-believers (37%) followed by Malawi (12%). Tanzania has a good proportion of ASM who follow Islam (17%) whilst the rest of the seven other countries Islam is followed by less than (5%) among ASM. Table below shows the distribution of interviewed ASM by religion.

Table 6: Distribution of Interviewed ASMs by religion

Religion	MADAGASCAR		MALAWI		NAMIBIA		TANZANIA		ZAMBIA		ZIMBABWE		DRC		MOZAMBIQUE	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
None	262	37.4	44	12.1	2	2.1	24	5.1	18	4.1	27	7.5	50	4.3	38	3.8
Christianity	434	61.9	299	81.9	57	60.6	369	77.7	403	91.8	287	79.3	825	70.2	273	27.5
Islam	25	0.7	11	3	0	0	82	17.3	17	3.9	3	0.8	25	2.1	20	2

African Traditional Religion	0	0	11	3	35	37.2	0	0	1	0.2	45	12.4	275	23.4	623	62.7
Total	721	100	365	100	94	100	475	100	439	100	362	100	1175	100	994	100

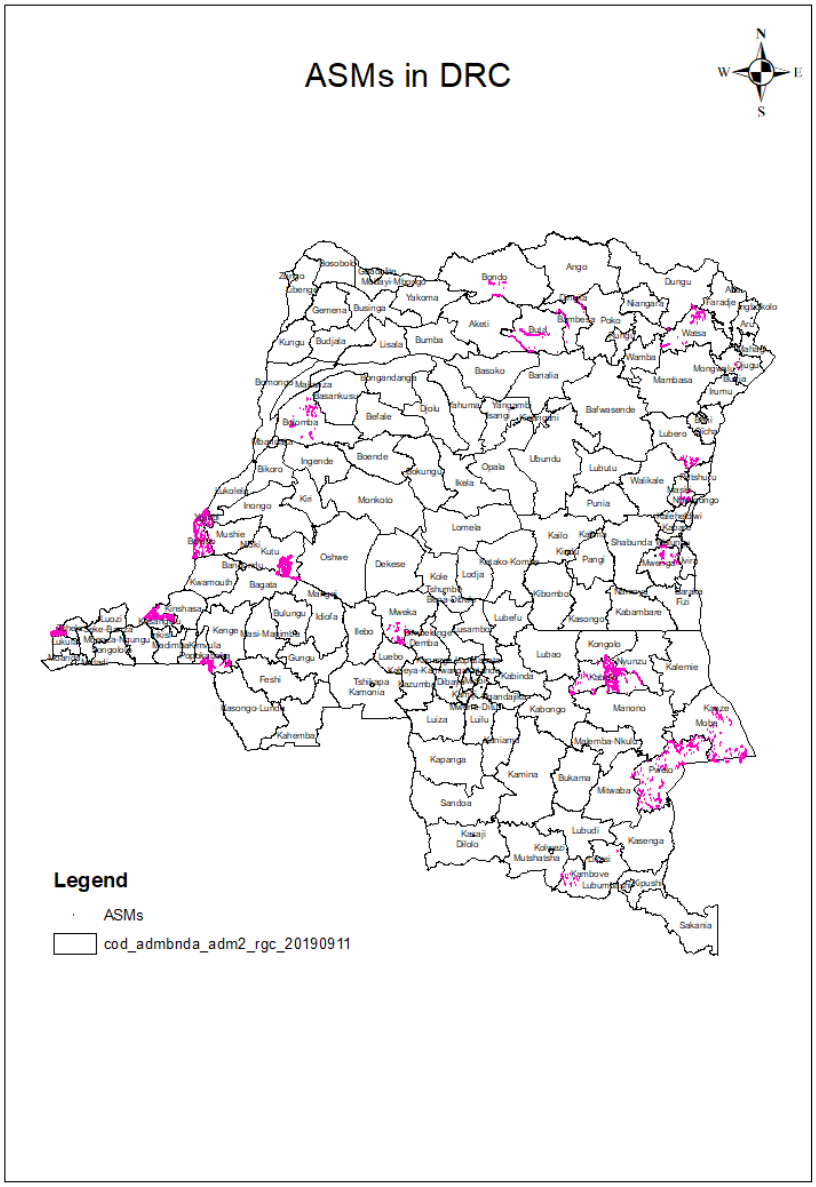
2.2 *ASM site distribution*

The ASM sites/hotspots were mapped and presented as a series of maps attached at the end of the report. The maps shown below are guides and they are in static mode at a very rough scale of the spatial distribution of the hotspots per country.

Maps showing the spatial Distribution of ASM Hotspots by country

1. Democratic Republic of Congo
Population Size of ASMs in and spatial distribution in DRC

The Democratic Republic of Congo has one million eight hundred and twenty-seven thousand three hundred and thirty-two (1 827 332) ASMs over the twenty-six districts of the country. There are close to zero ASM activities at the country's centre except Mweka district. Most activities are along the country's border especially on the East and West. Bolobo a town on the Congo River in the Mai-Ndombe province in the Western Part of the Democratic Republic of Congo has 149916 ASMs on 2883 active ASM sites, Kabolo, a town in the Tanganyika province along the Luabala River has the highest number of ASMs standing at 279032 at 5366 active ASM sites. Kasangulu, a small town in the DRC with an estimated population of 27 960 has the second highest number of ASMs at 258700. Refer to Table in *Annex 1* for more detail on distribution of ASM by region and district in DRC.


ASMs in DRC
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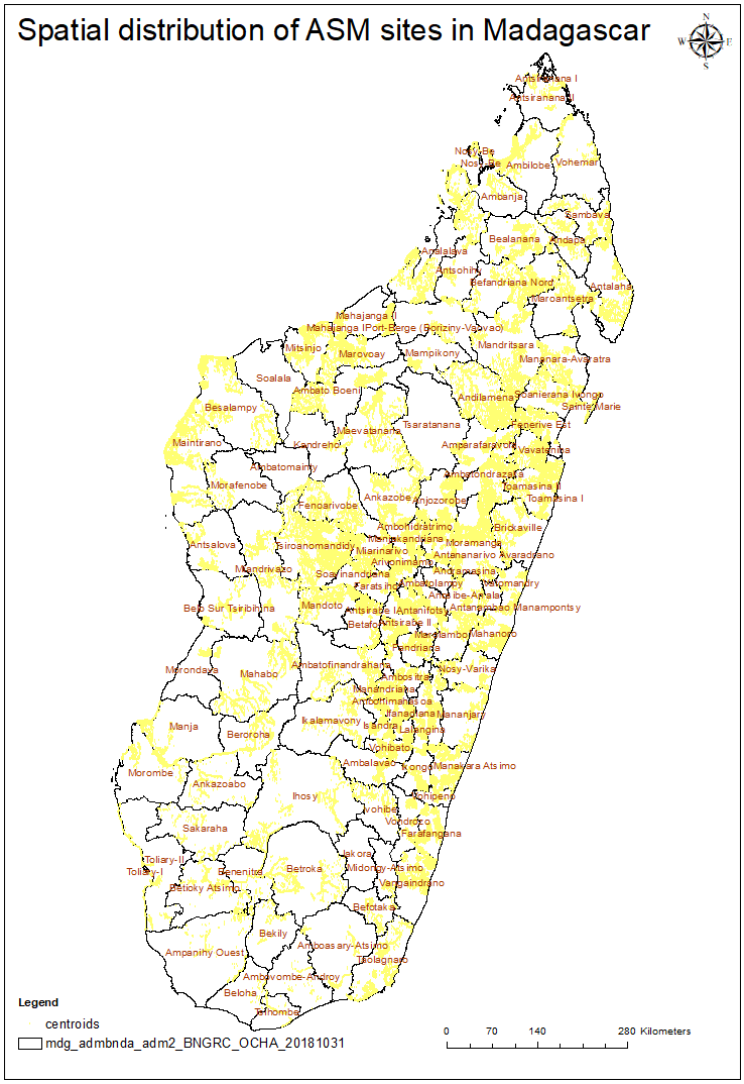
2. Madagascar

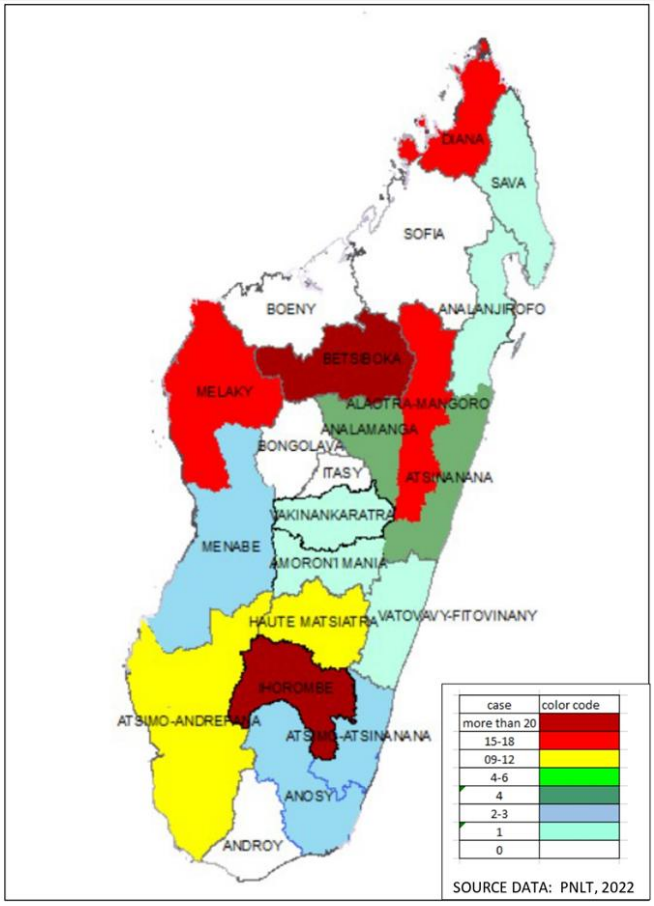
Population Size of ASMs and spatial distribution in Madagascar

Madagascar has a total number of one million one hundred and seventy-seven thousand four hundred and forty (1 177 440) ASMs over its 22 regions. The ASM activities are fairly distributed in the country but are mostly concentrated on the eastern central part of the Island Country. Worth noting is the absence or fewer ASM activities in the three districts of Iakora, Toliary 1 and Antsiranana 1. Ambatondrazaka the capital of the Alaotra Mangoro Region has the highest number of ASM activities in the country standing at 33 868 ASMs at 8466 active sites, Marovoay has the second number of ASMs in Madagascar at 32 897 on 8224 active sites whilst Maromanga has the third largest number of ASMs at 30 469 at 7617 active sites.

Refer to Table in *Annex 2* for more detail on distribution of ASM by region and district in Madagascar


Spatial distribution of ASM sites in Madagascar
N
W
E
S
Legend
centroids
mdg_admbnda_adm2_BNGRC_OCHA_20181031
0
70
140
280 Kilometers

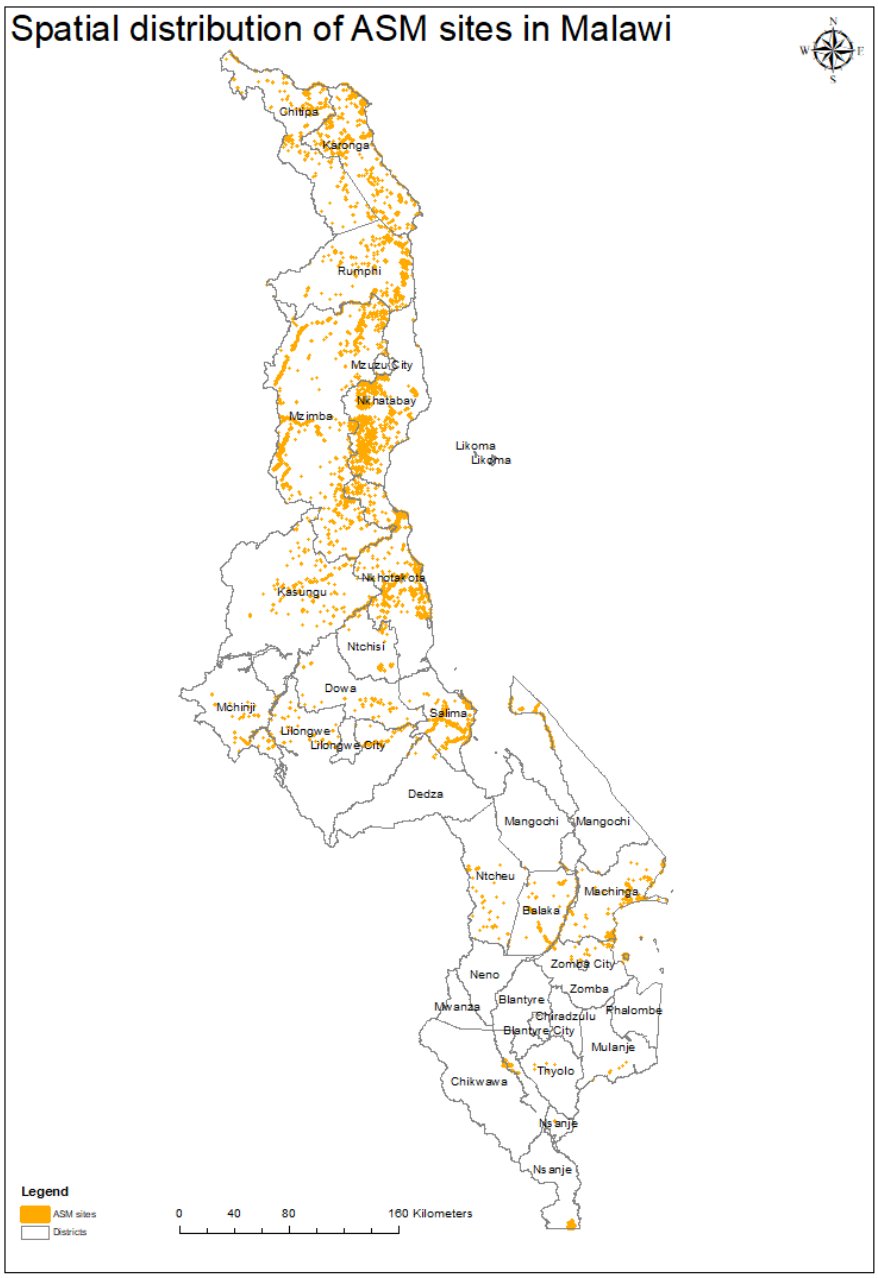
SPATIAL DISTRIBUTION OF ASM AND TB IN MADAGASCAR



3. Malawi

Population Size of ASMs and spatial distribution in Malawi

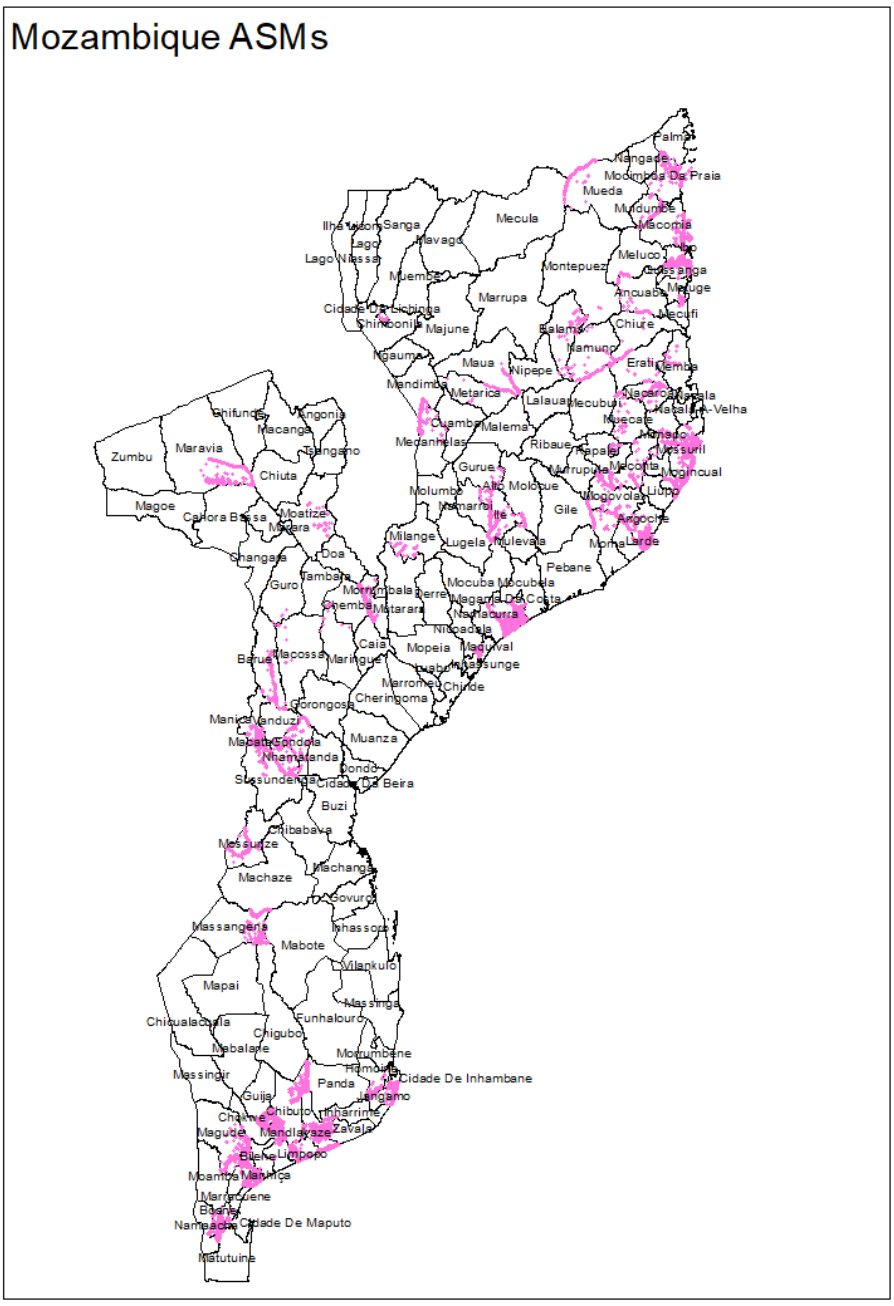
Malawi has a total of three hundred and ninety-seven thousand seven hundred and fifty-two (397 752) ASMs over its 3 regions and 28 districts. Most mining activities are concentrated on the Northern part of the Country than the southern region with a few activities dotted along Ntcheu, Balaka, Machinga and Zomba City. Nkhotakota is a port town/district in central Malawi on the Shore of Lake Malawi and has the highest number of ASMs at 75 629 at 1321 active sites whilst the Mzimba district has 65 603 ASMs at 1146 active ASM sites. The Karonga district in the northern region of Malawi along lake Nyasa has the third largest number of ASMs at 49 412 on 863 active sites. Refer to Table in Annex 3 for more detail on distribution of ASM by region and district in Malawi.


Spatial distribution of ASM sites in Malawi
N
W
E
S
Chitipa
Karonga
Rumphi
Mzuzu City
Nkhatabay
Mzimba
Likoma
Likoma
Nkhotakota
Kasungu
Ntchisi
Dowa
Mchinji
Salima
Lilongwe
Lilongwe City
Dedza
Mangochi
Mangochi
Ntcheu
Machinga
Balaka
Zomba City
Neno
Zomba
Mwanza
Blantyre
Chiradzulu
Phalombe
Blantyre City
Mulanje
Thyolo
Chikwawa
Nsanje
Nsanje
Legend
ASM sites
Districts
0
40
80
160 Kilometers

4. Mozambique

Population Size of ASMs and spatial distribution in Mozambique

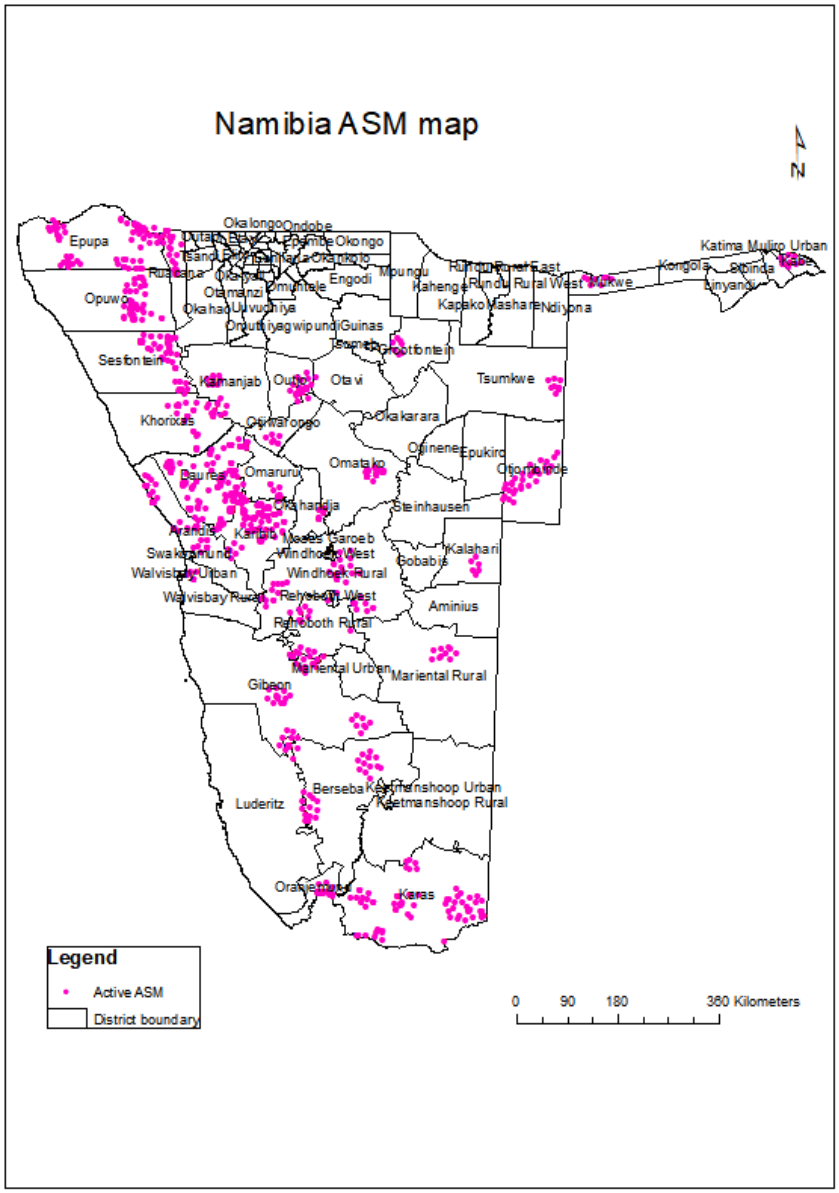
Mozambique has a total of seven hundred and four thousand, four hundred and seventy 704 470 ASMs over its 11 provinces, the country has an estimated population of 29.50 million. Most mining activities are concentrated on the eastern side of the top part of the country, along the centre and on the southern part of Mozambique. Maganja Da Costa, a district of the second most populated province in Mozambique, Zambezia, has the most ASMs in the country at 120 855 on 12085 active sites, which is almost double the number of Angoche. Angoche a district in the North Eastern Part of Mozambique in the province of Nampula has a total of 62 881 ASMs on 6288 active sites and has the second largest number of ASMs in the country. Refer to Table in Annex 4 for more detail on distribution of ASM by region and district in Mozambique


Mozambique ASMs
Palma
Nangade
Mocimboa Da Praia
Mueda
Mecula
Mudumbe
Muidumbe
Macomia
Ilha Vicon
Sanga
Lago
Mavago
Lago Niassa
Meluco
Montepuez
Cabo Delgado
Muembe
Ancuabe
Meluge
Marrupa
Cidade De Lichinga
Chiconono
Majune
Balama
Chiure
Mecufi
Ngauma
Namuno
Maua
Nipepe
Erati
Mandimba
Metarica
Nacaroa
Moma
Lalaua
Mecuburi
Nacala-Velha
Chifunde
Ungonia
Muecate
Macanga
Cuamba
Malema
Nacala
Zumbu
Maravia
Tsangano
Medanhelas
Ribaue
Rapale
Monapo
Mossuril
Gurue
Murrupula
Mecotta
Mogincual
Chiuta
Molumbo
Alto Molocue
Lumbo
Magoe
Namarroi
Ile
Mogovolas
Gile
Cahora Bassa
Moatize
Angoche
Mutarara
Milange
Lugela
Nulevala
Morrumbala
Larde
Changara
Doa
Pebane
Tambara
Mocuba
Mocubela
Guro
Terre
Maganja Da Costa
Chemba
Matarara
Namacurra
Nicoadala
Caia
Mopeia
Madival
Beira
Mapossa
Maringue
Inhassunge
Chinde
Marromeu
Cheringoma
Gorongosa
Manica
Vanduzi
Muanza
Mabaia
Gondola
Nhamatanda
Sussundenga
Dondo
Cidade Da Beira
Buzi
Chibabava
Messurize
Machanga
Machaze
Govuro
Massangena
Inhassoro
Mabote
Vilankulo
Mapai
Massinga
Chicualacuala
Funhalouro
Chigubo
Mabalane
Morrumbene
Massingir
Panda
Hamonia
Cidade De Inhambane
Guija
Jangamo
Chibuto
Inharrime
Chokwe
Magude
Mandlakazi
Zavala
Bilene
Limpopo
Moamba
Matola
Marracuene
Boane
Namaacha
Cidade De Maputo
Matutuine

5. Namibia

Population Size of ASMs and spatial distribution in Namibia

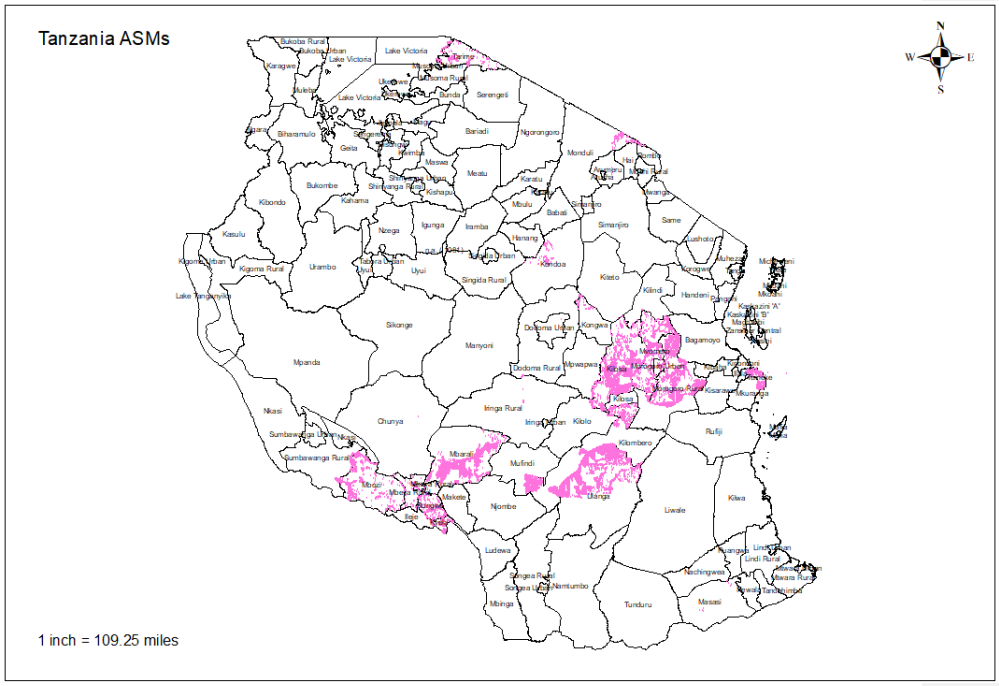
Namibia has the lowest number of ASM activities in the SADC region with a recorded value of 38 431 ASMs over 14 regions. The Northern western, central part of the country along the Western border seems to have a concentration of ASM activities than anywhere else in the country. Karibib in Erongo province has the highest number of ASMs at 10 116 over 920 active sites followed by Daures at 7437 ASMs over 676 active sites. Epupa in Kunene province has 2759 ASMs over 251 active mining sites. Refer to Table in Annex 5 for more detail on distribution of ASM by region and district in Namibia.


Namibia ASM map
N
Epupa
Opuwo
Sesfontein
Khorixas
Kamanjab
Outjo
Otavi
Tsumkwe
Okahandja
Omaruru
Omaterako
Otjiwarongo
Okakarara
Epukiro
Gobabis
Kalahari
Aminius
Windhoek West
Windhoek Rural
Swakopmund
Walvisbay Urban
Walvisbay Rural
Rehoboth West
Rehoboth Rural
Mariental Urban
Mariental Rural
Gibeon
Luderitz
Berseba
Keetmanshoop Urban
Keetmanshoop Rural
Karas
Katima Mulilo Urban
Kongola
Linyanti
Ndiyona
Kapako
Kahenge
Engodi
Okongo
Ondobe
Okalongo
Legend
Active ASM
District boundary
0
90
180
360 Kilometers

6. Tanzania

Population Size of ASMs and spatial distribution in Tanzania

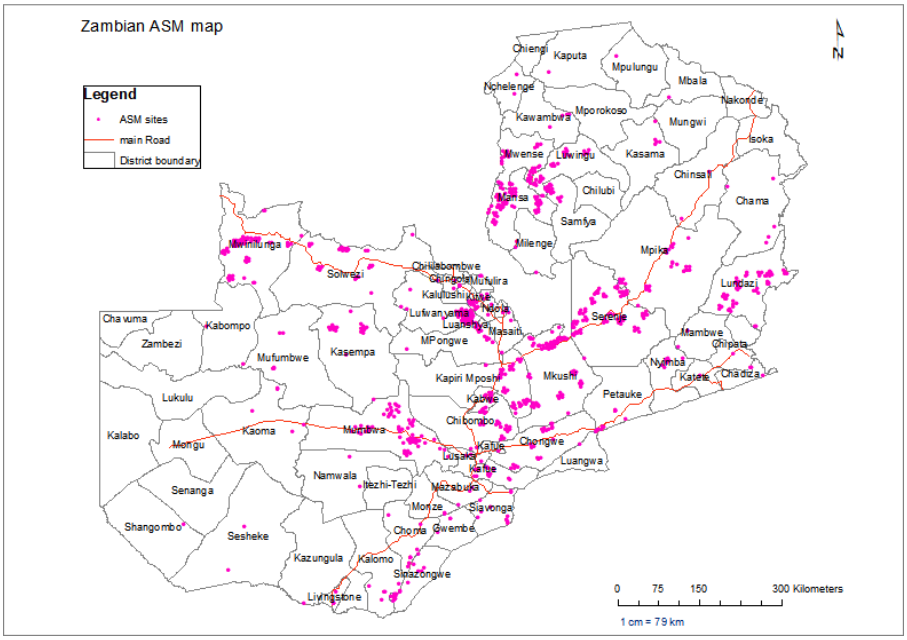
Tanzania has a total of one million four hundred and ninety-five thousand two hundred and twenty-three (1 493 223) ASMs. Most ASM activities run across the centre of the southern part of the country. Ulanga district which is one of the six districts of the Marogoro regions of Mahenge has the most number of ASMs at 552 509 over 50228 active sites. Mbarali district, one of the seven districts of the Mbeya Region has the second largest number of ASMs at 218 661, which is almost half that of Ulanga District. Kilosa, which is in the Morogoro region has 158 565 ASMs over 14 415 active mining sites. Refer to Table in *Annex 6* for more detail on distribution of ASM by region and district in Tanzania



7. Zambia

Population Size of ASMs and spatial distribution in Zambia

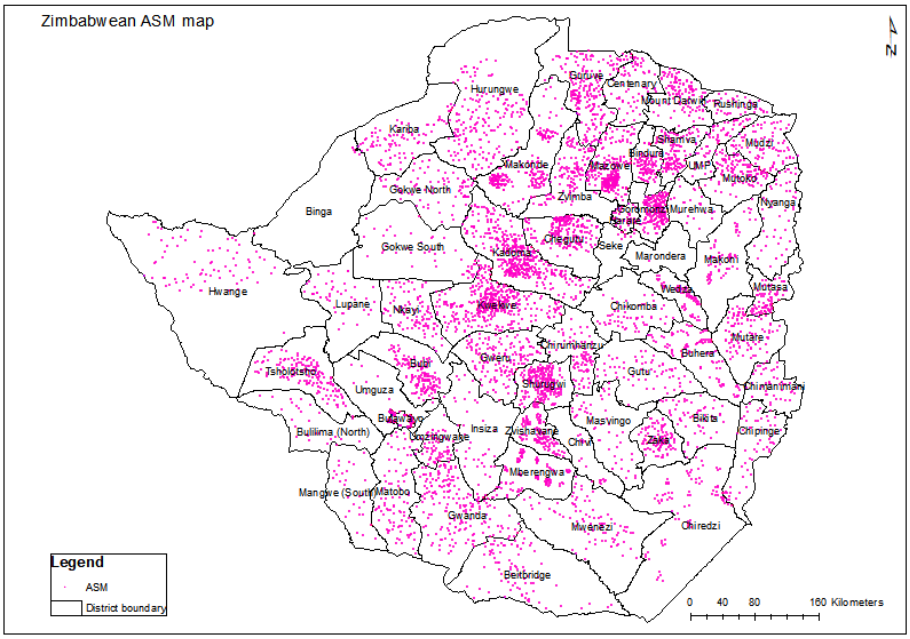
Zambia has a total of five hundred and twelve sixty-four thousand and sixty-four (512 064) ASMs over 10 provinces on an estimated population of 17.35 million. As shown on the map, most ASM activities are concentrated on the central part of Zambia. Manza has the highest number of ASMs at 55667, followed by Serenje district with 51007 ASM. Mumbwa which is in the Central province of Zambia has 38535 followed by Kapiri Mposhi and Mwinilunga with 36 950 ASMs each. Chibombo and Mkushi are some of the districts with over 30000 ASM. Refer to Table in Annex 7 for more detail on distribution of ASM by region and district in Zambia.

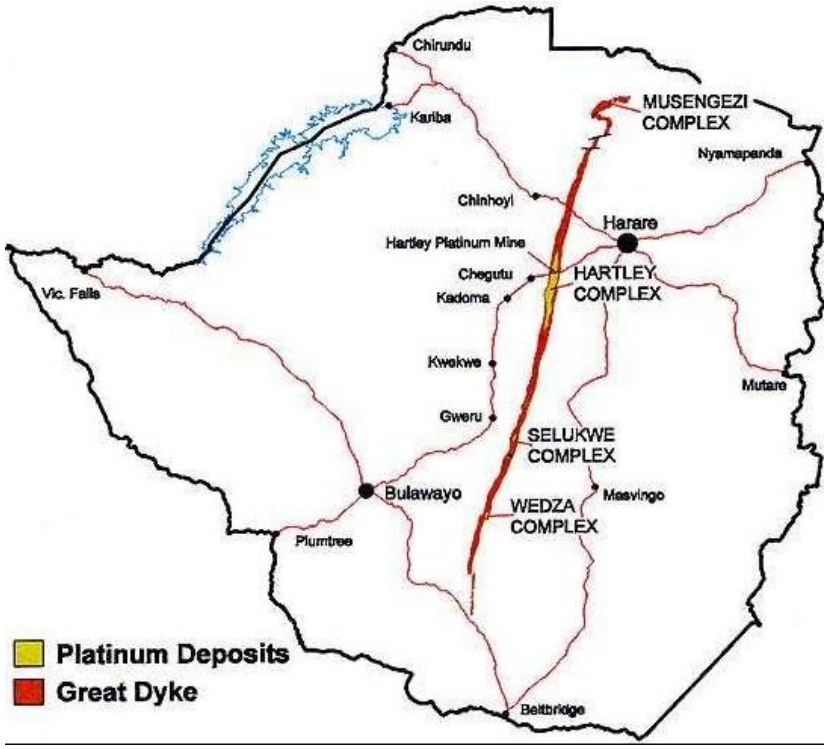


8. Zimbabwe

Population Size of ASMs and spatial distribution in Zimbabwe

Zimbabwe has a total of eight hundred and fifty-five thousand eight hundred and forty-eight (855 848) ASMs over 10 provinces and an estimated population of 16 665 409. The concentration of ASM activities is fairly distributed across the country but missing in some parts especially on the North-Western part along the border. Shurugwi, a district situated in the Midlands province, has the largest number of ASM standing at 62 666 over 2725 active ASM sites. Kadoma has the second highest value of ASMs 51446 on 2237 active sites. Kadoma, is a district in the Midlands province situated in central part of Zimbabwe along the Famous Great Dyke which is home to a plethora of minerals. The third ranking district is Kwekwe, a district located in the same Midlands Province on the central part of Zimbabwe. Refer to Table in Annex 8 for more detail on distribution of ASM by region and district in Zimbabwe.


Zimbabwean ASM map
N
Hurungwe
Guruve
Centenary
Mount Darwin
Rushinga
Kariba
Shamva
Bindura
Mazowe
Makonde
UMP
Mudzi
Mutoko
Gokwe North
Zvimba
Goromonzi
Murehwa
Nyanga
Binga
Chegutu
Seke
Gokwe South
Kadoma
Marondera
Makoni
Hwange
Mutasa
Lupane
Nkayi
Chikomba
Mutare
Chirumhanzu
Bikita
Tsholotsho
Gweru
Gutu
Umguza
Shurugwi
Chimanimani
Masvingo
Bulilima (North)
Insiza
Zvishavane
Chivi
Zaka
Chipinge
Mberengwa
Mangwe (South)
Matobo
Gwanda
Mwenezi
Chiredzi
Beitbridge
Legend
ASM
District boundary
0 40 80 160 Kilometers



Map showing the Great Dyke.

a. *The ASM population, size estimates and demographic profile*

The equation for estimating ASM size was as follows:

Number of Active ASM sites (*N*) detected using Remote sensing, Machine learning models and GIS techniques multiplied by the average Number of ASMs per site (X)= Total number of ASMs per area (country or District).

Using the formula above, in the 8 study countries, the total size estimation of ASM is 7,012,582 with the majority being men, at 73 %, see table below. The largest estimated number of ASMs was found in DRC (1,827,332), followed by Tanzania (1,495223) and Madagascar at 1,177,460. The least ASM population size estimate was found in Namibia, with 38,431.

Country	Total Population of ASM	Proportion of men	
Malawi	397,754	72%	286,383
Namibia	38,431	87%	33,435
Zambia	512,064	88%	450,616
Zimbabwe	855,848	98%	838,731
Madagascar	1,177,460	67%	788,898
Mozambique	708,470	67%	474,675
DRC	1,827,332	57%	1,041,579
Tanzania	1,495,223	88%	1,315,796
Total	7,012,582	74%	5,230,114

b. *Legal and regulatory framework for ASM work*

All countries studied recognized ASM. However, the process of licencing varied across the countries, leading to significant illegal practices. In Zimbabwe for instance, 85% of the ASMs were registered, whilst only 28% were registered in Madagascar. On average, only 60% of ASMs were legally registered in the 8 study countries. The table below highlights the proportion of ASM reported to be legally registered in the study countries.

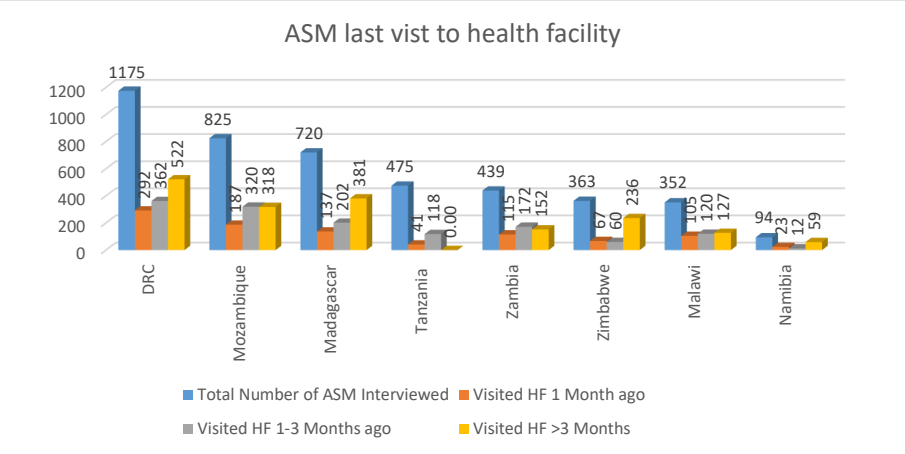
Country	Proportion of ASMs registered
Malawi	70
Namibia	70
Zambia	56
Zimbabwe	85
Madagascar	28
Mozambique	52
DRC	44
Tanzania	76
Average	60

Access to health and social services

Health care access to ASM remains low in all the study countries as highlighted in the summarized tables below

Health seeking behaviours among ASMs

Malawi recorded the highest [105/352 **(30%)**] %age of ASMs who reported having visited a health facility within the one (1) month preceding the country interviews, followed by Zambia [115/438 **(26%)**]. Among the ASMs interviewed, those residing in Tanzania (67%), Zimbabwe (65%) and Namibia (63%) reported having visited a health facility over 3-months prior to the interviews being conducted [Figure below].



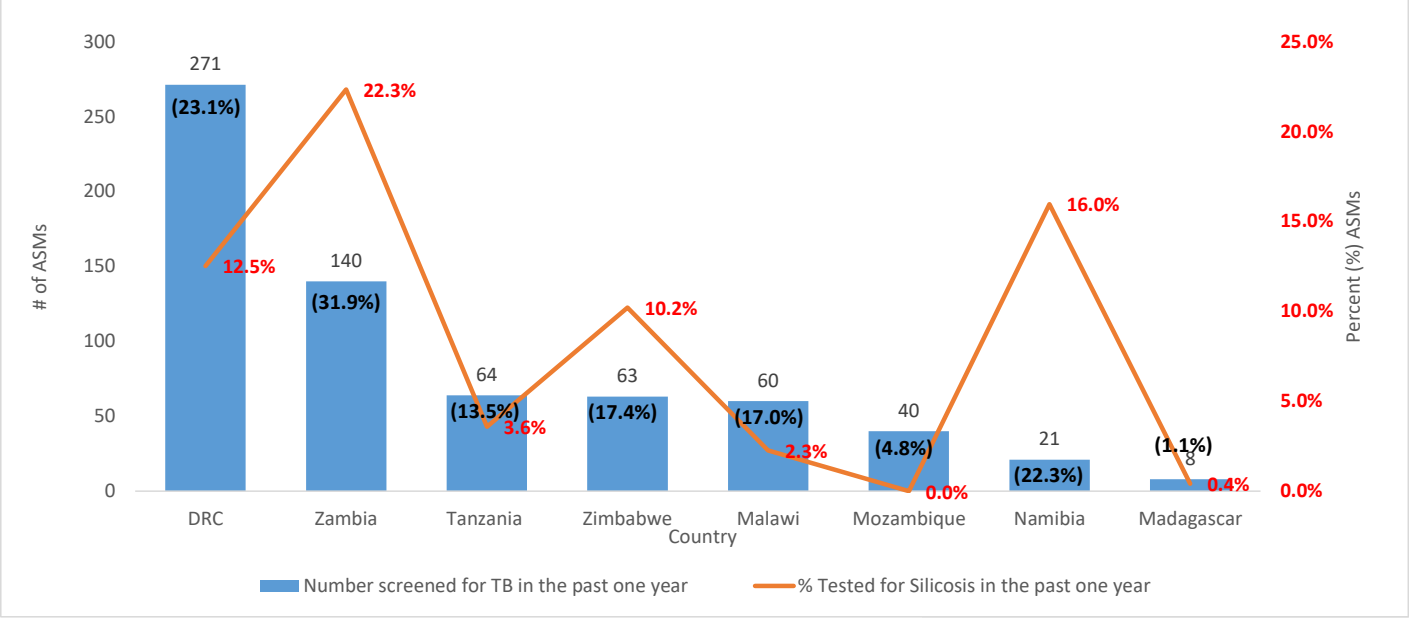
Services commonly sought from health facilities by ASMs

Occupational health services were the most sought service by ASMs across all study countries with the highest %age of ASMs seeking this service being from Namibia (56.4%) and DRC (52%). TB care services were sought after by less than 25% of ASMs across all study countries, with only one (<1%) of ASMs seeking this essential health service in Madagascar (Table below).

Health Service	MADAGASCAR	MALAWI	NAMIBIA	TANZANIA	ZAMBIA	ZIMBABWE	DRC	MOZAMBIQUE

	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Occupational health services	**180**	**25.0**	**68**	**18.6**	**53**	**56.4**	**178**	**37.5**	**158**	**36.0**	**100**	**27.5**	**188**	**52**	**122**	**38.0**
TB care services	**1**	**0.1**	**37**	**10.1**	**5**	**5.3**	**63**	**13.3**	**107**	**24.4**	**28**	**7.7**	**11**	**3.0**	**32**	**10.0**
HIV/AIDS care services	**0**	**0.0**	**66**	**18.1**	**3**	**3.2**	**148**	**31.2**	**127**	**28.9**	**44**	**12.1**	**11**	**3.1**	**38**	**12.0**
Care for chronic conditions (diabetes/hypertension)	**68**	**9.4**	**31**	**8.5**	**7**	**7.4**	**4**	**0.8**	**45**	**10.3**	**0**	**0.0**	**159**	**4.4**	**58**	**18.0**
STI diagnosis and treatment services	**2**	**0.3**	**27**	**7.4**	**1**	**1.1**	**4**	**0.8**	**93**	**21.2**	**8**	**2.2**	**0**	**0**	**13**	**4.0**
Family planning and Antenatal Care services	**95**	**13.2**	**45**	**12.3**	**5**	**5.3**	**7**	**1.5**	**37**	**8.4**	**22**	**6.1**	**18**	**5.0**	**22**	**7.0**
Occupational and Physical Rehabilitation	**66**	**9.2**	**37**	**10.1**	**15**	**16.0**	**2**	**0.4**	**92**	**21.0**	**14**	**3.9**	**43**	**12.0**	**6**	**2.0**
Malaria diagnosis and treatment services	**6**	**0.8**	**81**	**22.2**	**0**	**0.0**	**101**	**21.3**	**42**	**9.6**	**29**	**8.0**	**15**	**6.5**	**13**	**4.0**
Flue/Headache treatment	**0**	**0.0**	**9**	**2.5**	**3**	**3.2**	**1**	**0.2**	**12**	**2.7**	**71**	**19.6**	**11**	**3.0**	**3**	**1.0**
Stomach pain	**0**	**0.0%**	**1**	**0.3**	**1**	**1.1**	**2**	**0.4**	**4**	**0.9**	**25**	**6.9**	**4**	**1.0**	**3**	**1.0**
Body check-up	**0**	**0.0%**	**12**	**3.3**	**0**	**0.0**	**5**	**1.1**	**18**	**4.1**	**10**	**2.8**	**4**	**0.0**	**3**	**1.0**
Other services	**428**	**59.4%**	**62**	**17.0**	**11**	**11.7**	**37**	**7.8**	**26**	**5.9**	**50**	**13.8**	**39**	**11.0**	**6**	**2.0**

Screening for TB and Silicosis was determined by asking interviewees whether they had had a chest x-ray done or screened for TB using (at least) the WHO four (4) symptom screen checklist which inquired about symptoms of cough, fever, night sweats or weight loss in the 1-year preceding the interviews. ASMs in Zambia **[140/434 (31.9%)** represented the highest %age of ASMs screened for TB across all study countries. Pertaining to screening for silicosis, Zambia also reported the highest %age **(22.3%)** of ASMs who had been screened for silicosis by chest radiograph in the year preceding interview (Figure XX). Smaller %ages of ASMs were screened for TB and Silicosis in Mozambique; 4.8% and 0.0% respectively. ASMs in Madagascar were the least screened for TB (1.1%) and 0.4% of the interviewees had been screened for Silicosis.



Among the interviewed ASMs who were screened for TB, Table X summarizes the number of ASMs who were diagnosed with TB in the year preceding the interviews. All of the TB patients were initiated on an appropriate treatment regimen. Over 50% of interviewed ASMs screened for TB in DRC were diagnosed with TB. In Zimbabwe, 18/63 (28.6%) of ASMs who had been interviewed reported having diagnosed with TB and placed on treatment.

Table 4: %age of ASMs Screened for TB Who Were Diagnosed with TB, 8 SADC Countries

	MADAGASCAR	MALAWI	NAMIBIA	TANZANIA	ZAMBIA	ZIMBABWE	DRC	MOZAMBIQUE
Screened for TB	**8**	**60**	**21**	**64**	**140**	**63**	**271**	**40**
Diagnosed with TB	**3 (37.5%)**	**24 (40.0%)**	**8 (38.1%)**	**28 (43.8%)**	**56 (40.0%)**	**18 (28.6%)**	**150 (55.4%)**	**14 (35.0%)**

Access to Occupational Health and TB Related Services (Distances Travelled by ASMs to their nearest health facility)

In Malawi (37.3%) and Namibia (68%), a larger proportion of ASMs needed to travel over 10km to their nearest facility (Table XX). In Namibia, the average distance

travelled by ASMs to access their nearest health facility was 34.6km. Countries in which a higher %age of ASMs travelled distances less than 5km to their nearest health facility included Madagascar (81.5%) where the average distance travelled to the nearest health facility was 3.2km, Mozambique (56.4%) and Tanzania (54.3%).

Country	Total Number of ASMs interviewed	Distances to Nearest HF	Total Number of people	%age (%) of ASMs traveling distance
Malawi	**365**	**<1 km**	**2**	**0.6**
		1-5 km	**103**	**28.2**
		5-10km	**124**	**34**
		>10km	**136**	**37.3**
Namibia	**441**	**<1 km**	**0**	**0**
		1-5 km	**22**	**23.4**
		5-10km	**8**	**8.5**
		>10km	**64**	**68**
Zambia	**439**	**<1 km**	**28**	**6.4**
		1-5 km	**171**	**39**
		5-10km	**203**	**46.2**
		>10km	**37**	**8.4**
Zimbabwe	**363**	**<1 km**	**61**	**16.8**
		1-5 km	**139**	**38.3**
		5-10km	**89**	**24.5**
		>10km	**74**	**20.4**
Madagascar	**720**	**<1 km**	**76**	**10.5**
		1-5 km	**512**	**71**
		5-10km	**112**	**15.3**
		>10km	**21**	**2.9**
Mozambique	**825**	**<1 km**	**95**	**9.6**
		1-5 km	**465**	**46.8**
		5-10km	**214**	**21.5**
		>10km	**202**	**20.3**
DRC	**1175**	**<1 km**	**9**	**0.77**
		1-5 km	**528**	**45**
		5-10km	**405**	**34.5**
		>10km	**233**	**19.8**
Tanzania	**475**	**<1 km**	**0**	**0**
		1-5 km	**258**	**54.3**
		5-10km	**164**	**34.5**
		>10km	**53**	**11.1**

Challenges Faced by women and Children.

From the research study, we did not find any migrant women but women who worked as ASM were originating from their communities of work. They revealed that they face various challenges which hamper them from participating fully in ASM.

There are Legal and administrative constraints attributed to traditional customs that restrict women from owning resources and even land. Some are even denied access to mines due superstitious beliefs. In one district in Zimbabwe, women are refused to come near the mining sites as there is a myth that they can make the gold disappear hence they are barred to reach such sites.

Interviewed women cited Low levels of education which limit them from getting formal education on mines and mineral resources extraction hence most women and children do the light and menial work therefore they are given poor wages as compared to men.

Interviewed children indicated that they are exposed to the harsh and unfiltered language used by ASM.

Challenges faced by ASM in general

Challenges cited by ASM in their responses included remoteness of site locations, poor road networks, very long distances, security of tenure, poor cell-phone connectivity and poor access to clean and safe water for drinking and domestic use. To add to these challenges, ASM do not have financial resources to purchase machinery and equipment for extracting minerals, hence they use rudimentary methods. They lack financial support from the government and the capacity to increase their knowledge and skills since they operate on hand-to-mouth basis.

The major challenge highlighted by ASM in terms of policy is absence of security of tenure and the legality of their operations as they are always being sought out by the police. Over 60 % of ASM interviewed stated that lack of financial resources to formalise their trade, tedious registration processes and nepotism in allocation of sites makes it very difficult for them to operate formally. Hence, their activities remain illegal and they are always running away from arrest by the police.

Without government support, and cooperation with bigger entities, the law is the biggest stumbling block to artisanal and small-scale mining development.

CHAPTER 2: MALAWI

2.1 Introduction

According to Wikipedia, Malawi is a landlocked country in southeast Africa. It is wholly within the tropics; from about 9°30S at its northernmost point to about 17°S at the southernmost tip. The country occupies a thin strip of land between Zambia and Mozambique, extending southwards into Mozambique along the valley of the Shire River. In the north and northeast it also shares a border with Tanzania. Malawi is connected by rail to the Mozambican ports of Nacala and Beira. It lies between latitudes 9° and 18°S, and longitudes 32° and 36°E.

According to the Malawi national artisanal and small-scale mining policy symposium by ASM representatives of November 2014, The Artisanal and small Scale Mining operations are focused on mining of gemstones, rock aggregate, limestone, clay, salt, river and Dambo sands. The same report states that Artisanal small scale mining operations if carefully nurtured can significantly contribute to poverty alleviation and socio-economic development to the country. The benefits arising from the growth of ASM is found mainly in employment and its potential to provide support to rural livelihoods, thereby mitigating the pressures of urban migration.

2.2.1 Study Area

The selected districts were Mzimba, Kasungu, Dowa and Lilongwe.

Sampling

Sample Size Calculation

Using the sample size calculation formula for the unknown sample, the minimum required number of ASM respondents were 539. This was calculated using the Dobson Formula which is (How to Calculate Sample Size for Different Study Designs in Medical Research? - PMC, 2013):

$$S = \frac{Z_{1-\alpha/2}^2 . p (1 - p)}{d^2} ;$$

where: $Z_{1-\alpha/22}$ is the standard normal variate at 95% confidence level =1.96
p is the prevalence of TB among ASMs (14%), and
d is the absolute error = 5%

The sample size was reached based on the assumptions that were made that the prevalence of TB among the informal miners in Malawi is 17% according to a study done in Malawi through active case finding of TB among miners1 and a refusal rate of 10%. The sample size for the heads ASM sites, ASMs, and health facilities will not be determined a priori as the study is aimed at identifying as many units as possible.

3.3.2 Sampling technique

Malawi has a total of 28 districts, of which 30% (8) were to be included in the study. However, due to limited resources and time the research team ended up studying four districts. The percentage of 30% has been chosen considering the limited resources at hand. The four districts were purposively selected to include districts with varying levels of ASM activities (categorized as High, medium and low;) and the different types of minerals (subsector). For each district selected, ASMs were recruited consecutively until the desired sample size for the district was reached. A snowballing technique was undertaken to identify ASM sites and health facilities situated within 10km radius of ASM hotspot. All the consenting (and assenting if necessary) individuals working in ASM sites regardless of the role, sex/gender, and age were included in the study in order to meet our study objectives. The individuals that neither provided consent nor assented were not be included in the study. For the health facilities, only those within 10 km radius will be included in the study.

2.2.2. Study Limitations

The entire study was faced with challenges that the research team, through the team supervisor and assistance form the locals, managed to overcome and carry out the study successfully. The following are some of the study limitations:

Fear and uncertainty among ASM

The ASM believed that the data collection team may come with police to arrest them and the ASM had a hard time accepting and believing the data collection process. They thought it was a government move to get information to come and use later against them, researchers had to be vigilant in convincing them otherwise. This fear and suspicion led to some ASM leaders not allowing the team to visit their sites, but allowed the team to conduct interviews over the phone. In places where the team managed to reach the sites, fear and uncertainty was tackled through the informed consent process, where researchers gave the ASM power to participate on their free will. They were more likely to open up to the questions after this process of explaining project goals.

[1] Rambiki et al., “The Prevalence of Pulmonary Tuberculosis among Miners from the Karonga, Rumphi, Kasungu and Lilongwe Districts of Malawi in 2019.”

Long distances between ASM mining sites

In many instances, there were apparently long distances between mining sites and this militated against the overall district targets and the number of sites covered per day. The sites tended to be in isolated and found mostly in areas with terrible road infrastructure such that a lot of time was spent moving between sites. In most instances, research teams had to walk on foot for long distances to reach sites. The team tackled sites present in a particular area before moving on to the next, but this still resulted in lower number of sites reached in the 8-day mapping period.

Late Ethical Approval by the Malawi research Body for the ASM mapping

The exercise was faced with one main challenge which was slow response from the relevant body that does Ethical Approvals and this resulted in teams starting data collection before Ethical approval was done. Even though payments were made to the Research approval body, till now the clearance has not yet been done for this particular study.

2.3 Findings

2.3.0 Overview

A GIS and remote sensing techniques were used to map ASM sites throughout the country. This was followed by KIIs where a total of 565 interviews were conducted in three regions. The number and category of people interviewed is outlined in the table below:

2.3.1 Visited ASM sites

As explained in Chapter 1, various GIS and Remote Sensing techniques were utilised from the planning phase through data collection phase and analysis of data. ODK was used for data collection and forms were enabled for spatial data collection so as to link data collected from every mine with its actual real-world location using mobile based GPS technology. For detailed information refer to section 1.2.5.1 of this report.

Districts visited, ASM mines visited as well as nearest Health facility and the minerals mined.

District	Sites	Reported Minerals	Health centres
Mzimba	• **Kawilira** • **Mbiriwiza** • **Thoza** • **Mtwalo** • **Watereka** • **Sithembire (Euthini)** • **Mziwanda** • **Mperekesi** • **Kantheni** • **Mjinge** • **Chipatamoyo**	• **Aquamarine** • **Rose quartz** • **Mineral aggregates (gravel)** • **Gold**	• **Mzambazi community hospital** • **Mzimba District Hospital** • **Embangweni mission hospital** • **Mtwale health center**
Kasungu	• **Malawi village (5 sites)** • **Thamolatha (2 sites)** • **Mthimbwidzika** • **Chimbiya** • **Matongwe** • **Manjondo** • **Chiwinga** • **Chinguluwe** • **Kasiya/ kahonoko** • **Khundango** • **kwengwere** • **Chisazima**	• **Gold** • **Quarry stones**	• **Dwangwa Health Centre** • **Kasungu District Hospital** • **Gogode Health Centre**

	• **Tobias (Mpondagaga)** • **Kasera** • **Khungwa** • **Chamakala**		
Dowa	• **Mkantombwe** • **Mkanunkha** • **Water intake** • **Msungudzi** • **Kanankha** • **Wanje** • **Mlambe** • **Mkagu**	• **Gold** • **Split** • **Galena**	• **Mvera army** • **Grace mission** • **Chankungu health centre**
Lilongwe	• **Area 24 Ngwenya T/A Tsabango** • **Lumwila** • **Dzundi** • **Mtengo T/A Mazengela** • **Chiwamba** • **Lundu 1 T/A Chimutu** • **Ndiwo close to Khoma T/A Mazengela**	• **Quarry stone** • **Gold** • **Red garnet/split**	• **Matapila Health Center** • **Chiwamba Health Centre.** • **Mazengera Health Centre** • **Bwaila hospital**

	• **Mbingwa Likuni T/A Malili**		

2.3.2 Type of Minerals Mined

Commodities that are being mined by ASM by country, region and district and overall based on the visited ASM

Figure 5: Pie chart on Commodities being mined

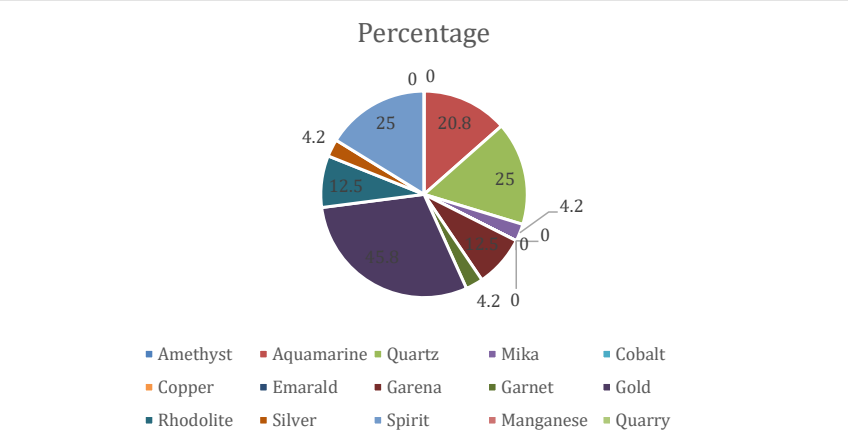


Table 6 and Figure 5 show that most ASM were involved in gold mining (45.8 %), Quartz (25 %), Aquamarine (20 %), Quarry (16.7 %) and Rhodolite and Garena (12.5 %, respectively). The proportion of ASM in gold mining points to the economic push towards getting instant rewards, a hand-to-mouth correlation between artisanal and small scale mining and basic survival of persons and families of ASM.

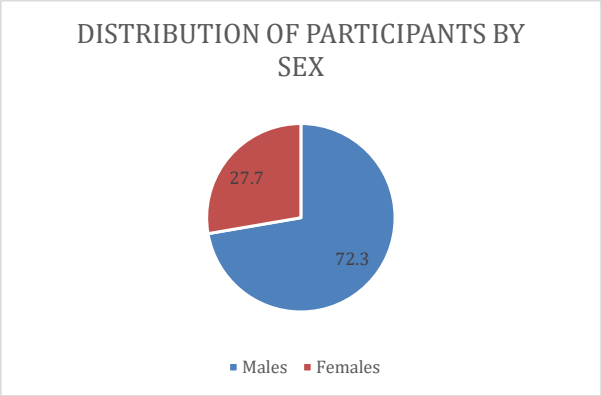
2.3.3 Population Size and Demographic Profile of ASMs

Table 3 presents data on participants by age group and the %age of participants in the study by age group. There were a total of 365 participants in the study. Data from

Age Group	Number Of Participants	% of Participants in
13-17	6	1,6
18-24	93	25,5
25-29	67	18,4
30-34	52	14,2
35-39	32	8,8
40-44	32	8,8
45-49	31	8,5
50-54	19	5,2
55+	33	9
Total	365	100

the table shows that artisanal and small mining is dominated by the young, with most participants being in the 18-34-year age group, with 25.5% in the 18-24-year age group, 18.4% in the 25-29-year age group, and 14.2% in the 30-34-year age group. The age groups from 35-49 years have almost 10%, but the data on participants reveals that the younger the person is, the more they are involved in artisanal and small-scale mining

Figure 3 : Distribution of study participants by Sex



The study participants had a distribution of 72.3% males and 27.7% females as shown in Figure 3 above. the male presence in artisanal and small mining is evidence that mining is highly attractive to, and populated by, males. .

Distribution of study participants by size of households they support.

Table 4 below shows that most of the interviewed ASM come from a family of 1-5 members (69.6%) followed by those who come from families with 6-10 members (29.6%) and the least of the interviewed participants support more than 10 family members.

Distribution of study participants by Household Size

Table 5 shows that 69.9 % of respondents come from households of 1-5 persons, followed by 29.6 % who come from households of 6-10 persons, and 0.8 % come from households of more than 10 persons.

Table 5: distribution of participants by household Size

Household size	MALAWI	
	N	%
1 – 5	254	69.6
6 – 10	108	29.6
> 10	3	0.8
Total	365	100

Distribution of Study Participants by Religion

As depicted by Table 5 below, most ASM interviewed come from the Christian religion (81.9%) followed by those who are non-believers and have no religion. Islam and African Traditional religions have equal share of 3% each among the interviewed ASM.

Table 5: Distribution of Study participants by Religion

Religion	MALAWI	
	Number	%
None	44	12.1
Christianity	299	81.9
Islam	11	3
African Traditional Religion	11	3
Total	365	100

2.3.4 Operational Environment

2.3.4.1 Legal and Regulatory Framework

Findings from this study showed that about 33.33% (8 out the 24 visted sites) are registered, the rest operate without formal registration or licences. This shows that very few of the ASM groups are registered in Malawi. According to the Mines and Minerals Act in Malawi, small-scale mining is restricted to Malawian nationals and does

not provide a clear path for locals to partner with law-abiding foreigners who have the financial muscle to support mineral extraction . It has been observed that the emphasis of the Government and civil society organizations is on the legal compliance of the ASM operations without providing alternative solutions to keep the miners at work.

Another challenge faced is the large sums of money required for registration, which makes registration difficult for the poor and rural folks who do not have access to loans as they cannot provide collateral needed by banks. This creates conditions for the well-off in society to access land legally, thus controlling the mining industry. Another concern raised by the interviewed individuals was that of corruption and the slow process of registration. For those without financial resources, the tedious process forces them to engage in unregistered mining. This then increases the risks involved in artisanal and small scale mining.

Most respondents explained that lack of funds to register for legal artisanal and small scale mining meant that they could not have their own claims where they could mine. As such, they resorted to illegal mining, which heavily reduced their capacity to make ends meet. Some of the respondents said that the rigourous and tedious registration process by the Government in screening of ASM papers, coupled with corruption, meant they had no choice but to mine illegally.

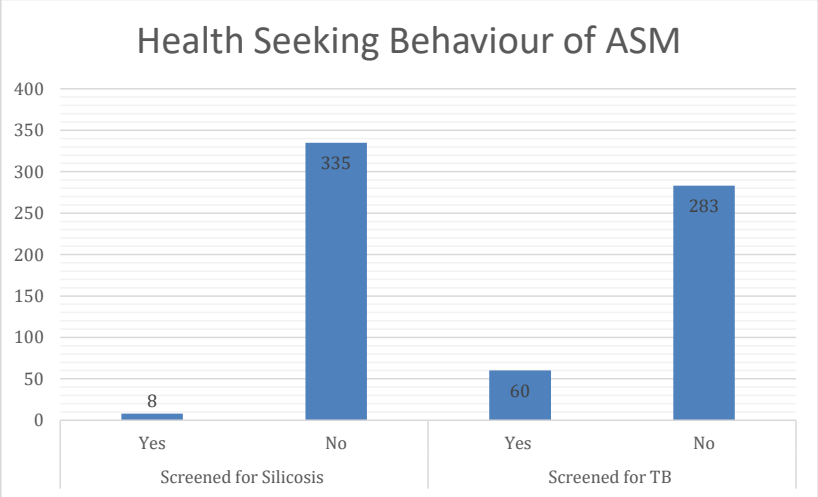
2.3.4.2 Health Services

Health seeking behaviours by ASM Graph

Attitudes of ASM (including visiting facilities for TB testing) were generally noted to be negative. Figure 6 below indicates that only 10% of ASM were tested for Silicosis while at least 90% were never screened for silicosis and 83% as well were never screened for TB. Findings also highlighted a worrisome trend which shows that 95% of ASM were never tested for T.B. while only 5% were tested. Interviewed miners stated that the average distance to the closest health facilities was 8kilometres, which they said was too far from their places of work. The ASM stated that the intense nature of artisanal and small-scale mining, plus distance to health facilities meant they did not have time to spare to go to health facilities to seek medical help. They stated that

travelling to Health Facilities meant loss of precious time that should be utilised at work, especially since most of them were illegal miners who were not on any payroll.

Figure 6: Distribution of Health Seeking behaviours of ASM



ASM access to Occupational Health and TB related services

Miners in Malawi cited several reasons that increased their risk to TB infection and transmission. Firstly, it was the citing of lack of adequate knowledge of the diseases especially on how it can be transmitted from person to person. Miners highlighted how their day to day tasks involve inhaling dust and the lack of proper protective clothing such as masks, in some cases miners covering their faces with torn cloth could be noticed. With little cash to spare, the thought of taking milk is alien.

Findings from the study showed that with little time and monetary resources set aside to seek medical attention and/or health services, artisanal and small scale miners are at risk of contacting TB. Female miners admitted to visiting local health facilities for various illnesses and/or diseases, especially those related to sexual health and HIV testing; but they stated that they did not expressly go there for TB screening. Male

miners also stated that they visit local health facilities usually when their wives are pregnant and they go on for HIV testing. While the TB screening related services may be available at the health facilities, the findings pointed to a lack of awareness and knowledge about these services among artisanal and small scale miners.

Current state of Health Facilities offering Health services to ASM.

Respondents from the study stated that the health system in Malawi is characterized by a shortage of funding, and skewed staffing and resource allocation across rural and urban areas. The skewed distribution of resources is demonstrated by the staffing arrangements, where 50% of the physicians and nurses are assigned to core hospitals, thus under-staffing rural health facilities. This demonstrates a problem with deployment policies, as priority is placed on urban areas. In terms of quality if health care services available to ASM, research findings point to a health system with human resource shortage as both urban and rural health centres have up to 80% vacancy rates. Senior medical officer positions are particularly affected, thus hindering effective planning and consequently, execution of health services delivery. It is important to point that miners in most rural areas complained that at times the facilities are unable to carry out their functions efficiently because of the number of patients that each health worker have to cater to per day.

Average distance travelled by ASM to get health services

Findings from the study revealed that some miners travel between 11-15 kilometres to access health care services. WHO guidelines advocate for a 7kilometre radius. However, the average number of kilometres travelled to access health services nationwide was 10kilometres .

2.3.4.3 Socio cultural and economic factors

Gender considerations

- Legal and administrative constraints attributed to traditional customs that restrict women from owning resources and even land. Some are even denied access to mines due superstitious beliefs.

- Most women and children do the light and menial work therefore they are given poor wages as compared to men.
- Children are exposed to the harsh and unfiltered language used by ASM

Equipment and machinery

Data from the study showed that ASM had trouble procuring cutting-edge machinery and equipment necessary for extracting high-quality minerals. Considering that more than two thirds of these ASM could not raise enough finances to be legally registered, study findings are consistent with incapacity to invest in machinery for mineral extraction. These findings, which are consistent with other studies, show that the rate of occupational injuries rose because these miners lacked standard equipment.

Start-up capital

ASM average earnings and expenditure in Malawi

Study data analysis revealed that for on average, an ASM can earn around USD 3573.63 per month and they may expend about USD 1703.4 per month.

Physical location and geographic access

ASM in Malawi use a variety of transport to reach their mining sites. Most of the ASM stay at their mining sites. However, those that travel either go on foot for short distances, use their personal cars or rely on public transport. The majority of miners rely mostly on public transport

Lack of Mining knowledge

Miners who participated in the study demonstrated an apparent lack of knowledge on basic mining processes, and the geological nature and structure of minerals being mined. The lack of knowledge also extended to health related risks of mining. The study found out that miners were not quite aware of risks of being exposed due to lack of protective clothing and use of rudimentary technologies for mining. There was a general disregard among miners of ways of avoiding harm through protecting themselves or learning about more efficient ways of mining.

2.4 Discussion

The data collection exercise was a success. Considering that most of the sites were hard to reach, which was not unexpected, there was indeed an occupation hazard for the research assistants, but the data collection exercise was a complete success. Important to note are the observations that include strict and hard to achieve legislative requirements for most ASM to own a license, Long distances to be travelled by ASM to seek health services, poor roads and poor network connectivity due to lack of infrastructure in the most remote parts of Malawi, poor water and sanitation conditions for ASM.

2.5 Recommendations

Based on the conclusions drawn from the study, the following recommendations are made:

Recommendation	Responsible Person(s)
Increase funding towards Human resources for health. Add the number of nurses and doctors at Health facilities to reduce workload for the current staff	Government
Set up mobile clinic to service the hard-to-reach ASM communities	Government
Training and Education on TB and OHS related illnesses among ASM required	Government
Medicines and medical equipment to screen, test and teat TB and related illness	Government

Relax the legislative instruments governing acquisition of ASM licences and make sure the processes are fast	Government lead by Ministry of Mines and Justice
Improve road network and telecommunications infrastructure to cover even the remote areas where most ASM activities are taking place	Government led by the Ministry of Transport and the Telecommunications Department
Improve the WASH conditions for the remote areas. Work towards improving access to clean water for drinking and for domestic purposes especially in the hard to reach and most remote parts of the country. Most ASM lack proper toilet facilities and they use the bush.	Government led by the Ministry of Water Resources and Health and social Amenities Department
The Government needs to work hard to remove Legal and administrative constraints attributed to traditional customs that restrict women from owning resources and even land. Some are even denied aceess to mines due superstitious beliefs	Government led by Ministry of Gender and social services

CHAPTER 3: NAMIBIA

3.1 Introduction

Namibia is located on the south-western coast of Africa; it is bordered by Angola to the north, Zambia to the northeast, Botswana to the east, South Africa to the south and east, and the Atlantic Ocean to the west. It is the driest country in sub-Saharan Africa lying between two large deserts; Namib and Kalahari.

According to the (EGP) Environmental Governance Programme of Namibia (2023), Artisanal and Small-Scale Mining (ASM) is a major source of income and livelihood for many unemployed people in Namibia, particularly those in rural communities and vulnerable groups. In the regions of Erongo, Kunene and Karas, ASM hotspots support around 2,000 households, with a focus on mining of semi-precious stones (EGP, 2023).

3.2 Methodology

3.2.0 Overview

Refer to Chapter 1, section 1.3 for a description of the methodological approach.

3.2.1 Study Area

Based on results of the mapping and consensus with staff from the geological unit, the following regions were selected for ASM site visits and administration of KII questionnaires. Kunene, Erongo, and IIKaras. These are considered to be the most populated with small-scale mines. Below are maps showing the regions selected for the study:

Sampling

The Namibian team deployed a multi-stage cluster sampling technique in all the regions selected for this study. As part of sampling, study locations were selected according to recent statistics on mining localities and sought from various relevant sources that could be accessed within the limits of the study. This required the use of different sources, particularly from the Government's Minisrty of Mines and Energy. Critical data that is required for the sampling process of each regions/disctircts will include:

- Registered and non-registered ASMs and the minerals mined,
- Regions/Districts within which the mines operated;
- Regional/District population;
- Mining populations for each mining concern identified.

The final stage of sampling involved the selection of the actual respondents in each selected regions and districts.

Sample Size Calculation

Using the sample size calculation formula for the unknown sample, the minimum required number of ASM respondents were 129. This was calculated using the Dobson Formula which is (How to Calculate Sample Size for Different Study Designs in Medical Research? - PMC, 2013):

$$S = \frac{Z_{1-\alpha/22}.p\,(1 - p)}{d2};$$

where: $Z_{1-\alpha/22}$ is the standard normal variate at 95% confidence level =1.96
p is the prevalence of TB among ASMs (14%), and
d is the absolute error = 5%

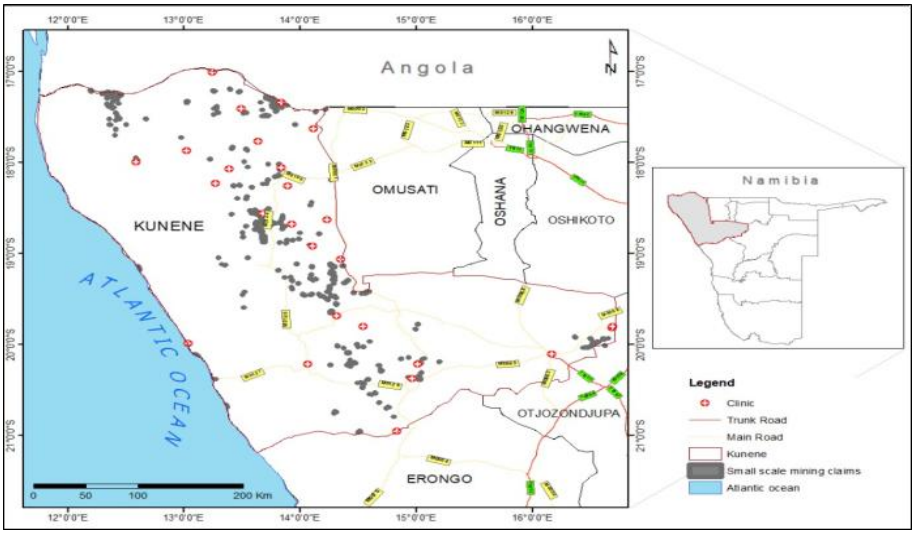


Figure 1: Kunene Region Smal Scale Mining areas

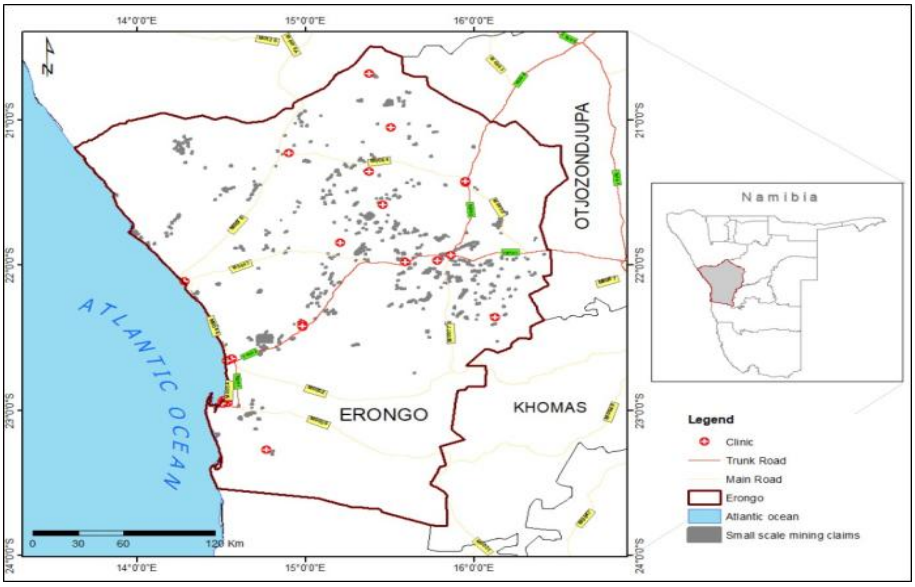


Figure 2: Erongo Region Smal Scale Mining areas

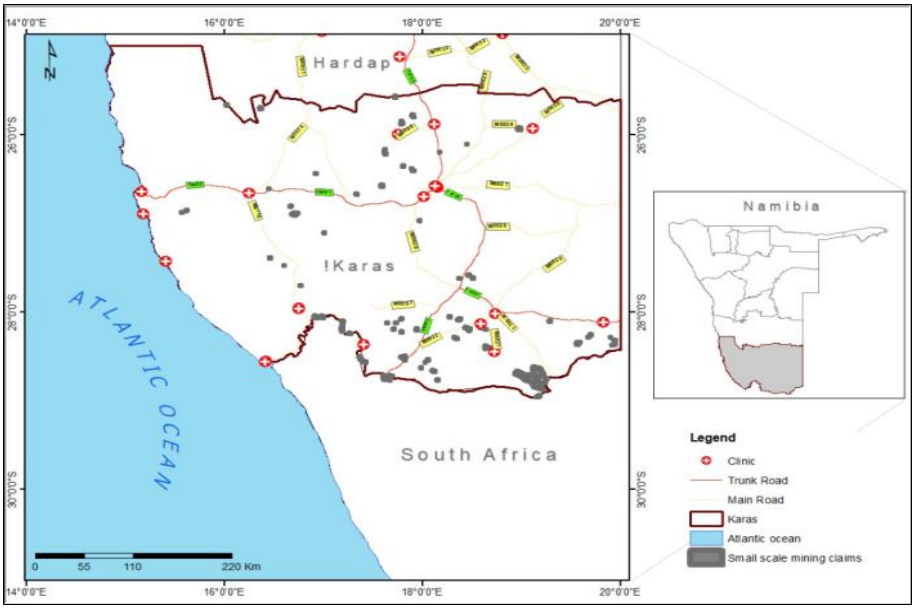


Figure 3: Kara Region Smal Scale Mining areas

The following number of Districts in Namibia will be included in the study as determined by the sampling strategy that was adopted.

Country	No of Constituencies/Districts	No of constituencies/districts be sampled	No of data collectors per district	Total Nos of data collectors
Namibia	121	14	-	11
Total				**11**

Sampling Areas		
Kunene North (Province/Region)	7 Districts	55 ASM
Erongo (Province/Region)	4	45 ASM
Karas (Province/Region)	3	29 ASM
TOTAL	**14 DISTRICTS**	**300 ASMs**

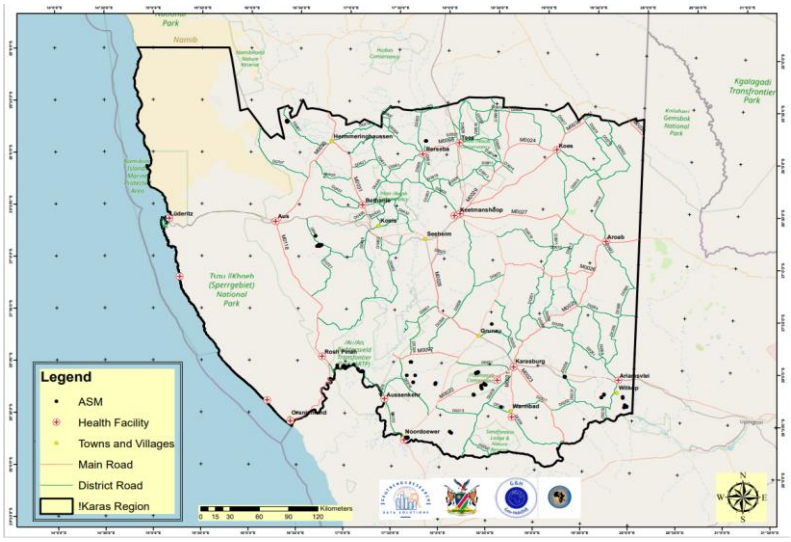


Figure 0.1. ||Kharas Region

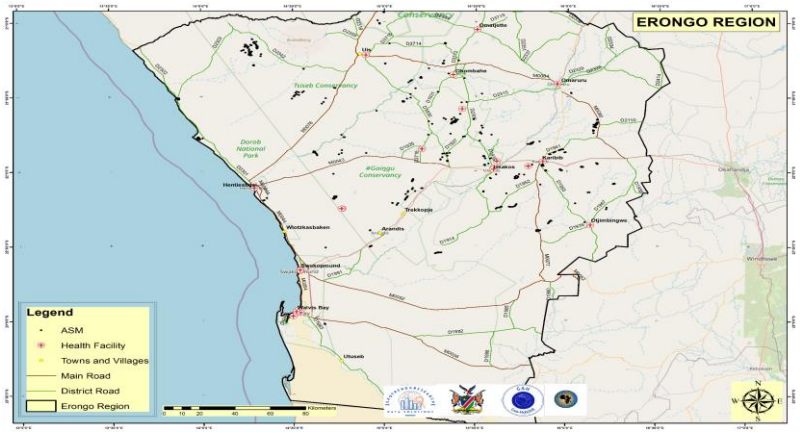


Figure 0.2: Erongo Region

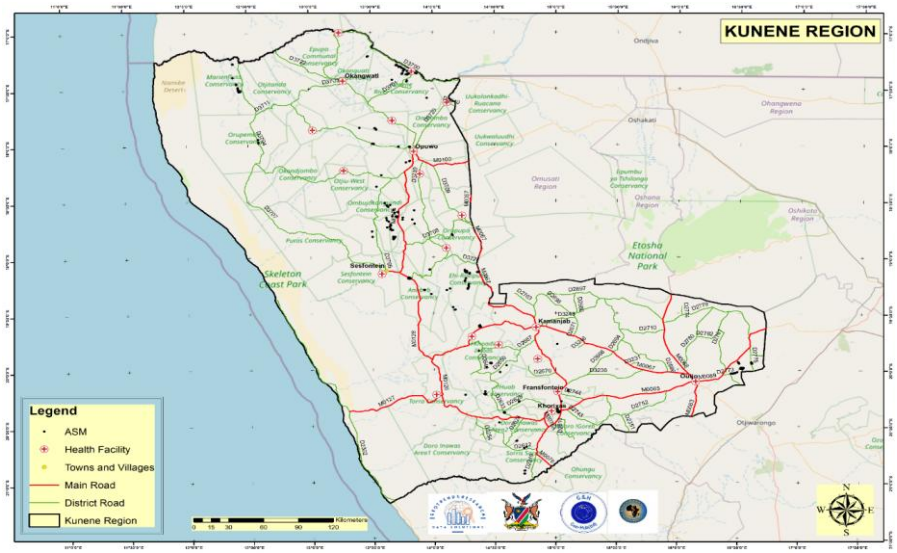


Figure 0.3 Kunene region

The table below shows the ASM sites visited by region

Region	Sites
Kunene	● Okovasiona,

	• kozondje • Onguta • Orunguru, • /Gam • Ruspoort pos • Mesopotanie • Lofdal • Driekrone pos • Araideidael • Fransfontein • Khoro !goreb
Erongo	• Otjimbwingwe • Uis • Usakos • Brandberg • Goboboseb
||Kharas	• Karasburg • Witkop • Ariamsvlei • Gamseb conservacy

3.2.2. Data Collection and Analysis

Refer to Chapter 1, section 1.3.6 and 1.3.7

3.2.2. 1Study Limitations

The entire study was faced with challenges that the research team, through consultations with country coordinator, team supervisor and assistance form the locals, managed to overcome and carry out the study successfully. The following are some of the study limitations:

Site inaccessibility

Some sites were located in hard-to-reach areas in terms of terrain and not easily accessible as they were found in areas without good road networks. However, the study team overcame this challenge by engaging locals who helped in navigating terrain and locating the ASM sites.

Fear and Uncertainty among ASM

A few miners were uncomfortable with being interviewed as they suspected the researchers could be undercover police officers. They turned away the teams because they operate without licenses and feared arrest. The supervisor managed to liaise with them, explaining in-depth the nature and background of the project and assured them there will be no confidential information to be obtained from the miners.

Lack of Cooperation from Health Personnel

Most health workers were unwilling to cooperate at first. They demanded that the researchers should have given a notice prior to their coming and they complained about loss of time in their tight schedules. However, after researchers showed them stamped letters from the Executive Director of Health and the Mines Office, they cooperated. This problem was also resolved through explanation of possible benefits to the communities and capacity of health centres to offer services being investigated.

Potentially Violent Conduct from Miners

Some miners were quite difficult to deal with and just like the other challenges, this was overcome by a thorough explanation of the project to the miners.

3.3 Findings

3.3.0 Overview

A GIS and remote sensing techniques were used to map ASM sites throughout the country. This was followed by KIIs where a total of 167 interviews were conducted in 3 regions. The number and category of people interviewed is outlined in the Table 1: KII Per country and category of KIIe below:

3.3.2 Type of Minerals Mined

Based on the information from key informants and review of records, the common types of minerals mined by the ASMs are listed in the table below:

Table 5. Types of Minerals Mined by Constituency

Constituency	Commodity mined
• *Epupa*	• *Sodalite*
• *Karasburg*	• *Blue stone gemstones*
	• *Gemstones*
	• *Prenite*
	• *Prinite*
	• *Rose quartz*
	• *Sand mining*
• *Karibib*	• *Crushing dolomite dust or White marble*
	• *Marble*
	• *Tourmaline*
	• *Tourmaline and Lithium*
	• *White Mables*
	• *Red Garnet*
• *K**horixas***	• *Tins and Chalcopyrite*
• *K**horixas** constituency*	• *Copper*
• *Namibia*	• *Aquamarine and tourmaline Gemstone*
	• *Aquamarine quartz*
• *Opuwo Rural*	• *Copper*
• *Opuwo Rural Constituency*	• *Copper and Sem Precious Stone*
• *Otjimbingwe*	• *Copper and Lithium*
	• *Dimension stones, granite*

		• *Iron and tourmaline*
		• *Lithium*
		• *Lithium and Gemstone*
		• *Sand mining*
		• *Tourmaline*
		• *Tourmaline and Amethyst*
		• *Tourmaline crystal*
Uis	• ***Sesfontein***	• *Copper, Crysolla and Gemstone*
		• *Copper, Crysolla, silica, and Fluoride*
		• *Copper, Gemstone and Crysolla*
		• *Crysolla*
		• *Crystal, prinite,crestote*
		• *Lithium and tourmaline*
		• *Semi precious minerals*
		• *Tourmaline*
		• *Tourmaline, mica and tin*
Usakos		• *Calcite*
		• *Gemstones*
		• *Granite*
		• *Sand mining*
		• *Semi precious minerals*
		• *Tourmaline, Aquamarine*
		• *White Mable's*

3.3.3 Population Size and Demographic Profile of ASMs

The estimated population of ASM in Namibia is 38,431 miners with the majority being men at 87.2%. The ASM population disaggregated by constituency is indicated in the table in annex 5 below. The average ASM site has about 11 miners

The age distribution of ASMs is as indicated in the pie chart below:

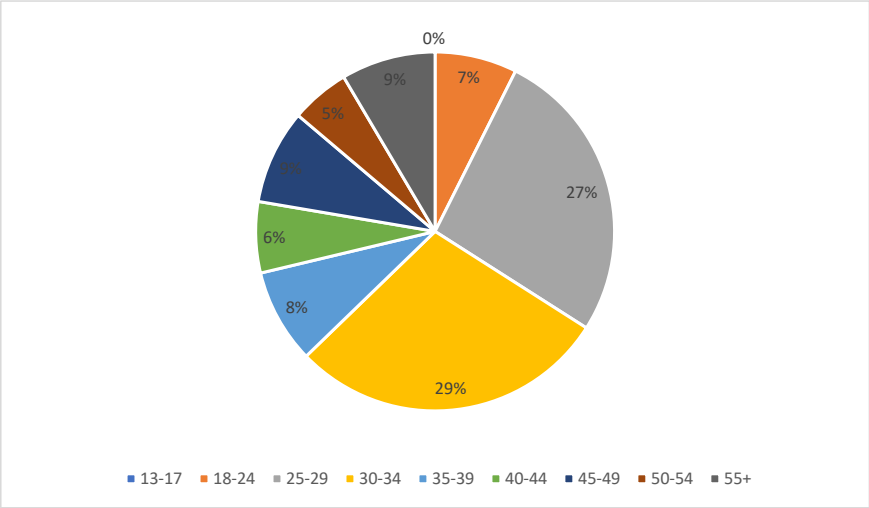


Figure 0.4 . ASM distribution by age

3.3.4 Operational Environment

3.3.4.1 Legal and Regulatory Framework

ASM is legal in Namibia, however, about 30% of ASM is not registered and thus conduct mining illegally. Majority of ASMs that were not registered indicated willingness to register and mine legally however, they cited challenges hindering the registration process and these included lengthy application processes and environmental clearance licence approval from responsible ministries and lack of money for the registration process.

3.3.4.2 Health Services

Health seeking behaviour of ASM

Health seeking behaviour of ASM, including visiting health facilities for TB testing, were generally noted to be negative. Figure 5 shows that only 15 out of 94 participants were tested for Silicosis. When it comes to TB, the figure of those who have never sought to be tested is 78 %. One factor the miners raised as a deterrent to seeking

health services was that the nearest health facility was about 35 kilometres away. They also attributed their lack of health seeking enthusiasm to not having free time, travelling or walking to health facilities was believed to be a loss of precious time that should be utilised at work.

Fig 5: Health seeking behaviour of ASM

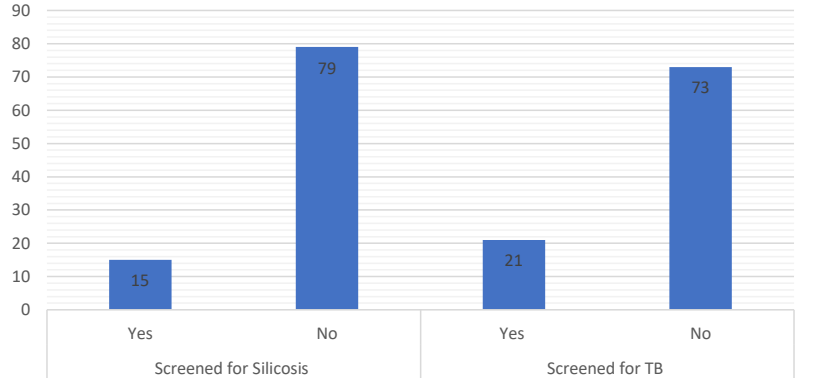
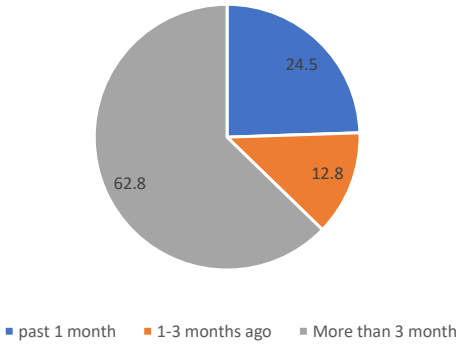


Figure 6 shows that from the 94 interviewed people, 23 people (24.5 % visited a health facility in the past month and only 12 people (12.8) in the past 1 to 3 months. Most people had last visited a health facility more than 3 months from the time of interview.

Fig 6: Health seeking behaviour of ASM in last few months



ASM access to Occupational health and TB related services

About 56.4 % of respondents stated that they have access to Occupational health services whilst only 5.3 % said they have easy access to TB related care services. A total of 22.3 % of the participants had been screened for TB. From those that had been screened for TB, the proportions of those who had been screened at a health facility were 57.1 %, with 4.8 % screened by a community volunteer whilst 38.1 % were part of a targeted active TB screening outreach programme.

Current state of Health Facilities offering Health services to ASM

Overall access to healthcare in Namibia is good, with 76 % of the population living within a 10 kilometres radius of a health facility. On average, in rural areas, where most ASM are located, the catchment for health facilities is about 5 780 people per clinic and 58 825 people per district hospital (Christians, 2020). While the spatial distribution of health centres may create a good picture, health facilities in most areas have insufficient number of health workers and the patient-doctor or nurse-ratio is high.

The miners in most rural areas complained that at times the facilities are unable to carry out their functions efficiently because of the number of patients that each health worker have to serve per day. The Namibian Ministry of Health is experiencing high staff turnover in certain operational areas due to lack of a clear career progression within the ministry. This has resulted in the ongoing need for training of newly recruited staff. Staff who have retired are also not being replaced because of limited budgetary allocation.

Average distance travelled by ASM to get health services

Findings from study show that some miners live at least 35km far away from health facilities, in areas that are beyond the WHO recommendation of 7 kilometres. The study found out that the distance to a health facility may even go up to 35 kilometres in some areas.

3.3.4.3 Socio cultural and economic factors

Gender considerations

Women interviewees revealed that they face challenges as they practice mining. The challenges they face are:

i. Legal and administrative constraints attributed to traditional customs that restrict women from owning resources.
ii. Low levels of education which limit them from getting formal education on mining. This then limits their access to employment in mines.
iii. The division of labour as most women and children do the light and menial work hence being given poor wages as compared to man.

Equipment and machinery

Small scale miners interviewed had challenges acquiring machinery and equipment as it required a lot of money. They said they sometimes have to give up a certain percentage of their earnings in exchange for use of other people's machinery.

Start-up capital

Miners complained of their limited access to financial resources as they are poverty stricken and do not have access to loans from financial institutions where collateral is required.

Physical location and geographic access

ASM in Namibia use a variety of transport to reach their mining sites. Those who work and stay within close distances mostly walk but others usually hike or board public transport if they do not own private cars.

3.4 Discussion

Challenges cited by ASM in their responses included remoteness of site locations, poor road networks, very long distances, security of tenure, poor Cellphones connectivity and poor access to clean and safe water for drinking and domestic use. To add to these challenges, ASM do not have financial resources to purchase machinery and equipment for extracting minerals, hence they use rudimentary methods. They lack financial support from the government and the capacity to increase their knowledge and skills since they operate on hand-to-mouth basis. ASM also highlighted that there are too many disputes/conflicts especially amongst illegal miners. They then end up injuring one another, and in some instances, kill each other.

The Namibian National Mining Policy states that the government is aware of the perception that small-scale miners do not receive adequate attention and accordingly undertakes to investigate cost-effective and efficient methods for the claim registration system for small-scale miners. It is further acknowledged that the process of pegging and registration of mining claims in terms of the Mining Act is still centralised and not always readily available to small-scale miners throughout the country, and that the decentralisation of administrative and support services may assist in solving this problem.

The centralised nature of the application for the pegging of claims, the lack of formal provision and regulation of the off-set markets, and the lack of access to finance for

small-scale miners are all bottlenecks with regards to formalisation of ASM activities in Namibia. A weakness of the administrative process is the brief duration of permits and the inadequate monitoring of the small-scale mining sector, and this under-development of the mining claims system has resulted in a growth in illegal mining activities.

The research findings pointed to these ministries being potentially under staffed or under-funded to process applications on time. It was noted that this gave room to corruption in respective ministries as members of staff could process quickly papers of those who pay bribes.

In Erongo most ASM stated that they could not afford registration fees, and they could not access loans because they lack collateral needed by banks. This creates conditions for registration to only be possible for those who have money, thus giving control of mining rights to a well-off people in communities. This was also noted in ||Kharas where most mining sites are owned by a few individuals.

It can be noted that ASM still face challenges in registering their activities due to the fees required and some policies that govern these activities. ASM also have poor health seeking behaviours which make them vulnerable to TB and related Occupational Health hazards.

3.5 Recommendations

- Support ASM financially through giving them loans
- Lower the registration fee for ASMs
- Ministry of Mines, Mine Workers Union, Emerging Mining Association of Namibia and Ministry of Health and Social Services (MoHSS) to incorporate relevant stakeholders into the existing TWG.
- MoHSS to incorporate TB services for ASM sites in the outreach programs
- Ministry of mines to conduct a national outreach to register and licence all ASM yearly.
- Ministry of agriculture, water and forestry to ensure provision of clean water to the ASM sites.
- Ministry of works and transport to construct stable road infrastructures.
- Ministry of Information and Communication Technology to ensure network accessibility.

- Relevant stakeholders with the support of donors including ECSA to provide suitable trainings for ASM miners such as
    - Health and Safety – basic safety procedures, first aid, hygiene and sanitation.
    - Technical and Operational – mining techniques & mine site management.
    - Environmental Management
    - Regulatory and Legal Compliance
    - Financial Literacy and Business management
    - Community relations and Social Issues
    - Technical Innovations

CHAPTER 4: ZAMBIA

4.1 Introduction

This mapping exercise seeks to map and estimate the size of the ASM in Zambia. Additional information on the size, location, and access to occupational health care services of ASM will go a long way in facilitating a coordinated and well organised approach towards intervention efforts.

4.2 Methodology

4.2.0 Overview

Refer to Chapter 1, section 1.2 for a description of the methodological approach.

4.2.1 Study Area

The selected districts were Kafue, Chilanga, Lufwanyama, Mumbwa, Chingola, Mapatizya, Mkushi, Mansa, and Kalulushi. A team of one country coordinator, two supervisors and 8 data collectors went to each of the 9 selected districts to conduct the data collection exercise.

- Include a Map of the study districts
- Include table of sites visited

4.2.2. Data Collection and Analysis

Refer to Chapter 1, section 1.2.4 and 1.2.5

In preparation for the data collection, the research assistants were oriented on the data collection tools using the ODK software. The informed consent forms and some of the translated tool guides were printed, in readiness of the data collection. At the district, the team had already spotted possible KIIs to be interviewed and some of the hotspots to be visited. An emphasized method was to maximize snowballing, so that we find as many sites as possible.

Data collection was done with a goal of mapping mining sites, interviewing key informants, artisanal and small mining leaders, individual ASM as well as mapping relevant health facilities

4.2.2. Study Limitations

The entire study was faced with challenges that the research team, through consultations with the team supervisor and assistance form the locals, managed to overcome and carry out the study successfully. The following are some of the study limitations:

Site inaccessibility

Some sites were located in hard to reach areas in terms of terrain and not easily accessible as they were found in areas without good road networks. However, the study team overcame this challenge by engaging locals who helped in navigating terrain and locating the ASM sites.

Fear and Uncertainty among ASM

Some miners where not comfortable with the interview questions as they thought it was the government move to stop them from their activities. The supervisor managed to liaise with them, explaining in-depth the nature and background of the project and assured them there will be no confidential information to be obtained from the miners.

Lack of Cooperation from Health Personnel

Few health workers were also not ready to give the research team time to be interviewed out of their tight schedules, they wanted the team to make an appointment through the top district officials before interviews can be conducted. This problem was also resolved through explanation of possible benefits to the communities and capacity of health centres to offer services being investigated.

Potentially Violent Conduct from Miners

Some miners were difficult to deal with. Among miners were political cadres who thought the interview team were just spying for some information that would dent their image to the top government officials, however just like the other challenges, this was overcome by a thorough explanation of the project to the miners.

Communication barrier

In some areas, the interview team faced challenges communicating with the participants. However, this was overcome by utilisation of locals as interpreter.

4.3 Findings

4.3.0 Overview

A GIS and remote sensing techniques were used to map ASM sites throughout the country. This was followed by KIIs where a total of XX interviews were conducted in 4 regions. A total of 15 mines were visited, and 565 interviews were conducted in the country.

4.3.1 Visited ASM sites

GIS and Remote sensing techniques used to come up with estimates

As explained in Chapter 1, various GIS and Remote Sensing techniques were utilised from the planning phase through data collection phase and analysis of data. ODK was used for data collection and forms were enabled for spatial data collection so as to link data collected from every mine with its actual real-world location using mobile based GPS technology. For detailed information refer to section 1.2.5.1 of this report

SN	SITE	COUNTRY	REGION	DISTRICT
1	Shimabala	Zambia	Copperbelt province	Kafue district
2	Sage Mine	Zambia	Copperbelt province	Chilanga district

3	Pilala	Zambia	Copperbelt province	Lufwanyama district
4	Chiwempala dump site	Zambia	Copperbelt province	Chingola district
5	NFCA Dump site	Zambia	Coperbelt province	Kalulushi district
6	Luili	Zambia	Central province	Mumbwa district
7	Matala Mine	Zambia	Central province	Mumbwa district
8	Mindeko	Zambia	Southern province	Mapatizya district
9	Misika	Zambia	Southern province	Mapatizya district
10	Kariba	Zambia	Southern province	Mapatizya district
11	Gramilarge	Zambia	Southern province	Mapatizya district
12	Sako	Zambia	Central province	Mkushi district
13	Chiponya Junction Mine	Zambia	Central province	Mkushi district
14	Muntubusa Mine	Zambia	Luapula province	Mansa district
15	Amizo Mine	Zambia	Luapula province	Mansa district

4.3.2 Type of Minerals Mined

Commodities that are being mined by ASM by region and district and overall based on the visited ASM

Study findings showed that commodities that are being mined by ASM include Amethyst, quartz, cobalt, copper, emerald, gold, quarry stones and Manganese. Regionally, the commodities differ. For example, in the Copperbelt Province, most miners are involved in Copper Mining; in Lusaka province they are mostly into quarry stones; in Central Province districts like Mkushi and Mumbwa, the most mined mineral was Manganese and Copper; while in Southern Province most miners are mining Amethyst.

4.3.3 Population Size and Demographic Profile of ASMs

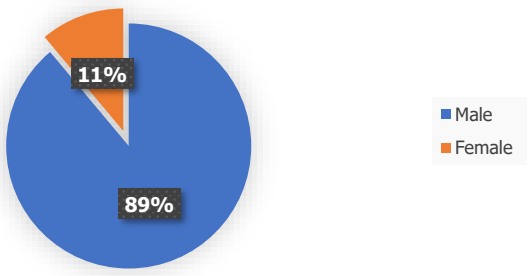
Table 3: Number of ASM found in visited districts

SN	DISTRICT	SITES VISITED	NO. OF ASM FOUND
1	Kafue	Shimabala	29
2	Chilanga	Sage Mine	2
3	Lufwanyama	Pilala	77
4	Mumbwa	Luili	123
		Matala Mine	
5	Chingola	Chiwempala dump site	65
6	Mapatizya	Mindeko	36
		Misika	
		Kariba	
		Gramilarge	
7	Mkushi	Sako	41
		Chiponya Junction Mine	
8	Mansa	Muntubusa Mine	132
		Amizo Mine	
9	Kalulushi	NFCA Dump site	84

Distribution of study participants by Sex

The bulk of study participants were male, 89 %, with females constituting the remaining 11 % as shown in the figure below:

Figure 1: Distribution Of Participants by Sex



4.2.3.2 Distribution of study participants by Age group

Young people between age 18 and 29 constitute a great potion of participants in ASM in Zambia, mainly as illegal miners. In terms of composition of five-year age groups, Miners between age 25-29 years had the highest %age of 28 %, followed by age 18-24 years, 30-34 years and 35-39 years (23 %, 17 % and 15 %, respectively) as shown in Figure 2 below.

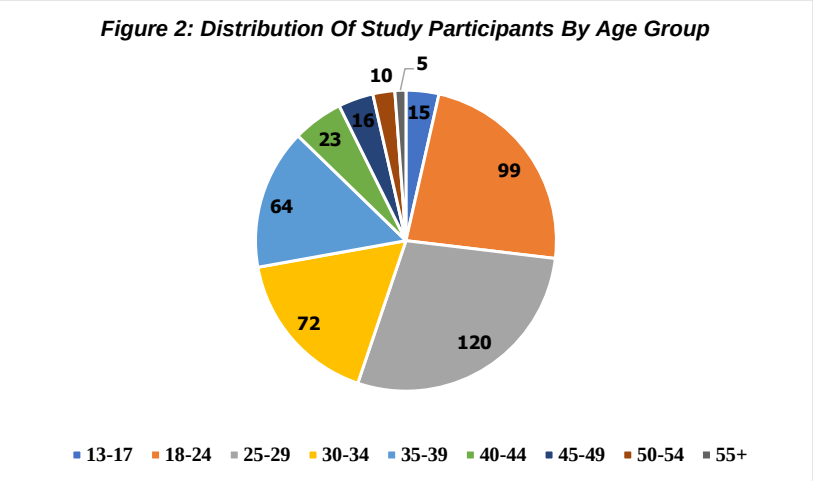


Figure 2: Age groups of study participants

Total estimates of ASM population

Based on our remotely sensed image analysis combined with Geospatial techniques, we managed to derive the estimates for ASM population in Zambia by district. Findings from the study reveal that the total estimate of ASM population in Zambia is 512 064 miners directly working in ASM activities. Our estimates are derived from multiplying the average number of workers found at a site by the number of active sites in the district and we sum the totals for all the districts. The study shows that 11 % of these are females and 89 % males.

4.3.4 Operational Environment

4.3.4.1 Legal and Regulatory Framework

Proportions of Registered and unregistered ASM and challenges faced associated with registration of ASM

In most parts of the interviewed districts the main issue highlighted was the slowness of the registration system and the unaffordability of registration fees. From this study 44.4 % ASM said they were unregistered and operating without licences. This is nearly half of the ASM sites that were visited in Zambia, a very high proportion of unregistered ASM operating without legal permission. However, most people were hopeful that things would improve under the new government as they have seen the implementation of strong measures and changes of non-functional policies.

Obtaining Mining Licenses

Many miners interviewed stated that the process of obtaining a mining licence from the government is tedious and it takes a lot of time for licences to be approved. As such, most of the miners usually start the mining process even before their licenses are approved.

4.3.4.2 Health Services

Health seeking behaviours by ASM

Health seeking behaviour of ASM, including visiting health facilities for TB testing, were generally noted to be negative. Figure 3 shows that only 98 out of 438 participants were tested for Silicosis. This meant up to 88 % have not. When it comes to TB, the figure of those who have never sought to be tested is 140 out of 298 (78 %). One factor the miners raised as a deterrent to seeking health services was that the nearest health facility was about 7 kilometres away. They also attributed their lack of health seeking enthusiasm to not having free time, travelling or walking to health facilities was believed to be a loss of precious time that should be utilised at work. Miners also said they lack knowledge of screening as they have not seen or heard about any screening campaigns.

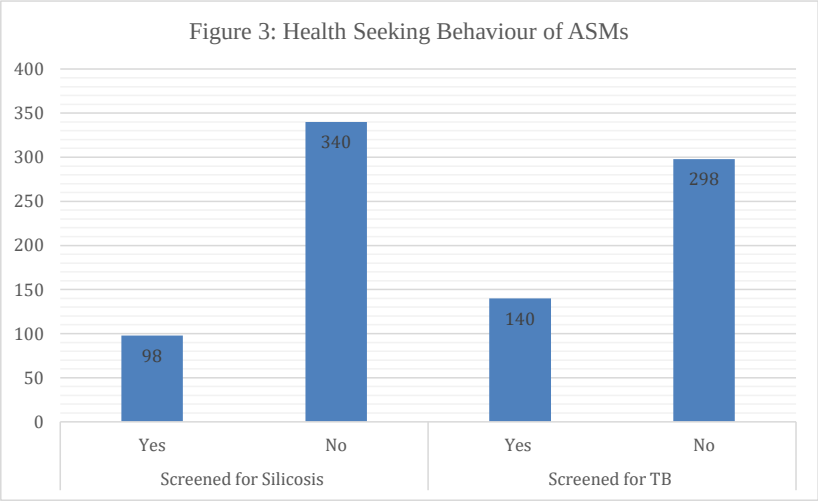
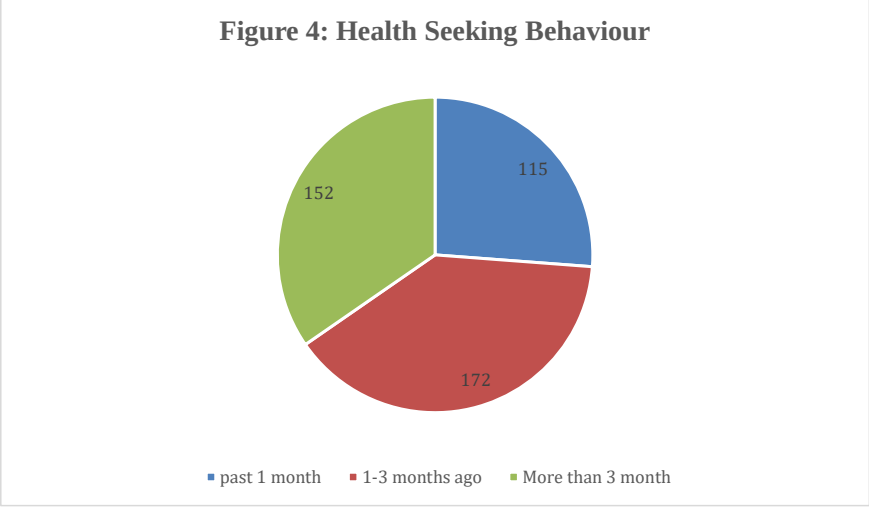


Figure 4 shows that from the 439 interviewed people, 115 people (26.2 %) visited a health facility in the past month, and 172 people (39.2 %) in the past 1 to 3 months. Around 152 people had last visited a health facility more than 3 months from the time of interview



ASM access to Occupational health and TB related services

Miners are a critical population in TB transmission as they are at an increased risk for TB due to occupational circumstances, and often shift between areas of residence in search of employment and survival. The study findings showed that most miners have not been screened for TB due to lack of access to TB screening services and a general lack of awareness on the importance of getting screened. Miners who had knowledge stated that they live in fear of a positive diagnosis for TB as as that would take them away from work for an extended period of time. A running theme across interviews was potential loss of employment as the main barrier to seeking TB related services among miners. Those in the employ of others were unwilling to share information on TB screening with mine authorities for fear of job loss. Another factor which was perceived by the interview team to be key in making miners not seek occupational health and TB related services, was the long distances to clinics and hospitals. It was revealed that on average, most miners have to travel at least 6-7 kilometres in order to access health services.

Current state of Health Facilities offering Health services to ASM.

Many health facilities that were interviewed showed that they have the capacity to treat a number of common complaints and diagnose many conditions including HIV, malaria, STIs and pregnancies without requiring patients to travel to distant health centres. However, some health facilities in rural areas like Mapatizya and Mkushi have limited services they can provide to the community. Many health facilities in the area do not have proper equipment to screen their patients for Tuberculosis and conduct X-rays. As such, patients are asked to travel to the district general hospital which is far from mining sites where the miners are conducting their operations.

Health facilities in most areas have insufficient number of health workers. The miners in most rural areas complained that at times the facilities are unable to carry out their functions efficiently because of the number of patients each health worker has to serve per day. As a result, health workers are usually exhausted and are at times found to be ungentle their clients.

Another challenge the health facilities are facing in these rural areas is lack of medicine which is inhibiting service delivery. During the study, some miners responded that they don't even waste their time to visit the health facilities in their areas because they know

already they will get a prescription and asked to buy medicine on their own from the privately-owned pharmacies.

Average distance travelled by ASM to get health services

Study finding show that miners in all the sites interviewed travel an estimated 6.9 kilometres to access health services. Most respondents stated that they live within a 15 kilometres radius of a health centre, but there are some who may even travel up to 25 kilometres to access health services.

4.3.4.3 Socio cultural and economic factors

Gender considerations

Interviewed women revealed that they face challenges as they practice mining. Among the challenges they face are;

i. Legal and administrative constraints attributed to traditional customs that restrict women from owning resources.
ii. Low levels of education which limit them from getting formal education on mines and mineral resources extraction.
iii. Most mine leaders refuse women from getting close to mining sites because traditionally they perceive women are of bad luck, so when they come close to sites they believe the minerals will disappear.

Equipment and machinery

Small scale miners interviewed had challenges acquiring machinery and equipment as a lot of money is required. As a result, they are forced to work within their available means resulting in failed mining targets or operating below their expected daily production.

Most miners interviewed complained that the sites they are working on have limited amount of minerals to work on. They further added that they are somehow only permitted to work on dump sites which usually have little minerals, as such it takes them a lot of time to find good minerals that they can sell on the mineral markets.

Start-up capital

Miners especially those in Central and Southern provinces complained of lack of financial support from the government to back their mining businesses.

Physical location and geographic access

ASM main mode of Transport by country region, district and overall

ASM in Zambia use a variety of transport to reach their mining sites. Those in urban areas like Chingola and Chambishi on the Copperbelt, province and, Kafue and Chilanga in Lusaka province use vehicles to their sites. Those that are near to the sites normally just walk on foot to reach the sites. In rural areas such as Mapatizya, Mkushi, Lufwanyama, Mumbwa and Mansa, the most common mode of transport are motorbikes and bicycles. Many mining sites are not accessible by vehicles as there are no proper roads to and from mines. As such, mine supervisors, leaders and mineral buyers are forced to leave their vehicles at a distant point and either hire a motorbike or walk on foot the rest of the way.

4.4 Discussion

Challenges cited by ASM include, exposure to chemicals and dangerous environments without protective clothing and poor access to clean and safe water for drinking and domestic use. To add to these challenges, ASM do not have financial resources to purchase machinery and equipment for extracting minerals, hence they use rudimentary methods. They lack financial support from the government and the capacity to increase their knowledge and skills since they operate on hand-to-mouth basis. ASM also highlighted that there are too many disputes/conflicts especially amongst illegal miners. They then end up injuring one another, and in some instances, kill each other

High levels of formalisation are a hallmark of ASM in Zambia. Formalisation is interpreted as legalization or the awarding of a legal title. The level to which ASM operators are permitted to legally operate in Zambia is rated as "very high" in The World Bank's (2016) mining and Governance study. In contrast to most of sub-Saharan Africa where ASM is primarily informal, this high level of formality is present

partly due to the fact that ASM in Zambia has historically concentrated on the mining of the restricted zones that are designated as areas under license in order to find emeralds and amethyst. What the Zambia case reveals is that formalisation, or more accurately legalisation, has done little to unlock the benefits that are often touted as the outcomes of formalisation. For instance, Siwale and Siwale (2017) discover that even while emerald ASM miners have mining licenses, they have had trouble obtaining funding, institutional support, and technological assistance from the state. According to Siwale (2018), formalization has resulted in a variety of mining arrangements with various effects in the amethyst sector. There are now three different forms of mining agreements: legal business ventures, quasi-formal joint production arrangements with elements of both formality and informality, and formalized, mine-owner led organizations that resemble modern firms and are growth oriented. Individuals who possess licenses for speculative purposes also appear as an additional group of ASM miners. It is evident that formalization is a required but not sufficient condition for the sector's development in Zambia.

The exercise was a success considering that the research team managed to visit and interview ASM from different sampled districts and managed to conduct interviews without too many challenges. The team managed to use the deployed GIS and remote sensing techniques to map the distribution of ASM in order to come up with the estimate of their numbers by district. Study findings show that ASM face various challenges accessing health services, and, health workers face various challenges in trying to offer Occupational Health services to the surrounding ASM communities.

4.5 Recommendations

Based on study findings, the following recommendations are made:

Recommendation	Responsible Person(s)
Improve access to medicines by Health facilities	Government
Increase health personnel at health facilities to improve health personnel to patient ratio	Government

Avail equipment for TB screening and X-ray machines to primary health care facilities particularly those serving ASM communities	Government
Training and Education to spread information on safety practices, hazard identification, and emergency procedures in mining among ASM.	Government
Awareness campaigns and outreach programs on Regular health check ups among ASM communities particularly monitoring their respiratory health and general wellbeing.	Government
Support ASM in constructing proper Water and Sanitation facilities including boreholes and toilets	Government
Remove the current Legal and administrative constraints towards obtaining ASM licenses	Government led by ministry of mines
improve levels of mining education among women	Government
Demystify the current myths on women and mineral disappearance to encourage women participation in ASM	Government
Set up dispute resolution mechanism that governs ASM and related business	Government led by the Ministry of Justice and Ministry of Mines
Improve the roads and communications infrastructure in remote ASM sites	Government led by Ministry of Roads and communications

CHAPTER 5: ZIMBABWE

5.1 Introduction

Zimbabwe is a landlocked country in southern Africa lying north of the Tropic of Capricorn. During summer, the whole country experiences warm temperatures as a result of the sun being directly overhead. It straddles an extensive high inland plateau that drops northwards to the Zambezi valley where the border with Zambia is and similarly drops southwards to the Limpopo valley and the border with South Africa. The country has borders with Botswana (813 km), Mozambique --1,231 km, South Africa (225 km), Zambia-- 797 km and almost meets Namibia at its westernmost point.

According to a recent report from the African Mineral Resources Development Centre, Zimbabwe's mining industry is focused on a diverse range of small to medium mining operations. The most important minerals produced by Zimbabwe include gold, asbestos, chromite, coal and base metals. The 8 rural provinces with the districts where mining activities take place include Matabeleland North, Matabeleland South, Midlands, Masvingo, Mashonaland East, Mashonaland West, Mashonaland Central and Manicaland. Most mining activities are concentrated in the provinces within the districts that include Sanyati, Kadoma, Chakari, Shurugwi, Mazowe, Bindura, Shamva Gokwe, North,and South, Mutare, Chegutu, Chinhoyi, Zvishavane, mutoko, Insiza, Kwekwe, Gweru, Lupane, Battelefields, Gwanda, Bubi and Umzingwane.

Distribution of Minerals in Zimbabwe

Province	District	Type of Mineral
Matabeleland North	Bubi	Gold
	Hwange	Tin
Msavingo	Bikita	Lithium
Matabeleland South	Umzingwane	Gold
	Insiza	Gold
	Gwanda	Gold
	Matobo	Gold
Midlands	Kwekwe	Gold
	Gweru	Gold
	Shurungwi	Gold,
	Gokwe North and South	
	Zvishavane	Asbestoes, Gold
Mashonaland West	Sanyati	Gold
	Chegutu	Gold
	Mhondoro - Ngezi	Platinum
	Makonde	Gold, Dolomite, Copper
Mashonaland East	Mutoko	
	Goromonzi	Platinum

Mashonaland Central	Mazowe	Gold
	Bindura	Gold
	Shamva	Gold
Manicaland	Mutare	Gold
	Mutasa	Gold

The concentration of ASM and formal mining activities are main concentrated along the Great Dyke which is approximately 550 km long and is 3 km–12 km: rich in gold, diamonds, platinum, chrome, asbestos and tin. ASMs contribute an average of 60 to 77% percent of the gold production in Zimbabwe.

The mining industry contributes approximately 8% towards the country's GDP. About 35 different metals and minerals are produced in Zimbabwe. The main minerals produced in Zimbabwe by order of contribution to exports are, platinum group elements, gold, diamonds, chrome (ferrochrome), coal and coal products, iron ore (steel), nickel, cooper, granite and graphite.

ASM in Zimbabwe has been producing significant amounts of gold which sometimes is seen to surpass large scale mining. In 2004, ASM produced 60% of the total gold produced in Zimbabwe (c. 29 tons); in 2005 the ASM sector produced 50% of the total gold production in Zimbabwe (21 tons).

The exact number of artisanal and small-scale miners (ASM) worldwide remains unknown; This mapping exercise seeks to map and estimate the size of the ASM in Zimbabwe.

5.2 Methodology

5.2.0 Overview

Refer to Chapter 1, section 1.2 for a description of the methodological approach.

5.2.1 Study Area

Geohub conducted a study to estimate the population size of artisanal and small-scale miners (ASM) and hotspots and the extent to which they access occupational Health and Tuberculosis services in Zimbabwe. The selected districts were Mutare, Mutasa, Shamva, Bindura, Matobo, Gwanda, Shurugwi, and Kwekwe. A team of one country

coordinator, one supervisor and 3 data collectors went to each of the 8 selected districts to conduct the data collection exercise.

The study was carried out in eight randomly selected districts from four provinces of Zimbabwe. This is indicated in the table below

Province	District
Manicaland	Mutare/Penhalonga
	Mutasa
Mashonaland Central	Shamva
	Bindura
Matabeleland South	Matobo
	Gwanda
Midlands	Shurugwi
	Kwekwe

5.2.1.1 Sampling

2. Individual ASMs

From the sampling frame identified, the minimum required number of ASM respondents will be 539. This was calculated using the Dobson Formula which is (Charan and Biswas, 2013):

$$S = \frac{Z_{1-\alpha/2}^2 . p(1-p)}{d^2};$$

where: $Z_{1-\alpha/2}^2$ is the standar normal variate at 95% condifence level =1.96

p is the prevalence of TB among ASMs, and

d is the absolute error = 5%

Other assumptions that were made were that the prevalence of TB among ASMs in Zimbabwe is 4% according to a study done in Zimbabwe through active case finding of TB among ASMs (Moyo *et al.*, 2021).

Table 6: Distribution of ASMs to be Interviewed by District

Province	**Districts Sampled**	**ASM Estimated**	**ASMs to be interviewed**
Manicaland	1	1500	77
Midlands	3	8500	231
Matabeleland South	2	5000	154
Mashonaland Central	1	5000	77
Total	**7**	**20,000**	**320**

5.2.2. Data Collection and Analysis

Refer to Chapter 1, section 1.2.4 and 1.2.5

5.2.2. Study Limitations

A number of challenges were encountered during the ASM project implementation in Zimbabwe but in cases where the data collection teams faced challenges, there were consultations between the teams and the country coordinator, which helped a lot in managing some of the challenges listed below:

Difficulties Obtaining a sample

The study experienced challenges in recruiting study participants. For example, there were instances where research teams had to continuously look for potential respondents because in some areas politically connected mine owners refused to

have their miners interviewed. However, the study team overcame this challenge by engaging a local association Zimbabwe Miners for Artisanal Miners (ZAMA) to help us reach the desired sample of ASM.

Difficulties Obtaining Ethical Clearance from the Research Body (MRCZ)

The exercise was faced with one main challenge which is lack of approval for the exercise to take place by the Ethical Approvals Board, the Medical research Council of Zimbabwe (MRCZ). Up to now the ethical clearance is not yet out and this will hinder dissemination of results.

Preponderance of ASM mining the same mineral

In all visited sites ASM stated that they were only extracting gold and no other mineral. This could have been avoided if purposive sampling was done to make sure the study targets diverse mines. Due to lack of extensive finances the study had to focus on what was on the ground based on the random sampling process that was utilised.

Lack of Cooperation from ASM

Study teams experienced stiff resistance from miners who were not willing to participate as they were afraid of being imprisoned for the mining activities they would be doing. In Shamva, at least half of the miners fled from the research team. However, team worked hard to convince those who stayed to listen, and eventually with authority from the Ministry of Health and Child Welfare as well as ZAMA they agreed to participate

Lack of Cooperation from Health Personnel

Few health workers were also not ready to give the research team time to be interviewed out of their tight schedules and lack of proper clearance from the Research Council of Zimbabwe, they wanted the team to make an appointment through the top district officials before interviews can be conducted. This problem was also resolved through explanation of possible benefits to the communities and capacity of health centres to offer services being investigated.

Potentially Violent Conduct from Miners

Some miners were difficult to deal with. Miners were sceptical and thought the interview team wanted to spy on them and then later there would be consequences from police or the government as their work is illegal/ not registered. Like other challenges, this was overcome by a thorough explanation of the project to the miners and how there would no repercussions for participating.

Communication barrier

In some areas, the interview team faced challenges communicating with the participants. However, this was overcome by using district level officers from the Mines offices and Ministry of Health and Child Care who were well known in the area and are respected by the ASM, and proper translation of the structured interviewer question was properly done.

5.3 Findings

5.3.0 Overview

A GIS and remote sensing techniques were used to map ASM sites throughout the country. This was followed by KIIs where a total of 363 interviews were conducted in 4 regions. A total of 17 mines were visited, and 363 interviews were conducted in the country.

5.3.1 Visited ASM sites

Spatial Distribution of visited ASM sites by District

Location of ASM sites by Provinces, districts and minerals mined and health facilities

Table 1: Showing Provinces, Districts and Mines visited as well as nearest Health facility and the minerals mined

Province	District	Sites	Reported Minerals	Health Centers
Manicaland	Penhalonga	Redwing Hope Zaina	Gold	Mutare Provincial Hospital

		Tsapauta		
	Mutasa	Premia Estate Sango	Gold	Old Mutare Hospital Mutasa District Hospital
Mashonaland Central	Shamva	Queens Gift Jocking F Syndicate Mugagau	Gold	Shamva Rural Hospital
	Bindura	Garati Kitsi	Gold	Bindura Provincial Hospital
Matabeleland South	Matopos	Matobo National Park	Gold	Kezi Rural District Hospital
	Gwanda	Western Nicholson	Gold	Gwanda Provincial Hospital OHS Clinic West Nicholson Clinic
Midlands	Shurugwi	Hidden Treasure Danga5	Gold	Shurugwi District Hospital
	Kwekwe	Kings Toox Markerting Cheziya	Gold	Kwekwe General Hospital

5.3.2 Type of Minerals Mined

Zimbabwe is home to several minerals including gold, diamond, lithium, platinum, Chrome, Coal and several other precious stones. However, findings from the sampled four provinces show that ASM are mainly contracted along gold bearing belts, diamonds, chrome, silica and lithium. All the visited ASM sites indicated that they were mining gold in their areas. Thus, gold is the predominant mineral that ASM in Zimbabwe are extracting.

5.3.3 Population Size and Demographic Profile of ASMs

Numbers of ASM found in visited the sites by districts

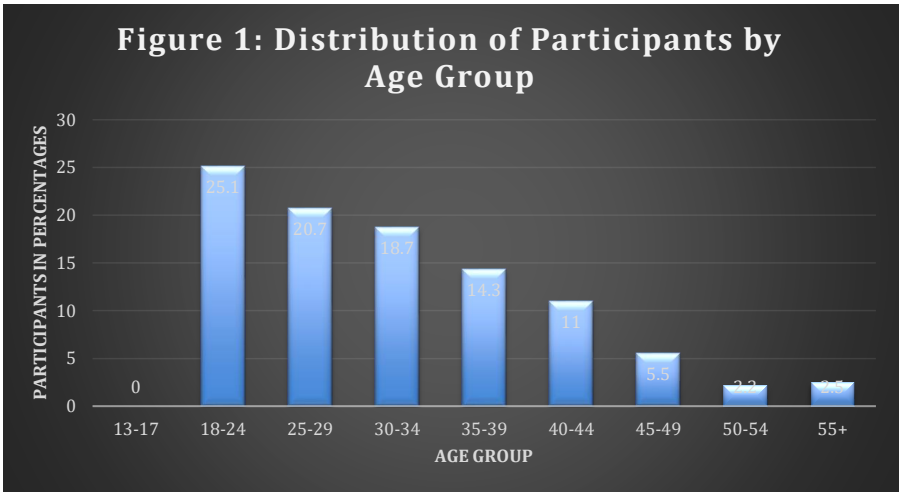
SN	District	Sites visited	No of ASM interviewed
1	Penhalonga	Redwing	20
2		Hope Zaina	19
3		Tsapauta	20
4	Mutasa	Premia Estate	20
5		Sango	20
6	Shamva	Queens Gift	20
7		Jocking F Syndicate	19
8		Mugagau	20
9	Bindura	Garati	20
10		Kitsi	19
11	Matobo	Matobo National Park	53
12	Gwanda	Western Nicholson	42
13	Shurugwi	Hidden Treasure	20
14		Danga Five	21
15	Kwekwe	Kings	20
16		Tools Marketing	20
17		Cheziya	20

Distribution of study participants by Age group

Figure 1 shows the distribution of participants by age group. The total number of interviewed participants was 363 persons. Findings show that artisanal and small-scale mining is dominated by young people. The proportions of persons in artisanal and small-scale mining are high in the 18-24-year age group (25.4 percent), 25-29-year age group (20.7 percent), 30-34-year age group (18.7 percent) and the 35-39-year age group (14.3 percent). Research findings show that there were no children between the ages of 13-17 years involved in artisanal and small-scale mining activities in the mining sites visited during the assessment. It is unclear whether the children

were hidden, or are law abiding in those areas, or measures implemented by Government are effective in curbing employment of children.

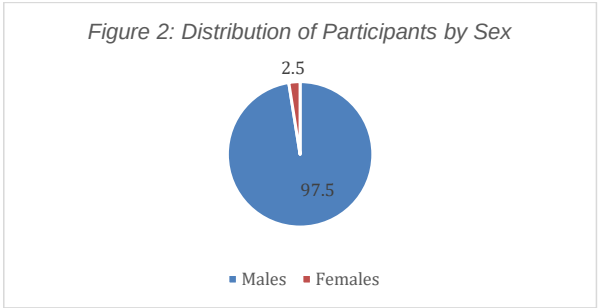
Figure 1: Distribution of Participants by Age Group



Distribution of study participants by Sex

The composition of study participants was 97.5 percent males, 2.5 percent females and those who prefer not to say about their sex as shown in the Figure 2 below. Study findings point to a male dominated mining sector. Female miners stated that they practice traditional way of gold panning, (what is called kuzungura in ChiShona*).*

Figure 2: Distribution of Participants by Sex



Based on the Remote sensing image analysis combined with the geospatial analytics approaches adopted in this study, the total size estimate of ASM population in 855 848 across the country. It is close to a million ASM operating in the country. 5.3.4 Operational Environment

5.3.4.1 Legal and Regulatory Framework

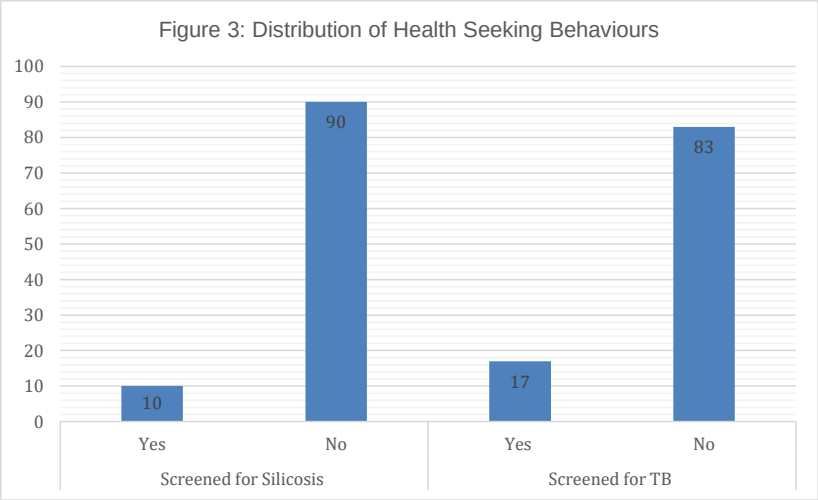
A good number of interviewed ASM team leaders indicated that it is not easy to obtain a mining licence. Hence, many of the ASM remain unregistered and illegal. Political and economic crises are the major causes of illegal mining due poverty as well as the tedious registration process. Findings from the study showed that most miners usually start the mining process even before their licenses are approved. Other findings highlighted that minerals extracted illegally tend to be smuggled to neighbouring countries like South Africa. ASM stated that they do this in order get foreign currency to counter the heavily eroded local currency Real Time Gross Settlement (RTGS) that has suffered hyperinflation since its implementation.

5.3.4.2 Health Services

Health seeking behaviours by ASM

Health seeking behaviour of ASM, including visiting health facilities for TB testing, were generally noted to be negative but it is currently improving due to targeted screening services with mobile trucks that is being conducted by Ministry of Health within the mining environment. Figure 3 shows that only 10(10) percent were tested for Silicosis while at least 90 (90) percent were never screened for silicosis. When it comes to TB, 83% percent of ASM were never screened for T.B. One factor the miners raised as a deterrent to seeking health services was that the nearest health facility was about 8 kilometres away. They also attributed their lack of health seeking enthusiasm to not having free time, travelling or walking to health facilities was believed to be a loss of precious time that should be utilised at work. Miners also said they lack knowledge of screening as they have not seen or heard about any screening campaigns.

Figure 3: Distribution of Health Seeking Behaviours



ASM access to Occupational health and TB related services

Miners in Zimbabwe cited several reasons that increased their risk to TB infection and transmission. Miners highlighted that sometimes that had to spend days underground, in tunnels that are poorly ventilated due lack of proper mining equipment. In addition, research findings show that those who spend the most days underground without food or proper mining equipment are illegal miners. These illegal miners do so because they mine whenever they get a chance or have access to someone else's equipment. They also stated that staying underground for longer period of time increases chances of finding gold fortune, what they refer to as "*mutaka" (which the high-grade ore which is collected by the miners)*. Study findings also show that most miners visited health facilities for other services, and not TB screening and testing. In most cases, miners only visited Health facilities for services such as HIV related services and accompanying children or wives to Ante Natal Care (ANC) visits.

Current state of Health Facilities offering Health services to ASM.

Health Facilities interviewed in Zimbabwe bemoaned shortage of human resources, due to the ongoing exodus of healthcare workers to western countries. Despite all this, facilities stated that they have capacity to treat a number of common complaints and

diagnose many conditions including TB, HIV, malaria, STIs and pregnancies without requiring patients to travel to provincial or district health centres. Miners who visited these health facilities complained about medicines/drug shortages. Jimu et al (2023) acknowledge that the country's healthcare system has been troubled by drug shortages for the past eight years, ranging from small health facilities to provincial hospitals. Drugs reported to be in short supply were Diazepam and Morphine, and important medical equipment such as pulse oximeters and syringe pumps. Furthermore, Zimbabwe experienced a critical shortage of personal protective equipment (PPE) and X-rays for Tuberculosis testing (Makoni, 2020).

It is important to point that miners in most rural areas complained that at times health facilities are unable to carry out their mandate efficiently because of the number of patients that each health worker has to serve per day. For example, at least 58 nurses in Mashonaland Central province resigned within the first 90 days of the COVID-19 pandemic, citing fear, anxiety and physiological distress emanating from lac of enough PPE, as well as increased workload. Due to such occurrences, health workers are usually exhausted and may at times be unfriendly to clients.

Study findings also show that miners who usually visit Health facilities are the ones with chronic ailments like HIV. They regularly visit to get their medication and to get check-ups since their conditions put them at risk of getting various infections that may compromise their immune system, (Jimu et al, 2021)

Average distance travelled by ASM to get health services

Findings from the study show that some miners travel as far as 5-20 kilometres to access health care services. The WHO guidelines advocated a 7-kilometre radius. However, the average kilometres from this study were noted to be 8 kilometres.

5.3.4.3 Socio cultural and economic factors

Gender considerations

During the interviews, women revealed that they face challenges as they practice mining. Among the challenges they face are;

i. Low levels of education which limit them from getting formal education on mines and mineral resources extraction.

ii. In one district in Zimbabwe, women are refused to come near the mining sites as there is a myth that they can make the gold disappear hence they are barred to reach such sites

iii. On a positive note, the Government of Zimbabwe is advocating for more women in mining and farming.

Equipment and machinery

Fast depleting minerals

In Zimbabwe, usually, miners visit previously mined areas, and most miners interviewed complained that the sites they are working on has limited amount of minerals to work on as most of the minerals will have been taken by the early miners. They further added that they are somehow only permitted to work on disused mines, rivers (alluvial mining) and does not need complicated machinery and open pits which usually have little minerals, as such, it takes them a lot of time to find good minerals that they can sell on the mineral markets.

Lack of Equipment and Machinery

Findings from the research show that ASM have challenges acquiring modern machinery and equipment suitable for extracting high quality minerals. Interviews in Kwekwe, in the heart of the Great Dyke that is rich in gold, silver, chromium, platinum, and nickel, revealed that miners lack skills and training in that area in their operations. These miners lack standard machinery and have poor ventilation, which often leads to increased rates of occupational health conditions.

ASM main mode of Transport by country region, district and overall

ASM in Zimbabwe use a variety of transport to reach their mining sites. Those in urban areas like Shurugwi and Kwekwe on in the Midlands province and, Penhalonga and in Manicaland province , use vehicles to access their sites. Those that are nearer to the sites normally just walk on foot to reach the sites. In rural areas such as Gwanda,

Shamva, and Masvingo, the most common mode of transport are cars and bicycles and can even travel by foot. *knowledge Levels*

Miners, especially in the Midlands districts Kwekwe and Shurugwi, cited lack of knowledge of the health services around them and this resulted in illnesses and deaths of miners. The current economic challenges mean that individuals lack necessary skills because skills or specialist education is expensive. Artisanal and small-scale mining is laden with both educated and uneducated people who joined the mining sector to earn a living on a hand to mouth basis.

5.4 Discussion

Challenges cited by ASM in their responses included remoteness of site locations, poor road networks, very long distances to health facilities, security of tenure and stringent measures in obtaining mining licenses. Furthermore, poor Cell-phone connectivity, exposure to chemicals and dangerous environments without protective clothing and poor access to clean and safe water for drinking and domestic use worsened the situation. To add to these challenges, ASM do not have financial resources to purchase machinery and equipment for extracting minerals, hence they use rudimentary methods. They lack financial support from the government and the capacity to increase their knowledge and skills since they operate on hand-to-mouth basis. ASM also highlighted that there are too many disputes/conflicts especially amongst illegal miners. They then end up injuring one another, and in some instances, kill each other.

Formalisation is significant and is given prominence in Zimbabwe because the country's Vision is hinged on a mining sector that harnesses the potential of artisanal and small-scale mining. This stimulated local/national entrepreneurship, improve livelihoods and advance integrated rural social and economic development (Machinga, 2020). This therefore calls for an improved framework that recognises the technological advancement and the strategic value of ASM as a legitimate actor within the mining sector. In 2004 alone it was noted that 60 percent of gold in Africa is produced by ASM (African Minerals Development Centre, 2023). This therefore calls for support from the government through frameworks and models that will recognise the significance of ASM such that Zimbabwe will become an upper middle-class

country by 2030. In Zimbabwe, there were approximately 400 000 miners operating illegally in 2017 alone, (Dalu et al 2017).

The ASM sector is characterised by rampant criminality (smuggling of gold), violence (gangsterism), environmental degradation, low levels of safety measures, absence of health care seeking behaviours, lack of technical skills, lack of inadequate equipment, and machinery, and lack of business capital, (Machinga 2020). There is need for immediate attention to protect this cohort. With the government formally pronouncing its intention to formalize the ASM sector, the pronouncement is primed on the realization that this sector is important to the country's economy. According to the 2020 Monetary Policy Statement, in 2019, the artisanal and small-scale miners contributed 17,478 tonnes (compared to 10,181 for primary producers), which is about 60 percent of the total gold deliverables of 27.66 tonnes recorded with the Fidelity Printers and Refineries (FPR) (Monetary Policy 2020). As such, formalisation without cushioning ASM is the biggest challenge to the sector.

Considering that the process of formalisation is multifaceted, safety, health, and environment (SHE) issues are some of the critical components that should be implemented and enforced (and should be customised to suit the local context). While ASM has the potential to contribute to more sustainable livelihood strategies, poor working conditions, accidents, and disease can reduce worker productivity (Machinga 2020). Oftenly, ASM work takes place in isolated, bushy areas where access to health care, basic sanitation or other social services are not easily accessible, safety and health issues become very critical.

The data collection exercise was a success. Considering that most of the sites were hard to reach, which was not unexpected, there was indeed an occupation hazard for the research assistants but the data collection exercise was a complete success. It can be noted that ASM activity is male dominated in Zimbabwe. Important to note are the observations that include strict and hard to achieve legislative requirements for most ASM to own a license, long distances to be travelled by ASM to seek health services, poor roads and poor network connectivity due to lack of infrastructure in the most remote parts of Zimbabwe, poor water and sanitation conditions for ASM.

5.5 Recommendations

Based on the conclusions drawn from the study, the following recommendations are made:

Recommendation	Responsible Person(s)
to strengthen of associations that will help represent this particular cohort in laws that will protect ASM. Awareness campaigns aimed at protecting miners and improving their health. This study therefore recommends government and stakeholders to strengthen screening of miners at their workplaces and even initiate them once diagnosed with TB. Capacity building of miners aimed at sensitizing and capacitating the group on the need to protect workers from the risk of acquiring occupational health conditions like TB and silicosis thus ensuring employees' health, safety, and welfare at work. Formalization of the sector to implement SHE issues	Government- Ministry of Mines and Chamber of Mines, Ministry of Mines
Procurement of medicines to prevent infections at clinics	Government – Ministry of Health and Child Care
Increase health workforce to balance the nurse-patient ratio to avoid long ques and patient waiting times at health centres	Government- Ministry of Health and Child Care
Training and Education programs for ASM to encourage them to take Protective personal equipment (PPE) always, do regular health checkups etc.	Government- Ministry of Mines and Mining Development

CHAPTER 6: MADAGASCAR

6.1 Introduction

ASM in Madagascar is estimated to be the second job provider after agriculture. The profile of ASM communities is yet to be explored and the Malagasy government has made an effort to attribute a particular focus on the ASM. The Malagasy initiatives include: new regulations adapted to ASM in order to promote formalisation, social and environmental initiatives, professionalisation via capacity building and equipment supply.

6.2 Methodology

6.2.0 Overview

Refer to Chapter 1, section 1.2 for a description of the methodological approach.

6.2.1 Study Area

Madagascar conducted a study to estimate the population size of artisanal and small-scale miners (ASM) and hotspots and the extent to which they access occupational Health and Tuberculosis services in the country. The selected 3 zones were (East, Center and South) covering the provinces of Toamasina), Antananarivo, Fianarantsoa and Toliara). A team of one country coordinator, one supervisor and 3 data collectors went to each of the 3 selected zones to conduct the data collection exercise.

6.2.1.1 Sample Size Calculation

From the sampling frame identified, the minimum required number of ASM respondents were 349 per district. This was calculated using the Dobson Formula which is (*How to Calculate Sample Size for Different Study Designs in Medical Research? - PMC*, *2013*):

$$S = \frac{Z_{1-\alpha/2}^2 . p (1 - p)}{d^2};$$

where: $Z_{1-\alpha/2}^2$ is the standard normal variate at 95% confidence level =1.96

p is the prevalence of TB among ASMs = 3%

d is the absolute error = 5%

NB: In the case of Madagascar, national TB prevalence (341 per 100 000 hab) was used because of the lack of data for the prevalence of TB among ASMs.

6.2.2 Data Collection and Analysis

Refer to Chapter 1, section 1.3.4 and 1.3.5

Four questionnaires were used: for ASM, for leaders of ASM groups, for managers of Health facilities and for key informant persons. The informed consent forms and some of the translated tool guides were printed, in readiness of the data collection

8.2.3 Study Limitations

A number of challenges were encountered during the ASM project implementation in Madagascar but in cases where the data collection teams faced challenges, there were consultations between the teams and the country coordinator, which helped a lot in managing some of the challenges listed below:

Site inaccessibility

The majority of sites were located in remote and hard to reach areas in terms of terrain and not easily accessible as they were found in areas without good road networks. However, the study team overcame this challenge by engaging locals who helped in navigating terrain and locating the ASM sites.

Security

Insecurity of the research team was one of the major obstacles encountered by the team in all the regions where the ASM work. It was necessary to be accompanied by a member of the forces of law and order (military). In the southern zone, the competent authority forbade data collectors to go to certain places because of the presence of

head-choppers and assailants both on the road and in the quarries/mines. This severely affected both data collection and data quality.

6.3 Findings

6.3.0 Overview

A GIS and remote sensing techniques were used to map ASM sites throughout the country. This was followed by KIIs where a total of 721 interviews were conducted in 4 regions. The number and category of people interviewed is outlined in the table below:

A total of 721 interviews were conducted in the country. Data collection was carried out from June 06 to June 19, 2023

6.3.2 Type of Minerals Mined

REGIONS	DISTRICTS	MINERAL POTENTIAL (Geological map)
SAVA	SAMBAVA	Ferrous metals,
	ANTALAHA	Stones, Gold, (loin)
	VOHEMAR	Ferrous metals,
	ANDAPA	Stones,
DIANA	DIEGO	Stones,
	AMBILOBE	Gold,
	NOSY BE	Ferrous metals,
BOENY	AMBATOBOENY	Stones,
	MAHAJANGA I	Stones,
	SOALALA	Ferrous metals,
BETSIBOKA	MAEVATANANA	Stones, Gold, Ferrous metals,
	TSARATANANA	Stones, Gold, Ferrous metals
MELAKY	ANTSALOVA	Ferrous metals,
	BESALAMPY	Gold, Ferrous metals,
	MAINTIRANO	Ferrous metals,
	MORAFENOBE	Ferrous metals,
SOFIA	ANTSOHIHY	Stones, Ferrous metals,
	MAMPIKONY	Stones, Ferrous metals,
	MANDRITSARA	Ferrous metals,
ITASY	ARIVONIMAMO	Stones, Gold,

	MIARINARIVO	Stones, Gold,
	SOAVINANDRIANA	Stones,
ANALAMANGA	ANDRAMASINA	Gold, Ferrous metals,
	ANJOZOROBE	Stones,
	ANKAZOBE	Stones,
	MANJAKANDRIANA	Ferrous metals,
BONGOLAVA	FENOARIVOBE	Stones,
	TSIROANOMANDIDY	Gold,
VAKINANKARATRA	AMBATOLAMPY	Gold, Ferrous metals,
	ANTANIFOTSY	Stones, Gold,
	ANTSIRABE I	Stones,
	ANTSIRABE II	Stones, Gold,
	BETAFO	Stones, Gold, Ferrous metals,
	FARATSIHO	Stones,
ALAOTRA MANGORO	AMBATONDRAZAKA	Stones, Ferrous metals,
	AMPARAFARAVOLA	Stones, Ferrous metals,
	ANDILAMENA	Ferrous metals,
	ANOSIBE AN'ALA	Stones,
	MORAMANGA	Stones, Gold, Ferrous metals,
ANALANJIROFO	FENOARIVO ATSINANANA	Gold, Ferrous metals (loin)
	MANANARA AVARATRA	Ferrous metals,
	SOANIERANA IVONGO	Stones, Ferrous metals,
ANTSINANANA	BRICKAVILLE	Stones, Gold, Ferrous metals,
	MAROLAMBO	Stones, Gold, Ferrous metals,
	TOAMASINA I	Stones, Ferrous metals,
	TOAMASINA II	Stones, Gold, Ferrous metals,
ATSIMO ANTSINANANA	BEFOTAKA SUD	Stones, Ferrous metals,
	FARAFANGANA	Ferrous metals,
	MIDONGY ATSIMO	Stones, Ferrous metals,
	VANGAINDRANO	Ferrous metals,
	VONDROZO	Ferrous metals,
AMORON'I MANIA	AMBATOFINANDRAHANA	Stones, Ferrous metals,
	AMBOSITRA	Stones, Gold, Ferrous metals,
	FANDRIANA	Stones,
	MANANDRIANA	Stones, Ferrous metals,
IHOROMBE	IAKORA	Stones,
	IHOSY	Stones, Ferrous metals,
	IVOHIBE	Stones, Ferrous metals,
MAHATSIATRA AMBONY	AMBOHIMAHASOA	Stones,

	FIANARANTSOA	Stones, Ferrous metals,
	IKALAMAVONY	Stones,
VATOVAVY	MANANJARY	Gold, Ferrous metals,
	NOSY VARIKA	Stones,
	IFANADIANA	Stones, Ferrous metals,
FITOVINANY	MANAKARA	Ferrous metals,
	VOHIPENO	Ferrous metals,
	IKONGO	Ferrous metals,
ATSIMO ANDREFANA	AMPANIHY	Stones, Ferrous metals,
	BENENITRA	Stones,
	BETIOKY ATSIMO	Stones,
	AMPANINY	Ferrous metals,
ANOSY	AMBOASARY ATSIMO	Stones, Ferrous metals,
	BETROKA	Stones, Ferrous metals,
	TOLAGNARO	Stones, Gold, Ferrous metals,
ANDROY	AMBOVOMBE	Ferrous metals,
	BEKILY	Stones, Ferrous metals,
MENABE	BELO TSIRIBIHINA	Ferrous metals,
	MAHABO	Gold,
	MIANDRIVAZO	Stones, Ferrous metals,

6.3.3 Population Size and Demographic Profile of ASMs

Distribution of Participants by Sex

From the total number of 721 interviewees who work in artisanal and small-scale mining, males were twice as many as women (67 percent). However, the number of women is not negligible, as they represent a third of the ASM population, *see Figure 1*.

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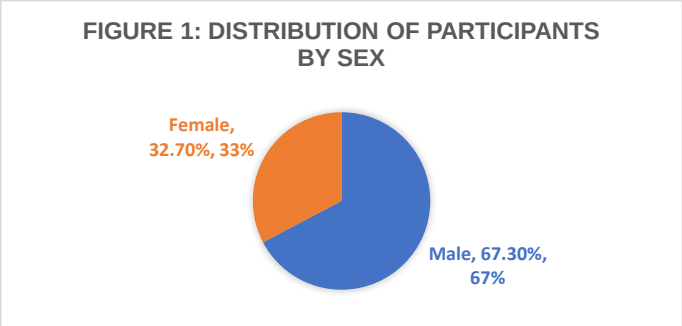
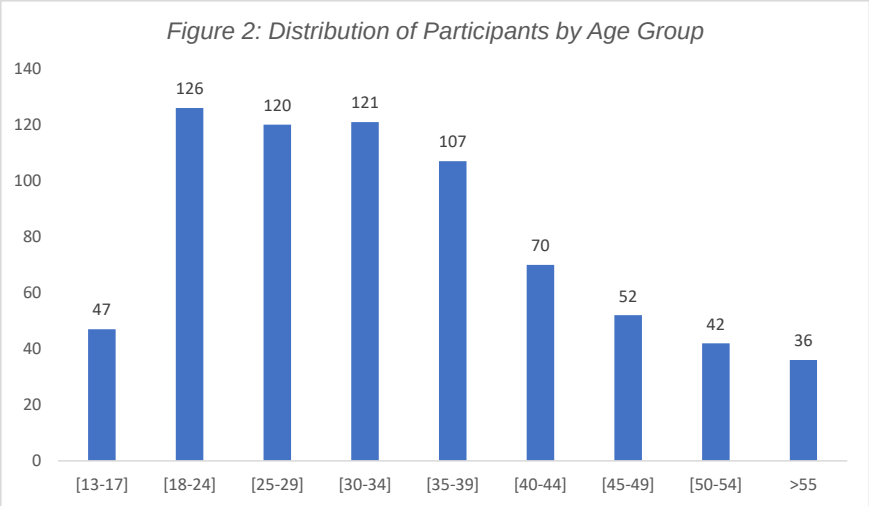
Figure 1: Distribution of Participants by Sex



Distribution of Participants by Age Group

Figure 2 shows the distribution of participants by age group. The total number of interviewed participants was 721 persons. Findings show that artisanal and small-scale mining is dominated by young people. The proportions of persons in artisanal and small-scale mining are high in the 18-24-year age group (17.5 percent), 25-29-year age group (16.6 percent), 30-34-year age group (16.8 percent) and the 35-39 year age group (14.8 percent). Research findings show that there were children between the ages of 13-17 years involved in artisanal and small-scale mining activities in Madagascar (6.5 percent).

Figure 0.1: Distribution of Participants by Age Group



Distribution of Participants by Household size and religion

Analysis of other socio-economic characteristics show that ASM are predominantly from households that have 1-5 members (75.8 percent, while households with 6-10 members contribute 23.3 percent, and households with over 10 members had 0.8 percent of the participants. In terms of religion, 61.9 percent of respondents were of Christian orientation, with 37.4 percent stating they have no religious affiliation, while Islam had 0.7 percent.

6.3.4 Operational Environment

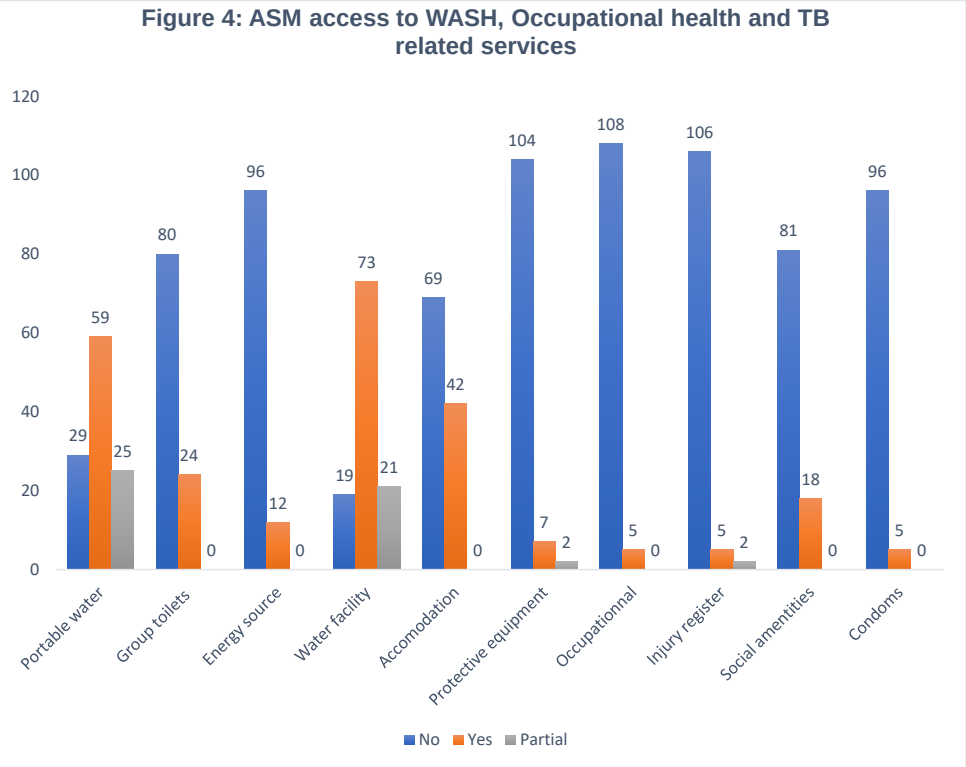
6.3.4.1 Legal and Regulatory Framework

The newly adopted mining code requires each mining permit and authorisation holder engages in a formal environmental protection plan or cahier de charges environmental. The latter is a document that includes the prevention, protection and rehabilitation of the natural resources, human capital.

6.3.4.2 Health Services

Data on WASH and OHS (*See Figure 4*) shows that indicators used to assess OHS are practically non-existent, such as protective equipment, injury register, access to condoms or social amenities. Concerning WASH, less than a third of ASM have no access to water, however less than half have access to drinking water and toilets are only available at less than 20 percent of sites where ASM work.

Figure 4: ASM access to WASH, Occupational health and TB related services



Health seeking behaviours by ASM

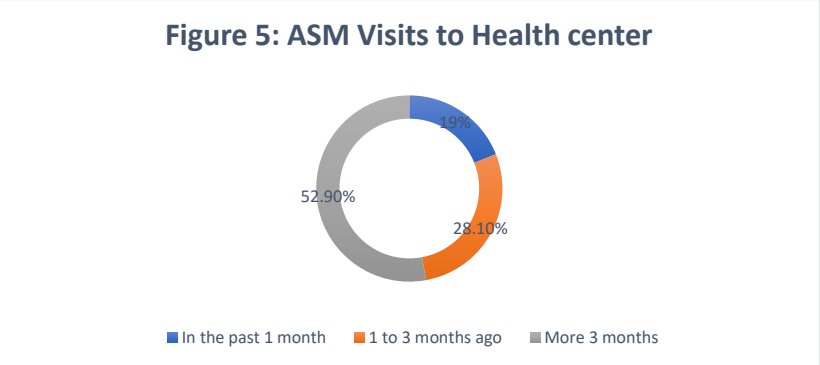
Health seeking behaviour of ASM, including visiting health facilities for TB testing, were generally noted to be negative. About 0.4 percent of the 711 participants were tested for Silicosis. This meant up to 99.6 percent have not. When it comes to TB, those who have never sought to be tested are 99.6 percent of 719 participants. Less

than 1 percent of ASM screened and/or tested for tuberculosis and silicosis. Those who screened and tested for TB did so at a target screening outreach (12.5 percent), through a community-based volunteer (0 percent), or at a health facility (87.5 percent). The proportions for Silicosis are 33.3 percent for target screening outreach, zero percent through a community-based volunteer, and 66.7 for health facilities.

One factor the miners raised as a deterrent to seeking health services was that the nearest health facility was about 3.2 kilometres away. This result must be interpreted in the light of the limitations concerning safety and geographical accessibility preventing researchers from interviewing ASM in reclusive locations. Movement is restricted around ASM areas, making 3.2 kilometres bigger than it seems to be. They also attributed their lack of health seeking enthusiasm to not having free time, travelling or walking to health facilities was believed to be a loss of precious time that should be utilised at work.

Figure 5 shows that more than half the ASM interviewed had not attended a health centre in more than 3 months from the day of interview, while about 19 percent had visited a health centre in the previous month leading to the study.

Figure 5: ASM Visits to Health centre

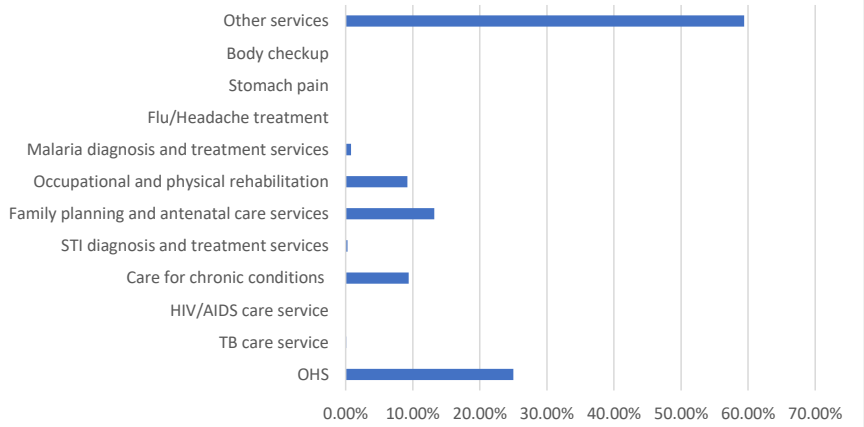


Health facilities providing services to ASM

The service provided in the majority of health centres surveyed is the standard service forming part of the minimum package of activities of a basic health centre in line with health policy. Some programs, such as tuberculosis control or malaria control, are not

very effective, and specialized services corresponding to the activities of ASM such as OHS are almost non-existent. Figure 6 shows the services available at health facilities.

Figure 6: Services Available at Health facilities



6.3.4.3 Socio cultural and economic factors

Gender considerations

Social beliefs that restricted women to access the mining area and to go extract mining products. The restrictions for women include the ability to negotiate high end mining products.

Equipment and machinery

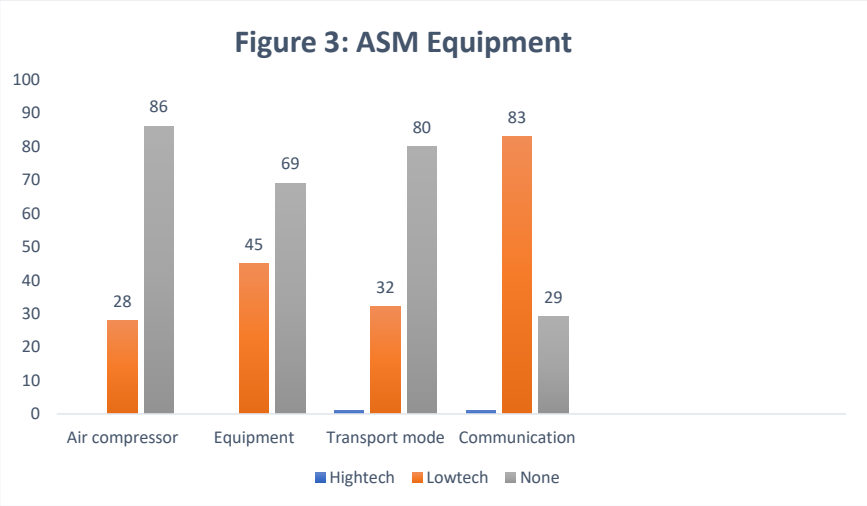
The ASM are not allowed to use heavy equipment according to the regulations, ASM are limited on using intensive hand labour, mechanised but light machinery , no mercury.

ASM Equipment and Infrastructure

Figure 3 shows ASM possession of equipment that facilitates effective and productive mining operations. Findings show that there are no ASM with high-tech air compressors, 24.5 percent have low-tech air compressors and 75.5 percent do not have air compressors. On mining equipment, none have high-tech equipment, while

39.5 percent have low-tech equipment, and 60.5 percent have no equipment. In terms of transport (vehicles), 2 percent have high-tech vehicles, 28.5 percent have low-tech, and 71.5 percent have no vehicles at all to use for their mining activities. Findings also show that 1.8 percent of ASM own high-tech communication devices, while 72.8 percent own low-tech devices and 25.4 percent do not own any communication technologies. In essence, equipment is almost non-existent, except for communication tools. However, the latter is low-tech.

Figure 3: ASM Equipment



Start-up capital

Physical location and geographic access

6.4 Discussion

Challenges faced by ASMs are the same with those mentioned in other countries before. There is nothing peculiar about the Madagascar ASM experiences

The data collection exercise was a success. Considering that most of the sites were hard to reach, which was not unexpected, there was indeed an occupation hazard for the research assistants but the data collection exercise was a complete success. There was also slight risk of meeting violent miners, which meant teams had to be accompanied by the military. Important to note are the observations that include strict and hard to achieve legislative requirements for most ASM to own a license, Long distances to be travelled by ASM to seek health services, poor roads and poor network connectivity due to lack of infrastructure in the most remote parts of Madagascar, poor water and sanitation conditions for ASM.

6.5 Recommendations

Based on the conclusions drawn from the study, the following recommendations are made:

Activities	Stakeholders	Indicators	Timeline
Awareness and sensitization	ASM communities CSOs PTFs Association of miners Women in mining	Number of training sessions organized, number of ASMs trained	July 2024- July 2025
Creation of a structure to coordinate the TB	Ministries in charges Health, population, labor and mines, multi-sectorial	Existence of one structure in charge of TB healthcare	2024-2026
Strengthening healthcare system: Creation of mobile TB case fining and treatment	Ministry of health, PTFs	Number of healthcare center offering TB case findings and treatment: available and accessible by miners and local communities	2024-2026
Reinforcement of WASH	Ministry of health, NGOs, multi-sectorial	Improved access of WASH: reduction of open defecation case, access to drinkable water and sanitation	2024-2026

Integration of TB control strategy cahier de charges of each mining permit	Multisectoral, Ministries, NGOs, PTFs, CSOs, private sector	Number of cahier de charges with TB control strategy	2024-2026
Further research on TB and ASM	Multisectoral, Ministries, NGOs, PTFs, CSOs, private sector	Number of studies on ASM and on TB	2024----
Supporting ASM communities: equipment and machinery, PPEs	Multisectoral, Ministries, NGOs, PTFs, CSOs, private sector	Number of formalized ASMs, number of miners using new technology and PPEs	2024----
Improving infrastructure (roads, health facilities)	Multisectoral, Ministries, NGOs, PTFs, CSOs, private sector	Number of infrastructures built	2024---

CHAPTER 7: MOZAMBIQUE

7.1 Introduction

Mozambique is a country with numerous developmental issues, as indicated by its ranking on the current Human Development Index, where it ranks low on major social and economic indices. Around 2010, Mozambique was seen transforming itself from a struggling agrarian economy as a direct result of emerging from decades of civil war in the early 1990s into one of Southern Africa's most important producers of coal and gemstones. The prevalence of war and constant instability always seems to stall progress, as seen in the last three years. In the last five years, the country has been ravaged by more than two cyclones, resulting in huge property destruction and loss of life, as well as a war in the northern regions. According to CINAM round 80% of the rural areas population live based in agriculture, hence they go for ASM as an immediate alternative for livelihoods. Acoording to CEMAM (2021) in Mozambique, ASMs amount 229 680, wherby 80,3% are men and 11,7% are women. The Artisanal Mining activity is practiced by thousands of people as livelihoods to increase revenue

and consequently the contribution to improvement of the well-being of the mining communities. Lately the country has registered an increasing growth of gems, precious metals e construction minerals, resulting from artisanal and small scale a mining. In the North region the countrys has gems, and precious metals, in the center region, precious metals, gems and construction materials and on the south region the country has mostly construction minerals.

ASM, like anywhere else in the SADC region, provides a platform for citizens to recover following economic and environmental crises because the local find it accessible for them to mine, once the resources are available. This was the situation in Mozambique following Cyclone Idai in 2019. When was the exercise undertaken? This mapping exercise seeks to map and estimate the size of the ASM in Mozambique.

7.2 Methodology

7.2.0 Overview

Refer to Chapter 1, section 1.2 for a description of the methodological approach.

7.2.1 Study Area

The selected study areas were Zambezia, Inhambane and Manica. A team of one country coordinator, one supervisor and 4 data collectors from Sok Consulting Private limited went to each of the 8 selected districts to conduct the data collection exercise.

In preparation for the data collection, the research assistants were oriented on the data collection tools using the ODK software. The informed consent forms and some of the translated tool guides were printed, in readiness of the data collection. At the district, the team had already spotted possible KIIs to be interviewed and some of the hotspots to be visited. An emphasized method was to maximize snowballing, so that we find as many sites as possible.

7.2.1.1 Sampling

From the sampling frame identified, the minimum required number of ASM respondents were 60 per district. This was calculated using the Dobson Formula which is (*How to Calculate Sample Size for Different Study Designs in Medical Research? - PMC*, *2013*):

$$S = \frac{Z_{1-\alpha/2}^2 \cdot p\,(1-p)}{d^2};$$

where: $Z_{1-\alpha/2}^2$ is the standard normal variate at 95% confidence level =1.96

p is the prevalence of TB among ASMs = 3%

d is the absolute error = 5%

NB: In the case of Mozambique, national TB prevalence (3368 per 100 000 hab) was used because of the lack of data for the prevalence of TB among ASMs.

Interviewed ASM respondents by district

Area	Number of ASM interviewed
Zambezia	**203**
Manica	625
Inhambane	166
Total	994

7.2.2. Data Collection and Analysis

Refer to Chapter 1, section 1.2.4 and 1.2.5

7.2.2. Study Limitations

The entire study was faced with challenges that the research team, through consultations with country coordinator, team supervisor and assistance form the locals, managed to overcome and carry out the study successfully. The following are some of the study limitations:

Site inaccessibility

Some sites were very difficult to access as they were found in areas with very bad roads. However, the study team overcame this challenge by engaging some local people who helped in locating the sites. To prevent this situation, the team should have contacted the associations who would show the best access ways, because 70% of the miners have access to the sites.

Unwillingness by the miners to be interviewed

Study teams experienced stiff resistance from miners who were not willing to participate Some miners where not comfortable with the interview questions as they thought it was the government move to stop them from their activities. Nevertheless, this issue was solved by the supervisor who managed to give a depth background of the project and assured them there will be no confidential information to be obtained from the miners. In future, there is need for thorough communication with the ASM associations who know their people and would have helped in mobilizing ASM to participate fully. They also would not trust the team because they were thinking they would be expelled from the areas.

Lack of Cooperation from Health Personnel

Few health workers were also not ready to give the research team time to be interviewed out of their tight schedules, they wanted the team to make an appointment through the top district officials before interviews can be conducted. This problem was also resolved through explanation of possible benefits to the communities and capacity of health centres to offer services being investigated. There was minimal engagement of the Ministry of Health who would delegate their people to support the exercise.

Potentially Violent Conduct from Miners

Some miners were difficult to deal with. Miners were sceptical and thought the interview team wanted to spy on them and then later there would be consequences from police or the government. Like other challenges, this was overcome by a thorough explanation of the project to the miners and how there would no repercussions for participating. This was because the miners felt threatened to be expelled and were not advised on the advantages of the exercise. Actually, it is obvious that the small-scale miners were not interviewed nor involved, because they would have been more collaborative, for they are legal and have no fear of any entities. Most of interviewed people were the non legals artisanal. It is important to mention that in Mozambique artisanals are called not regarding their status of legality, but regarding the low equipment they are allowed to use.

Communication Barrier

In some areas, the interview team faced challenges communicating with the participants. However, this was overcome by training and using a local person to translate.

7.3 Findings

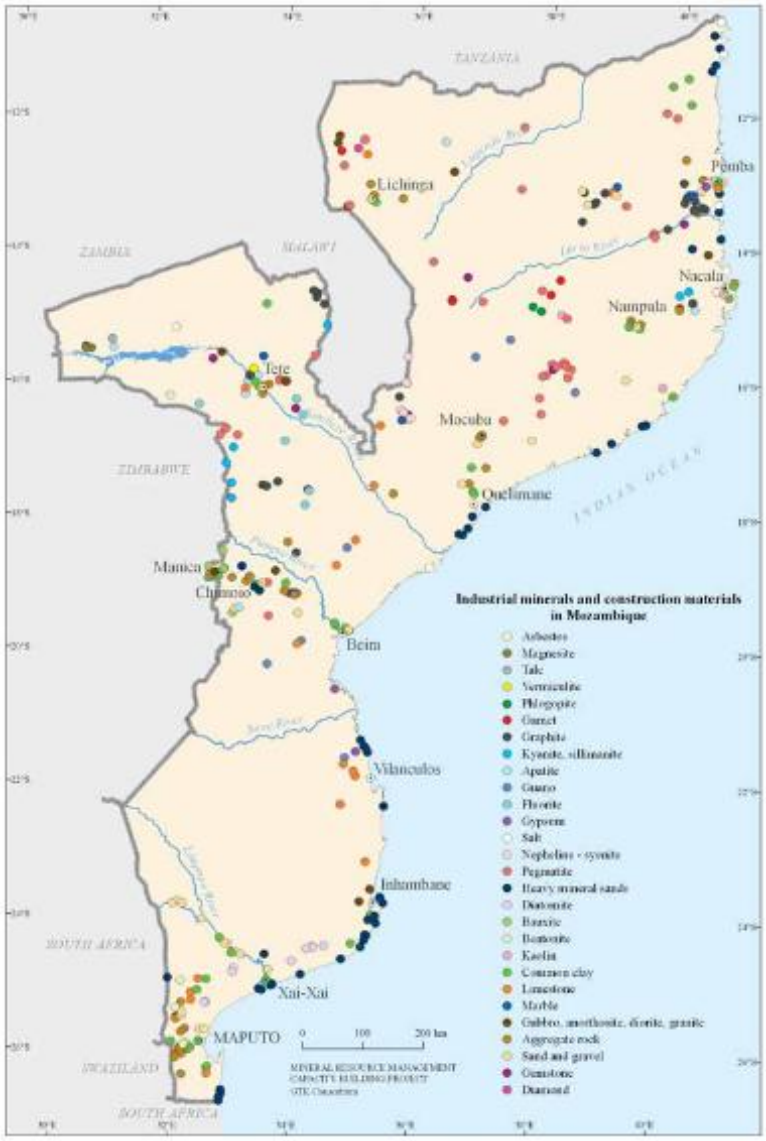
7.3.0 Overview

A GIS and remote sensing techniques were used to map ASM sites throughout the country. This was followed by KIIs where a total of 994 interviews were conducted in 3 regions. The number and category of people interviewed is outlined in the table below:

A total of 17 mines were visited, and 994 interviews were conducted in the country.

7.3.2 Type of Minerals Mined in Mozambique

- Map of type of minerals mined per region or district



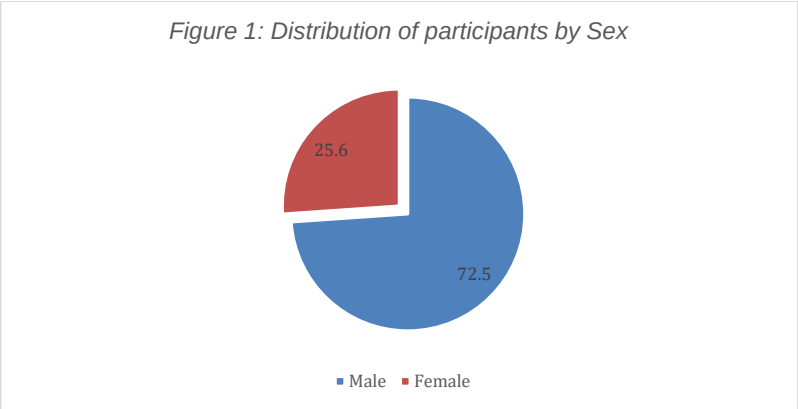
Recursos		Áreas de ocorrência
Minerais energéticos	Carvão mineral	Tete, Manica, Sofala e Niassa
	Petróleo	Bacias de Rovuma, Zambeze, Save e sofal pesquisa(em pesquisa).
	Gás natural	Cabo Delgado (Bacia do Rovuma), Sofala (Búzi) e Inhambane (Pande e Temane)
Minerais metálicos	Ouro	Cabo Delgado, Nampula, Manica, Tete e Zambézia
	Ferro	Tete, Manica e Nampula
	Cobre	Manica e Tete
Minerais não metálicos	Areias pesadas	Gaza, Nampula e Zambézia
	Mármore	Cabo Delgado (Montepuez)
	Grafite	Cabo delgado (Ancuabe), Tete e Nampula
	Pedras preciosas e semi-preciosas	Zambézia, Nampula, Cabo Delgado, Niassa e Tete
	Apatite	Nampula e Tete
	Bentonite	Maputo
	Bauxite	Manica e Zambézia
	Calcário	Maputo, Sofala e Nampula
	Caulina	Nampula e Zambézia
	Argila	Em todo país

7.3.3 Population Size and Demographic Profile of ASMs

Distribution of study participants by Sex

Figure 1 shows the distribution of participants by sex. From the total number of 994 interviewees who work in artisanal and small-scale mining, males constituted 72.5 percent while females were 25.6 percent. About 1.9 percent of responses given by participants was invalid.

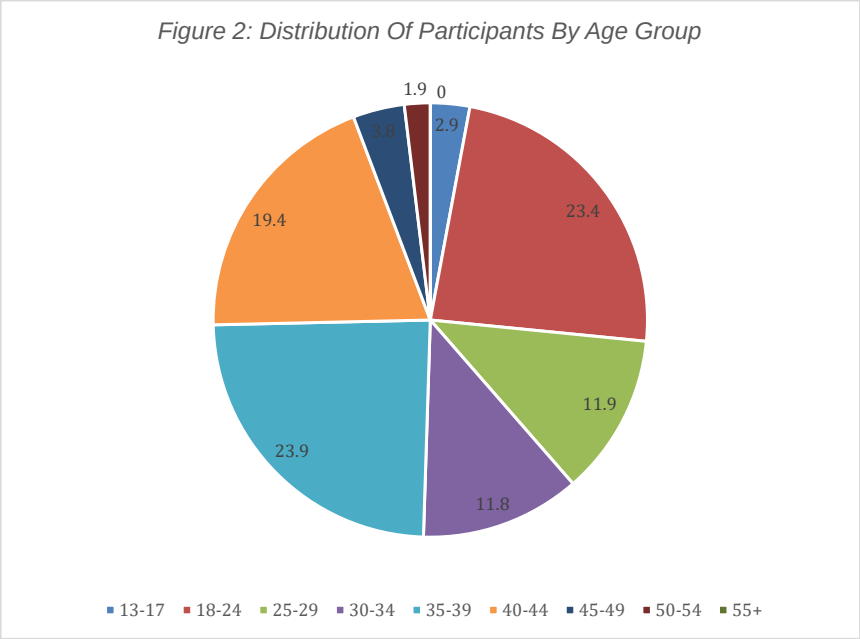
Figure 1: Distribution of participants by Sex



Distribution of study participants by Age group

Young people between age 18 and 39 constitute a great potion of participants in ASM in Mozambique. In terms of composition of five-year age groups, Miners between age 35-39 years had the highest percentage of 23.9 percent, followed by age 18-24 years (23.4), 40-44 years (19.4), 25-29 years (11.9) and 30-34 years (11.8 percent) *as shown in Figure 2 below*. Research findings show that there were children age 13-17 years involved in artisanal and small-scale mining activities in Mozambique (2.9 percent).

Figure 2: Distribution Of Participants By Age Group



Total estimates of ASM in Mozambican districts

Based on our research, Mozambique has a total of 708, 470 ASM but the CINAM report of 2021 states that the country has **229 680** ASM who are distributed across many districts of the country. There is need to investigate further on which figure has a better estimate of the realistic number of ASMs across Mozambique.

7.3.4 Operational Environment

7.3.4.1 Legal and Regulatory Framework

In most parts of the interviewed areas the main issue highlighted was the slowness of the registration system and the unaffordability of registration fees when applying for the small-scale mining certificate. The process takes too long both for artisanal mining and small-scale mining. Competition with large-scale mining and mineral exploration

companies for land has made it difficult to afford registration. The economic challenges in Mozambique have led to a shift in government priorities, with the government being less supportive to efforts to register, formalize and support the ASM sector. The bias is firmly with large companies, leading to low price of minerals in the informal sector (10 percent less than market price). From this study most ASM said they were unregistered and operating without licences.

In Mozambique's Poverty Reduction Strategy Paper, industrial mining is emphasized above artisanal mining since it has a larger potential to contribute to economic growth. Given the large number of miners and their mobility, the idea that the Provincial Governor should issue individual mining passes is impracticable. In practice, artisanal mining emerges whenever new ores are discovered, frequently resulting in true gold rushes. Miners may come from far away (since non-residents of the area are permitted by law) or from neighbouring nations. Individual mining passes for these big and fluid groups of miners would overload the provincial services.

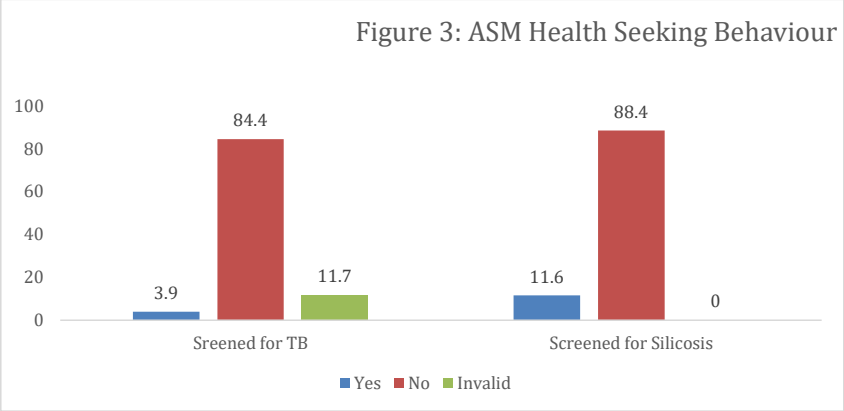
Current mining rules and regulations fall short of establishing an adequate framework to this end. Artisanal miners must obtain a "mining pass," which is valid for one year and grants the holder the ability to work in an artisanal mining region (decree No. 26/2006/section VI). Mining passes are only available to Mozambicans who live in the mining area.

7.3.4.2 Health Services

Health seeking behaviours by ASM

Health seeking behaviour of ASM, including visiting health facilities for TB testing, were generally noted to be negative. Figure 3 shows that 11.6 percent of participants were tested for Silicosis, and about 88.4 percent were not. When it comes to TB, the figure of those who have never sought to be tested was 84.4 percent, while 3.9percent were tested and 11.7 percent were invalid responses.

Figure 3: ASM Health Seeking Behaviour



ASM access to Occupational health and TB related services

In Mozambique, 35 percent of participants admitted to commonly seeking either occupational health services or TB care services when they visit health facilities. Around 46.8 percent of the total 994 people interviewed lived within 2-5 kilometres of a health facility, while 25.4 percent of these stated that they take an hour or less to reach a health facility, and 13.6 percent were invalid responses. On challenges faced in accessing health services, lack of money accounted for more than 50 percent of the responses, while other factors included distance, poor road network and not having free time.

Current state of Health Facilities offering Health services to ASM.

Mozambique has 1,596 health institutions spread among 11 provinces, 30 municipalities, and 157 districts, according to the World Health Organization. 96 percent of these clinics provide primary health care.

Average distance travelled by ASM to get health services

Findings from our survey notes that some miners travel as far as the advocated average by WHO to access health care services. WHO guidelines advocates a 7

kilometres radius. However, the average kilometres nationwide were noted to be 6.3 kilometres, which is low compared to the World Health Organization average.

7.3.4.3 Socio cultural and economic factors

Gender considerations

During the interviews, women revealed that they face challenges as they practice mining. Among the challenges they face are:

- **i.** The policy framework towards ASM is still poor hence there are no enforcements on laws protecting women and children in the industry. There is still need to protect the children from GBV, hence the children in school age should go to school and babies should be sent to a community kindergarten. The organized do not allow people below 18 years old workers.
- **ii.** The division of labour as most women and children do the light and menial work hence being given poor wages as compared to man. Women are more frequently associated with transporting and processing materials, as opposed to digging. Because women do not have the same kind of risk they receive less money, still they will gain more if they are the owners of the mine sites or holes.
- **iii.** In cases of women who own a piece of land for mining purposes it is difficult to access loans due to lack of collateral.
- **iv.** There are also women who sell food and earn money, others transport the materials and earn for those, others work in the cleaning and domestic activities in the houses of the miners.

Social Responsibility

There is a good example from the Eduardo Mondlane which has built 2 rooms for classes in an existing school for the community where they are mining in Tete province, Chifundo district, as they have promised prior to the license issuing**.**

Equipment and machinery

The ASMs have challenges to access funds or attract investors to buy machinery. Therefore most of them end up been sponsored by illegal investors who make unfair agreements at the loss of the ASM, not helping them to develop and grow.

Start-up capital

Being poverty stricken and without access to loans from financial institutions, miners complained of their limited access to financial resources. The economy is in turmoil because of war or threats of war, hence financial institutions are not keen to lend money. For ASM it is worse because they do not even have collateral to back the loans. A way to support it would be if the Government would support the miners with loans, because a huge part of the rural population live based on the ASM sector. If the Central Bank would support ASM, they would give loans and then buy the gold from the ASM uplifting the currency of the country.

Physical location and geographic access

Lack of security

Small scale miners interviewed had a challenging task in securing their mines from rebel groups hence the low investment on the group and opting for cheaper mining methods. Some ASMs who can afford ask for the protection of the police upon a certain tax to be paid.

Poor road network

The poor road network in the country isolates many ASM centres from registered mineral trading centres.

ASM in Mozambique use a variety of transport to reach their mining sites. About 51.5 percent of the participants either use a bicycle or a motorbike whilst 46.5 percent admitted to usually walking on foot.

Lack of license to commerce

Most ASM will sell their minerals at low prices in an illegal market. For the ASMs to be able to commerce, they first must be formalized and legalized, and then they will be able to apply for a commercialization license that is very expensive and many of them or most of them cannot afford to pay.

7.4 Discussion

Challenges cited by ASM in Mozambique are similar to the ones mentioned in the other countries discussed above. Still Mozambique is crisis due to the fact that the ASM community lacks in support for loans of banks either the financial support of government for start-up. The data collection exercise was a success. Considering that most of the sites were hard to reach, which was not unexpected thus the data collection exercise was a complete success. There was no risk to find insurgents, because the 3 areas inquired are not under war (Zambezia, Inhambane and Manica). Important to note are the observations that include strict and hard to achieve legislative requirements for most ASM to own a license, long distances to be travelled by ASM to seek health services, poor roads and poor network connectivity due to lack of infrastructure in the most remote parts of Mozambique, poor water and sanitation conditions for ASM.

7.5 Recommendations

Based on the conclusions drawn from the study, the following recommendations are made:

- Improve on Roads and network infrastructure
- Need to improve access to clean water and sanitation
- Government, civil society, partners to Support ASM with technical knowledge
- Government, civil society, partners to Support ASM with financial management skills
- Government, civil society, partners to Support for market linkage
- Government, civil society, partners to Support ASM with capital and machinery
- Government to Improve security in the mining sector
- Government to facilitate the registration hence the taxes to be paid for the legal processes should be affordable and not prohibitive.

- The production Taxes to be paid to Government should be affordable to encourage the ASM community to be legal and develop rural areas.
- Ministry of Health to provide health facilities in the ASM areas
- Ministry of Health to organize mobile hospitals for ASM sites

CHAPTER 8: DEMOCRATIC REPUBLIC OF CONGO

8.1 Introduction

The Democratic Republic of Congo (DRC) has a vast mineral endowment in its subsoil, with over 1100 compounds found, 22 of which are currently economically viable (World Bank, 2008). It is estimated that the country possesses over half of the world's cobalt reserves, as well as considerable reserves of tantalum, tin, gold, and diamonds. major foreign private investment in large-scale industrial mining has occurred in recent years, contributing to major macroeconomic growth. According to the latest EITI figures, the mining sector accounted for 64% of state budget (total of US $ 716,55 million), 99% of total exports, 24% of formal employment, and 13% of GDP in 2012 (Geenen, 2012).

Artisanal mining has a long history in the Democratic Republic of the Congo, extending back to colonial times. Cassiterite and coltan were discovered in the Kivu region23 in 1910, and the tin sector quickly became totally controlled by private Belgian corporations. By the first half of the 1940s, cassiterite output had risen to more than 10,000 tons per year, employing more than 73 000 people. Following a decade of increasing output, firms began to engage in industrial exploitation in the late 1940s and early 1950s, allowing for significant increases in output in the 1950s and 1960s. Struggling with wars (1996-1997 and 1998-2003), political instability, and corruption, the DRC has been fertile ground for illegal and unregulated ASM activities, particularly in the country's east. Because of the modest scale and relative mobility of the mining locations, the state has little practical control over the operation.

This study focuses on the ASM community in the Democratic Republic of the Congo as part of a collaboration between Geohub Pvt LTD and The East, Central, and

Southern Africa Health Community. This mapping exercise seeks to map and estimate the size of the ASM in the DRC.

8.2 Methodology

8.2.0 Overview

Refer to Chapter 1, section 1.2 for a description of the methodological approach.

8.2.1 Study Area

Data collection took place in 4 provinces namely (Tanganyika, Haut-Lomami, Lualaba and Haut-Katanga. The visited districts in the four provinces included Manono, Malemba-Nkulu, Luena, and Kolwezi. A team of one country coordinator, one supervisor and 13 data collectors went to each of the 8 selected districts to conduct the data collection exercise.

Data collection was done with a goal of mapping mining sites, interviewing key informants, artisanal and small mining leaders, individual ASM as well as mapping relevant health facilities.

.2.1.1 Sample Size Calculation

From the sampling frame identified, the minimum required number of ASM respondents were 239 per district. This was calculated using the Dobson Formula which is (*How to Calculate Sample Size for Different Study Designs in Medical Research? - PMC*, *2013*):

$$S = \frac{Z_{1-\alpha/2}^2 . p (1 - p)}{d^2};$$

where: $Z_{1-\alpha/2}^2$ is the standard normal variate at 95% confidence level =1.96

p is the prevalence of TB among ASMs = 3%

d is the absolute error = 5%

NB: In the case of DRC, national TB prevalence (319/100.000 according to WHO 2021 global tuberculosis report) was used because of the lack of data for the prevalence of TB among ASMs.

8.2.2. Data Collection and Analysis

Refer to Chapter 1, section 1.2.4 and 1.2.5

8.2.2. Study Limitations

The entire study was faced with challenges that the research team, through consultations with country coordinator, team supervisor and assistance form the locals, managed to overcome and carry out the study successfully. The following are some of the study limitations:

Site inaccessibility

Some sites were not accessible as they were found in areas with no proper access roads. However, the study team overcame this challenge by engaging some local people who helped in locating the sites.

Unwillingness by the miners to be interviewed

Some miners where not comfortable with the interview questions as they thought it was the government move to stop them from their activities. Nevertheless, this issue was solved by the supervisor who managed to give a depth background of the project and assured them there will be no confidential information to be obtained from the miners.

Lack of Cooperation from Health Personnel

Few health workers were also not ready to give the research team time to be interviewed out of their tight schedules, they wanted the team to make an appointment through the top district officials before interviews can be conducted. This problem was also resolved through explanation of possible benefits to the communities and capacity of health centres to offer services being investigated.

Potentially Violent conduct from miners

Some miners were just difficult to deal with. Among miners were political cadres who thought the interview team were just spying for some information that would dent their image to the top government officials, however just like the other challenges, this was overcome by brief introduction of the project to the miners.

Communication barrier

In some areas, the interview team faced challenges communicating with the participants. However, this was overcome by training and using a local person to translate.

8.3 Findings

8.3.0 Overview

A GIS and remote sensing techniques were used to map ASM sites throughout the country. This was followed by KIIs where a total of 1297 interviews were conducted in four regions. The number and category of people interviewed is outlined in the table below:

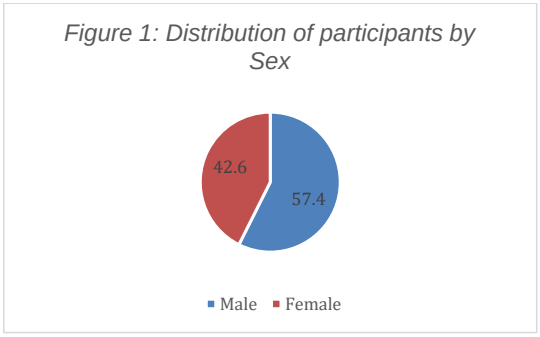
Country	DRC
Total Number of people Interviewed	1297
No. Government officials from Ministries of health, mines and labour	32
No. ASM Leaders/ owners of ASM sites	71
ASMs	1175
Health Facility Workers	19

8.3.2 Type of Minerals Mined

- Based on the interviewed ASM in this study, gold and diamond were the most mined commodities by ASM although some few ASM indicated that they were involved in extracting copper, lead, zinc and tin.

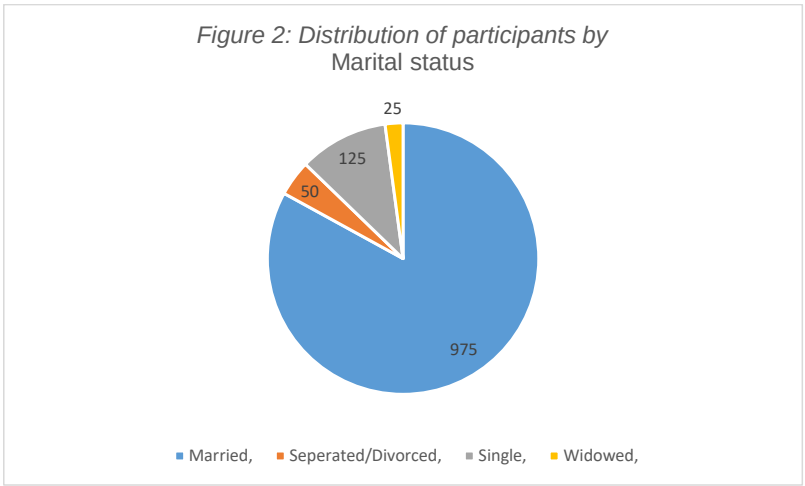
Figure 1 shows the distribution of participants by sex. From the total number of 1175 interviewees who work in artisanal and small-scale mining, males constituted 57.4 % while females were 42.6 %.

Figure 1: Distribution of participants by Sex



8.2.3.2 Distribution of Participants by Marital Status

Figure 2 shows that the majority of interviewees were married (83 %). Those who were single constituted 10 %, separated/divorced 4.3 %, and widowed 2.1 %



Distribution of Participants by Education level

Table 1 below shows that in terms of education, the highest number of ASM interviewed completed primary education (42.6 %), while 36.2 % have no formal education, and 21.3 % completed secondary education.

Table 1: Education Level Completed By ASM

Education Level	Frequency	%
No formal education,	425	36.2
Primary education completed,	500	42.6
Secondary education completed,	250	21.3
Total	1175	100

Distribution of study participants by Household size

Table 2 shows that 70.2 % of respondents come from households of 1-5 persons, followed by 27.7 % who come from households of 6-10 persons, and 2.1 % come from households of more than 10 persons.

Table 2: Distribution of Respondents by Household size

Household size	Frequency	%
1-5,	825	70.2
6-10,	325	27.7
above 10	25	2.1
Total	1175	100

Distribution of Participants by Income level

Table 3 shows that 19.2 % of respondents earn more than 250USD per month (12.8 % for 251-500USD and 6.4 % for 501-1000USD). The bulk of respondents earn 250USD or less per month (25.5 % for less than 50USD, 34.0 % for 51-100USD, and 21.3 % for 101-250USD).

Table 3: Distribution of Respondents Income

Income (USD)	Frequency	%
< 50,	300	25.5

50-100,	400	34.0
101-250,	250	21.3
251-500,	150	12.8
501-1000,	75	6.4
Total	1175	100

8.3.4 Operational Environment

8.3.4.1 Legal and Regulatory Framework

About 54 % of the interviewed ASM indicated that they were registered and 46 % were unregistered. In terms of registration, this very high, even though almost half are still unregistered and operate without licences. Many respondents highlighted the issue of high taxes in the mining as the push towards informal and illegal mining. The unstable security situation in DRC increases bureaucratic procedures and makes corruption rife, which is a significant deterrent for ASM registration.

The Mining Code (2002) and the Mining Regulations (2003) are the two primary legal documents that attempted to regulate the DRC mining sector. In 2018, the DRC President amended the 2002 Mining Code, which was subsequently passed by Congress and signed into law in March 2018. Mining activities in the DRC are also influenced by foreign legislation, such as Section 1502 of the Dodd-Frank Act, which imposed certain regulations for US companies using the DRC.

The Certified Trading Chains concept was developed in 2007 with the goal of promoting responsible mining practices and good governance in the artisanal mining sector, while also addressing supply security concerns for downstream supply chain stakeholders. Certification of high-value minerals, on the other hand, has created islands of legality where transparent trade helps to prevent conflict, sustain livelihoods, increase tax collections, and improve supply security for end users.

The DRC government established the Trading Centres (CdN) program at the end of 2009, as part of the Programme of Stabilisation and Reconstruction of Zones Emerging from Armed Conflicts (STAREC). The Trading Centres idea has hit a snag

for a variety of reasons. These range from resource restrictions to security hazards and the unauthorized exploitation of private concessions where artisanal mining should not be permitted.

8.3.4.2 Health Services

Health seeking behaviour of ASM, including visiting health facilities for TB testing, were generally noted to be negative. Figure 3 shows that only 8.5% of participants were tested for Silicosis. This meant up to 91.5 % were not. When it comes to, and TB, the figure of those who have never sought to be tested is 14.9 % and 85.1 % of ASM were never tested for tuberculosis.

Figure 3: Health Seeking Behaviour of ASMs

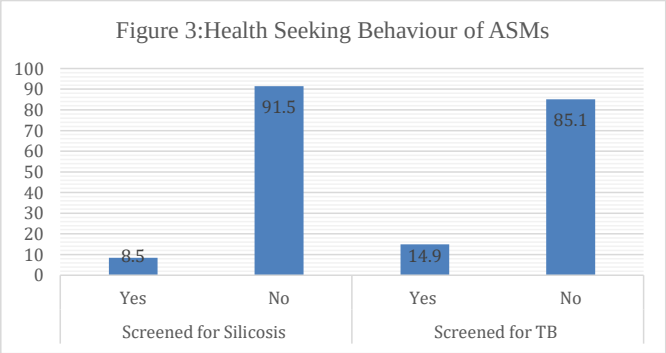
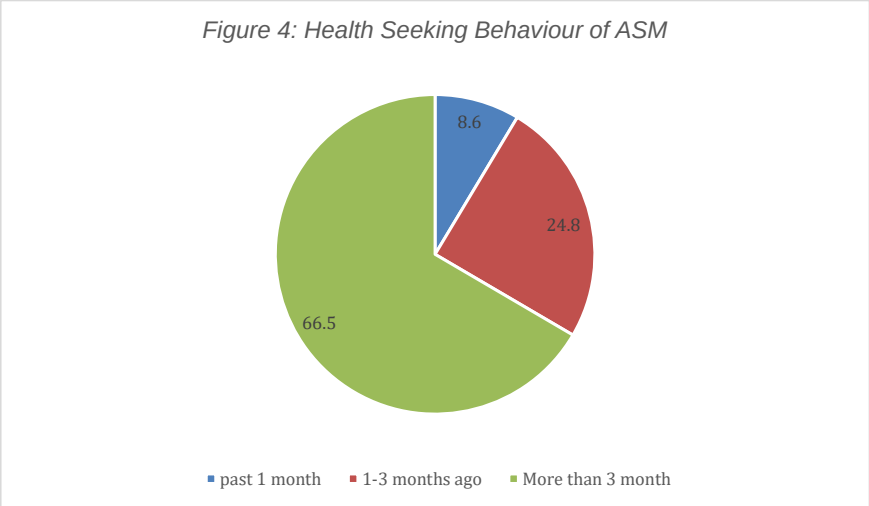


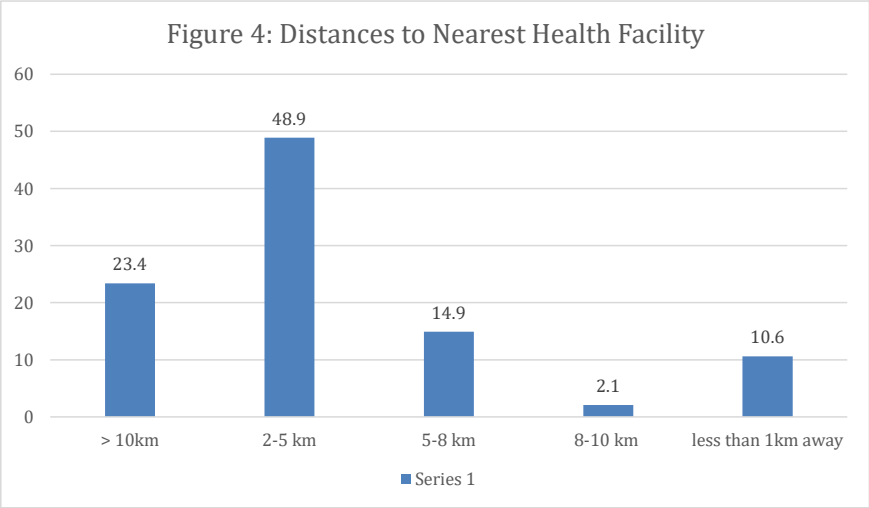
Figure 4 shows that from the 1175 interviewed people, 219 people (18.6 %) visited a health facility in the past month, and 291 persons (24.8 %) in the past 1 to 3 months. Around 665 persons (56.6%) had last visited a health facility more than 3 months from the time of interview.

Figure 4: Health seeking behaviour of ASM



8.3.4 ASM access to Occupational health and TB Related Services

Of the 1175 survey participants in the Democratic Republic of Congo, 10.6 % (124 persons) reported to be living within a kilometre from the nearest health facility, 48.9 % (586 persons) lived within 2-5 kilometres, 14.9 % (175 persons) lived 5-8 kilometres, 2.1 % (25 persons) lived 8-10 kilometres from the nearest health facility, and 23.5 % (276 persons) reported that they live more than 10 kilometres from the nearest health facility (*see Figure 4*).



The DRC's health system is divided into three levels. At the implementation level, there are 516 health districts, each with a district team in charge of a network of health centres and a district hospital. Districts typically have populations ranging from 100 000 to 200 000 people. Provincial health departments manage the intermediate level, which is in charge of technical and logistical support.

In 2005, the Democratic Republic of the Congo's government developed a comprehensive health system strengthening strategy (HSSS). The HSSS-guided reforms improved efficiency and effectiveness in the health sector, resulting in better health with limited financial resources. The changes, which are still being implemented, are aimed at health finance, partner and sector coordination, district-level service delivery, public financing and government ownership of the sector strategy, the pharmaceutical sector, and the Ministry's organic framework.

8.3.7 Average distance travelled by ASM to get health services

Evidence from this research shows that some miners walk more than the average set by WHO to access health services. WHO guidelines advocate a 7 kilometres radius. However, the average kilometres nationwide in the Democratic Republic of Congo was 6.29 kilometres.

8.3.4.3 Socio cultural and economic factors

Gender considerations

During the interviews, women revealed that they face challenges as they practice mining. Among the challenges they face are:

i. The policy framework towards ASM is still poor hence there are no enforcements on laws protecting women and children in the industry.
ii. The division of labour as most women and children do the light and menial work hence being given poor wages as compared to man. Women are more frequently associated with transporting and processing materials, as opposed to digging.
iii. Children are exposed to chemicals as they do menial but risky jobs. Children between do work in the tanzanite mines. In gold mining, the majority of children were employed in the reprocessing of tailings, manual crushing and grinding, and washing in sluice boxes hence being exposed to chemicals.

Equipment and machinery

Start-up capital

Poverty was noted to be a major challenge for most ASM have to entertain. Lack of financial resources limits what one can do to get the best possible output in mining. The major reason why ASM chose Artisanal Small-Scale Mining in the first place, that they can use rudimentary methods to mine. Miners lack the resources and capital to do other forms of businesses or to upgrade their mining methods.

Physical location and geographic access

Most ASM miners highlighted that poor roads are a challenge in the course of performing daily chores, working and accessing health facilities. The roads become worse and difficult to navigate especially during the rainy season.

The main mode of transport for 57.4 % of the participants in the Democratic Republic of Congo was either a bicycle or a motorbike, while 42.6 % mostly walk on foot to their workplaces.

Challenges cited by ASM in their responses included remoteness of site locations, high operation costs, lack of machinery and equipment for extracting minerals, poor road networks, bad roads that leave mines inaccessible during rainy season, very long distances to mining sites and mineral markets, absence of policy on security in mining sector, challenges with security of tenure in a war-torn country, poor Cell-phone connectivity and poor access to clean and safe water for drinking and domestic use. ASM also do not have financial resources to purchase machinery and equipment for extracting minerals, hence they use rudimentary methods. They lack financial support from the government and the capacity to increase their knowledge and skills since they operate on hand-to-mouth basis.

8.4 Discussion

The data collection exercise was a success. Considering that most of the sites were hard to reach, which was not unexpected, there was indeed an occupation hazard for the research assistants, but the data collection exercise was a complete success. Important to note are the observations that include strict and hard to achieve legislative requirements for most ASM to own a license, long distances to be travelled by ASM to seek health services, poor roads and poor network connectivity due to lack of infrastructure in the most remote parts of DRC, poor water and sanitation conditions for ASM.

8.5 Recommendations

Based on the conclusions drawn from the study, the following recommendations are made:

Recommendation	Responsible Person(s)
Improve the WASH conditions for the small-scale mines particularly those found in remote areas. Work towards improving access to clean water for drinking	Government led by the Ministry of Water Resources

and for domestic purposes especially in the hard to reach and most remote parts of the country. Support ASMs in constructing toilets and sanitary facilities as most ASM lack proper toilet facilities and they use the bush.	and Health and social Amenities Department
Foster Training and Education programs on Protective personal equipment, regular health check-ups among ASM	Government
Procure medicines and medical equipment to test and treat TB and related ailments	Government
Revise the policy framework to enforce laws protect women and children in the industry	Government
Relax the legislative instruments governing acquisition of ASM licences and make sure the processes are localised and completed District level so that they become fast and efficient	Government lead by Ministry of Mines and Justice
Improve road network and telecommunications infrastructure to cover even the remote areas where most ASM activities are taking place	Government led by the Ministry of Transport and the Telecommunications Department

CHAPTER 9: TANZANIA

9.1 Introduction

Tanzania is blessed with a wide range of other minerals, even though the mining of gold, gemstones (primarily tanzanite), and diamonds dominates the industry. Both large-scale mining (LSM) and artisanal and small-scale mining (ASM) operations are a part of the mining industry. The former is heavily mechanized and involves the multinational corporations, whereas ASM is carried out by people or groups with little equipment and some operate informally without mineral rights. The Mining Commission under the Ministry of Minerals, oversees mining operations. ASM first appeared in Tanzania at the turn of the 20th century and has since undergone constant change. Estimates of artisanal and small-scale miners in Tanzania range from 500,000 to 1.5million.
In Tanzania, it is estimated that more than one million people are directly involved in artisanal and small-scale gold mining (ASGM), a subset of artisanal and small-scale mining (ASM). Out of this, approximately 48.27 and 24.13% are men and children, respectively, while 27.60% are women[2]. Since 2000, LSM and ASM have been growing concurrently whereby the 2020 report shows that ASM gold production contributes to 28.6% of the annual total minerals produced[3]. However, for many Tanzanians, especially in the country's underdeveloped rural areas, ASM represents a significant source of income and business potential (Mwanza, 2019).

This report focuses on the ASM community in Tanzania as part of a project between Geohub Pvt LTD and The East, Central and Southern Africa Health Community. The report goes on to show how interviews and data collection was done to gain insight on the Tanzanian ASM community, estimating the size, the demographics and the challenges faced on a day to day.

9.2 Methodology

9.2.0 Overview

Refer to Chapter 1, section 1.3 for a description of the methodological approach.

9.2.1 Study Area

The selected regions and districts were Geita (Geita), Manyara (Simanjiro), Mbeya (Chunya), and Shinyanga (Msalala).

[2] Mutagwaba, W, Bosco Tindyebwa, J, Makanta, V, Kaballega, D and Maeda, G (2018) Artisanal and small-scale mining in Tanzania – Evidence to inform an 'action dialogue'. Research report, IIED, London.
[3] Mining commission, (2023). Annual report. https://www.tumemadini.go.tz/wp-content/uploads/Mining-Commission-Annual-Report-2021-2022-New.pdf

- Tanzania conducted a study to estimate the population size of artisanal and small-scale miners (ASM) and hotspots and the extent to which they access occupational Health and Tuberculosis services. The selected areas were Geita, Manyara, Mbeya, and Shinyanga. A team of one country coordinator, one supervisor and 8 data collectors went to each of the 4 selected districts to conduct the data collection exercise.
- In preparation for the data collection, the research assistants were oriented on the data collection tools using the ODK software. The informed consent forms and some of the translated tool guides were printed, in readiness of the data collection. At the district, the team had already spotted possible KIIs to be interviewed and some of the hotspots to be visited. An emphasized method was to maximize snowballing so that we find as many sites as possible.
- Data collection was done to map mining sites, interview key informants, artisanal and small mining leaders, and individual ASM, and map relevant health facilities. A total of 17 mines were visited, and 520 interviews were conducted in the country.

Table 1: Minerals Mined by Regions

Area	type of mineral mined
Geita	Gold
Manyara	Tanzanite
Mbeya	Gold
Shinyanga	Gold

9.2.1.1 Sampling

Sample Size Calculation

Using the sample size calculation formula for the unknown sample, the minimum required number of ASM respondents will be 539. This was calculated using the Dobson Formula which is (How to Calculate Sample Size for Different Study Designs in Medical Research? - PMC, 2013):

$$S = \frac{Z_{1-\alpha/2}.p\ (1 - p)}{d2};$$

where: Z1-α/22 is the standard normal variate at 95% confidence level =1.96
p is the prevalence of TB among ASMs (14%), and
d is the absolute error = 5%

.

9.2.2. Data Collection and Analysis

Refer to Chapter 1, section 1.3.3 and 1.3.4

As explained in Chapter 1, various GIS and Remote Sensing techniques were utilised from the planning phase through data collection phase and analysis of data. ODK was used for data collection and forms were enabled for spatial data collection so as to link data collected from every mine with its actual real-world. Several softwares were used to analyse both spatial data and the collected quantitative as well as socioeconomic data. These softwares included Stata, ArcGIS, QGIS, Google Earth engine. For detailed information refer to section 1.2.5.1 of this report.

9.2.3 Study limitations

The study was faced with challenges that the research team, through consultations with the team supervisor, managed to overcome and carry out the study successfully. The following were some of the study limitations:

i. Site inaccessibility

Some sites were difficult to access as they were found in areas with no proper access roads. However, the study team overcame this challenge by engaging some local people who helped in accessing the sites.

ii. Unwillingness by the miners to be interviewed

iii. Some miners were not comfortable with the interview questions as they thought it was the government move to stop them from their activities. Nevertheless, this issue was solved by the supervisor who managed to give a depth background of the project and assured them that no personal confidential information to be obtained in the research will be revelled in the report. Lack of Cooperation from Health Personnel

Few health workers were also not ready to give the research team time to be interviewed out of their tight schedules, they wanted the team to make an appointment through the top district officials before interviews can be conducted. This problem was also resolved through explanation of possible benefits to the communities and capacity of health centres to offer services being investigated.

Safety and security for data collectors

Miners were sceptical and thought the interview team wanted to spy on them and then later there would be consequences from the police or the government. Like other challenges, this was overcome by a thorough explanation of the project to the miners and how there would be no repercussions for participating.

iv. Communication barrier

In some areas, the interview team faced challenges communicating with the participants. However, this was overcome by training and using a local person to translate the questions.

9.3 Findings

9.3.0 Overview

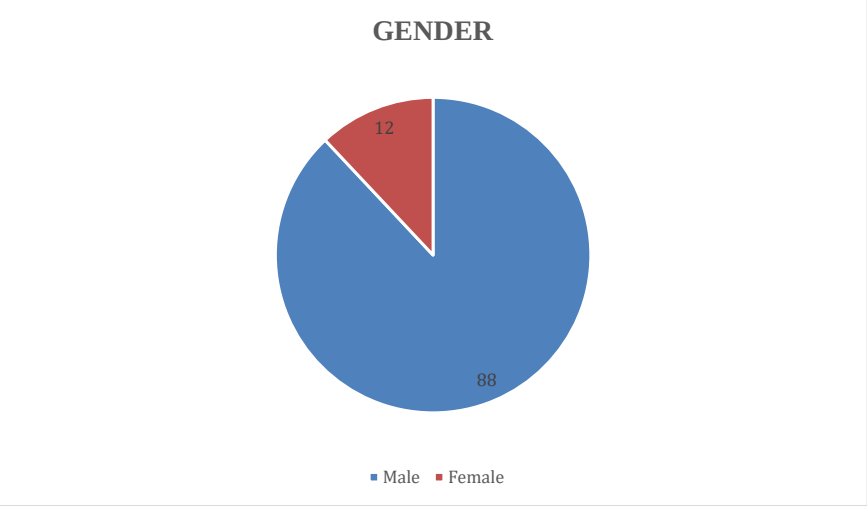
A GIS and remote sensing techniques were used to map ASM sites throughout the country. This was followed by KIIs where a total of 520 interviews were conducted in 4 districts. The number and category of people interviewed is outlined in the table below:

Country	Tanzania
Total Number of people Interviewed	520
No. Government officials from the Ministries of health, mines and labour	9
No. ASM Leaders/ owners of ASM sites	22
ASMs	475
Health Facility Workers	14

9.3.3 Population Size and Demographic Profile of ASMs

Figure 1 shows the distribution of participants by sex. In Tanzania, 88 % study participants were males and 12 % females.

Figure 1: Distribution of participants by Sex

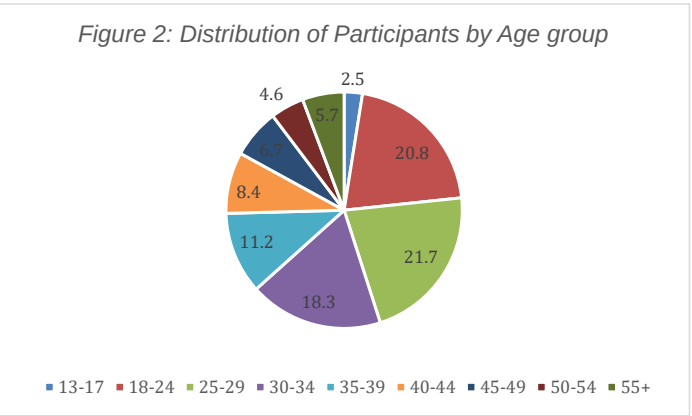


Age

Youth population between age 18 and 39 constitute a great portion of participants in ASM in Tanzania (72.1 %). In terms of composition of five-year age groups, Miners between age 25-29 years had the highest %. age of 21.7 %, followed by age 18-24 years (20.8 %), 30-34 years (18.3 %), 35-39 years (11.3 %) and 40-44 years (8.4 %), 45-49 years (6.7 %), 50-54 years (4.6 %) and the elderly 55+ years (5.7 %). *As shown in Figure 2 below*. Research findings show that there were children age 13-17 years involved in artisanal and small-scale mining activities in Tanzania (2.5 %).

Figure 2: Distribution of Participants by Age group

Figure 2: Distribution of Participants by Age group



9.3.4 Operational environment

9.3.4.1 Legal and Regulatory Framework for ASM

Proportions of Registered and unregistered ASM and challenges faced associated with registration of ASM

In most part of the interviewed districts the main issue highlighted was the slowness of the system and the unaffordability of registration fees. However, most people were hopeful that things would improve under the new government as they have seen the implementation of strong measures and changes of non-functional policies. Research showed that 76.3% ASMs are registered. Which points to some 23.7% unregistered ASMs operating in Tanzania

The President of Tanzania ordered a high-level review of mining laws and policies in 2008 in response to several complaints about them. The Bomani Presidential Mining Sector Review Committee was in charge of the review. The Bomani Review Committee's recommendations highlighted the necessity of changing the mining law system and related mining regulations. After a year, Tanzania's Mineral Policy was approved, with the main goals of recognizing ASM and advancing and assisting its growth. Despite taking this significant step, the Policy still lacks several crucial elements, such as occupational exposure to the ASM environment and environmental exposure at work, which simply demonstrates a lack of involvement by those working in ASM in the formulation of policy.

The gaps in Tanzanian mining policy are the challenges with regulating and controlling the negative effects of the ASM subsector. Mining policy in Tanzania ought to achieve a balance between the sector's effects on the environment, society, and economy. For instance, the National Forest Policy mentions the mining industry as one of Tanzania's major economic sectors before listing it as one of the fast-growing human economic activities that seriously degrade the environment.

9.3.4.2 Health Services

Health seeking behaviours by ASM

Total Number Surveyed	Distances to Nearest HF	Total Number of people	Proportion per distance
	<1 km	0	0
	1-5 km	258	54.3
	5-10km	164	34.5
	>10km	53	11.1

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Health seeking behaviour of ASM, including visiting health facilities for TB testing, were generally noted to be very low. Figure 3 shows that only 3.6 % were screened for Silicosis while at least 96.4 % were not screened for silicosis. When it comes to TB, about 13.5 % were tested, and 86.5 % were not tested. While both results are worrying it can be noticed that in Tanzania those screened for Silicosis are almost a quarter of those screened for TB. This can be used to compare and contrast the amount of knowledge miners have towards diseases they are at risk from and the availability of screening campaigns and centres. One factor the miners raised as a deterrent to seeking health services was that the nearest health facility was about 10.9 kilometres away. They also attributed their lack of health seeking enthusiasm to not having free time, travelling or walking to health facilities was believed to be a loss of precious time that should be utilised at work.

Figure 3:Health seeking behaviour of ASM

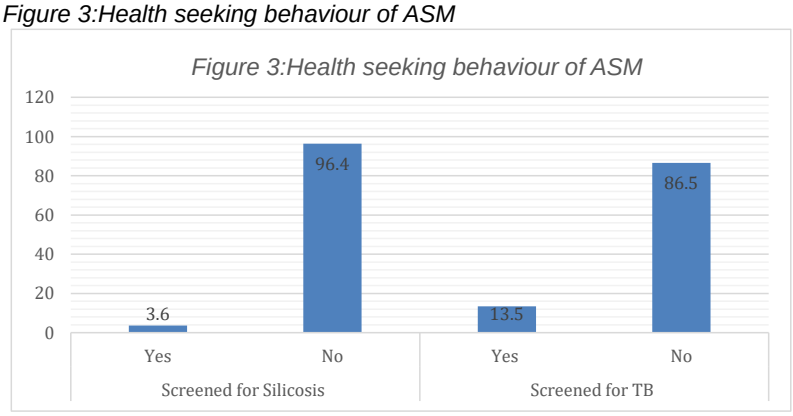
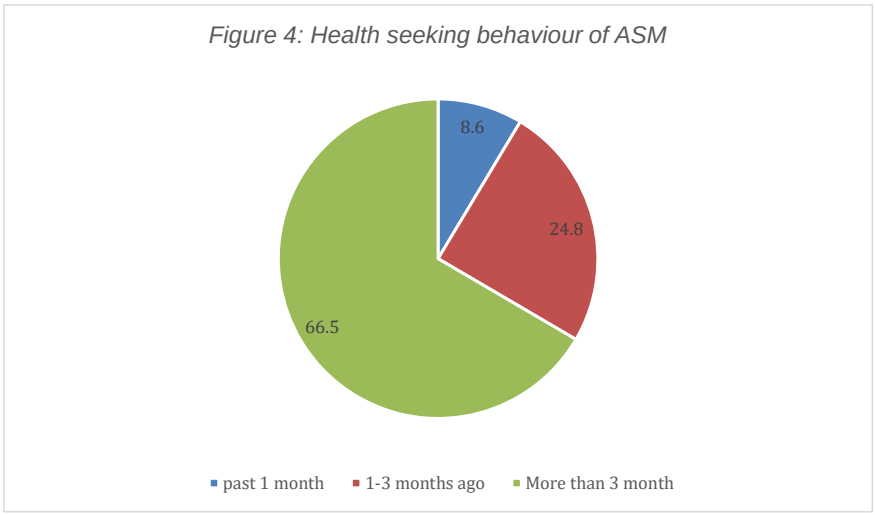


Figure 4 shows that from the 475 interviewed persons, 41 persons (8.6 %) visited a health facility in the past month, and 118 persons (24.8 %) in the past 1 to 3 months. Around 316 persons (66.5%) had last visited a health facility more than 3 months from the time of interview.

Figure 4: Health seeking behaviour of ASM



ASM access to Occupational health and TB related services

Screening for TB and Silicosis

Country	Total Number Interviewed	Number screened for TB in the past one year	Number screen for Silicosis in the past one year
Tanzania	475	64	17

About 13.3 % of those surveyed in Tanzania said they had easy access to TB-related care services, compared to 37.5 % who said they had access to occupational health services. About 13.5 % of the participants had undergone TB screening. Of those who had gone for TB screening, the proportions of where the screening was done were 42.2 % a health facility; none by a Health workers; and 57.8 % through . TB screening outreach program most facilitated by community health workers.

Current state of Health Facilities offering Health services to ASM.

Twenty-four healthcare facilities in the regions of Mbeya, Iringa, Songwe and Kigoma were upgraded in infrastructure relating to WASH as an effort between UNICEF and the government of Tanzania. These health facilities are overwhelmed and at often get overpopulated as they serve a population of over 1.5 million people, this gives each health facility an estimation of serving at least 62, 500 people.

Average distance travelled by ASM to get health services

Findings from our survey notes that some miners travel greater distances than the advocated average by WHO to access health care services. WHO guidelines advocate a 7 kilometres radius however, the average kilometres nationwide were noted to be 10.9 kilometres.

9.3.4.3 Socio-cultural and economic factors

Gender considerations

During the interviews, women revealed that they face challenges as they practice mining. Among the challenges they face are:

i. Legal and administrative constraints attributed to traditional customs that restrict women from owning resources.
ii. Low levels of education which limit them from getting formal education in mines.
iii. The division of labour as most women and children do the light and menial work hence being given poor wages as compared to men. Women are more frequently associated with transporting and processing materials, as opposed to digging.
iv. In gold mining, the majority of children were employed in the reprocessing of tailings, manual crushing and grinding, and washing in sluice boxes hence being exposed to chemicals

Equipment and machinery

Small scale miners interviewed had a challenging task in acquiring machinery and equipment as a lot of money is required. They stated that they sometimes had to give up a %age of their earnings as payment for using other people's equipment and machinery.

Start-up capital

Poverty was noted to be a major challenge for most ASM have to entertain. Lack of financial resources limits what one can do in order to get the best possible output in mining. The major reason why ASM chose Artisanal Small-Scale Mining in the first place, that they can use rudimentary methods to mine. Miners lack the resources and capital to do other forms of businesses or to upgrade their mining methods.

Physical locations and geographical access

ASM in Tanzania use a variety of transport to reach their mining sites. Those who work and stay within close distances mostly walk but others usually hike or board public transport if they do not own private cars. Challenges cited by ASM in their responses included remoteness of site locations, high operation costs, lack of machinery and equipment for extracting minerals, poor road networks, bad roads that leave mines inaccessible during rainy season, very long distances to mining sites and mineral markets, absence of policy on security in mining sector, challenges with security of tenure in a war-torn country, poor cell-phone connectivity and poor access to clean and safe water for drinking and domestic use. ASM also do not have financial

resources to purchase machinery and equipment for extracting minerals, hence they use rudimentary methods. They lack financial support from the government and the capacity to increase their knowledge and skills since they operate on hand-to-mouth basis. ASM also highlighted that there are too many disputes/conflicts especially amongst illegal miners. They then end up injuring one another, and in some instances, kill each other

9.4 Discussion

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The data collection exercise was a success. Considering that most of the sites were hard to reach, which was not unexpected, there was indeed an occupation hazard for the research assistants, but the data collection exercise was a complete success. Important to note are the observations that include strict and hard to achieve legislative requirements for most ASM to own a license, long distances to be travelled by ASM to seek health services, poor roads and poor network connectivity due to lack of infrastructure in the most remote parts of Tanzania, poor water and sanitation conditions for ASM.

9.5 Recommendations

Based on the conclusions drawn from the study, the following recommendations are made:

Recommendation	Responsible Person(s)
Need for Training, Education and Awareness campaigns on TB and Occupational health Related diseases among ASM. Government to encourage a culture of good Health seeking behaviour among ASM, foster regular health check-up	Government

Construct more health centres close to ASM or at least have mobile clinics which service the hard to reach ASM sites	Government
Improve the WASH conditions for the remote areas. Work towards improving access to clean water for drinking and for domestic purposes especially in the hard to reach and most remote parts of the country. Most ASM lack proper toilet facilities and they use the bush.	Government led by the Ministry of Water Resources and Health and social Amenities Department
Improve road network and telecommunications infrastructure to cover even the remote areas where most ASM activities are taking place	Government led by the Ministry of Transport and the Telecommunications Department
The Government needs to work hard to remove Legal and administrative constraints attributed to traditional customs that restrict women from owning resources and even land. Some are even denied access to mines due superstitious beliefs	Government led by Ministry of Gender and social services

Based on the conclusions drawn from the study, the following recommendations are made:

Recommendations

Artisanal and small-scale mining will continue to play a critical role in the economic growth of counties and livelihood of many countries in southern Africa. It is important that countries have robust mechanism to regulate ASM, protect and ensure safety and

health of the miners, ensure access to social services to ASM communities among others. In terms of recommendation as informed by the findings:

1.5.1 To countries

a) Develop, Review or Update the legislative framework for ASM

b) Review and streamline the regulatory frameworks including registration and licencing processes for artisanal and small-scale mining

c) Improve road network and telecommunications infrastructure to cover the remote areas where most ASM activities are taking place

d) Strengthen capacity of Mine Health and Safety to supervise and monitor and ensure compliance with MHS guidelines in ASM operations

e) Improve access to health services including occupational health services to communities around ASM sites.

f) Design and implement programs to create health awareness amongst ASM

g) Design and implement programs targeting skills and knowledge amongst health workers servicing ASM communities

h) Design and implement the WASH programs targeting ASM communities

i) Design and implement programs for enhancing gender equality targeting ASM communities

1.5.2 To ECSA and similar regional bodies

a) Develop regional prototype guidelines for ASM regulation and practice and advocate for its adoption at national level

b) Advocate for the formalization of the ASM at national level so that their contribution to the economic development for the countries and the region can be fully recognized

c) Support countries to establish robust occupational health services that cater for ASM

1.6 Conclusion

The assessment was structured in a manner that allowed for uniformity between all selected countries, utilising the same methodology and research tools. The core of the

assessment was the desire to utilise GIS and Remote sensing techniques to come up with estimates of ASM in each country and in the region. Different sub-national study areas were sampled in the selected countries, leading to the possibility of diverse outcomes. Although findings may be similar between some countries, there are also variations.

Annexes

Annex 1: Approximate numbers of ASM in DRC by Regions

ADM2_FR	ADM1_FR	NUMPOINTS	Total number of ASM
Aba	Haut-Uele	0	0
Aketi	Bas-Uele	31	1612
Ango	Bas-Uele	0	0
Ariwara	Ituri	0	0
Aru	Ituri	0	0
Bafwasende	Tshopo	0	0
Bagata	Kwilu	768	39936
Bambesa	Bas-Uele	510	26520
Banalia	Tshopo	0	0
Bandundu	Kwilu	0	0
Bangu	Kongo-Central	0	0
Baraka	Sud-Kivu	0	0
Basankusu	Equateur	0	0
Basoko	Tshopo	0	0
Befale	Tshuapa	0	0
Bena-Dibele	Sankuru	0	0
Beni	Nord-Kivu	0	0
Bikoro	Equateur	0	0
Boende	Tshuapa	0	0
Bokungu	Tshuapa	0	0
Bolobo	MaÃ¯-Ndombe	2883	149916
Bolomba	Equateur	448	23296
Boma	Kongo-Central	0	0
Bomongo	Equateur	0	0
Bondo	Bas-Uele	523	27196
Bongandanga	Mongala	0	0
Bosobolo	Nord-Ubangi	0	0
Budjala	Sud-Ubangi	0	0
Bukama	Haut-Lomami	0	0
Bukavu	Sud-Kivu	0	0
Bulungu	Kwilu	0	0

Bumba	Mongala	0	0
Bunia	Ituri	0	0
Businga	Nord-Ubangi	0	0
Buta	Bas-Uele	842	43784
Butembo	Nord-Kivu	0	0
Dekese	KasaÃ¯	0	0
Demba	KasaÃ¯-Central	17	884
Dibaya	KasaÃ¯-Central	0	0
Dibaya-Lubwe	Kwilu	0	0
Dilolo	Lualaba	0	0
Dimbelenge	KasaÃ¯-Central	0	0
Dingila	Bas-Uele	0	0
Djolu	Tshuapa	0	0
Djugu	Ituri	50	2600
Dungu	Haut-Uele	0	0
Faradje	Haut-Uele	0	0
Feshi	Kwango	0	0
Fizi	Sud-Kivu	0	0
Gbadolite	Nord-Ubangi	0	0
Gemena	Sud-Ubangi	0	0
Goma	Nord-Kivu	0	0
Gungu	Kwilu	0	0
Idiofa	Kwilu	135	7020
Idjwi	Sud-Kivu	0	0
Ikela	Tshuapa	0	0
Ilebo	KasaÃ¯	0	0
Ingbokolo	Ituri	0	0
Ingende	Equateur	0	0
Inkisi	Kongo-Central	0	0
Inongo	MaÃ¯-Ndombe	5	260
Irumu	Ituri	0	0
Isangi	Tshopo	0	0
Isiro	Haut-Uele	0	0
Kabalo	Tanganyika	5366	279032
Kabambare	Maniema	0	0
Kabare	Sud-Kivu	0	0
Kabeya-Kamwanga	KasaÃ¯-Oriental	0	0
Kabinda	Lomami	0	0
Kabongo	Haut-Lomami	2	104
Kahemba	Kwango	0	0
Kailo	Maniema	0	0
Kalehe	Sud-Kivu	9	468
Kalemie	Tanganyika	0	0
Kalima	Maniema	0	0

Kambove	Haut-Katanga	211	10972
Kamiji	Lomami	0	0
Kamina	Haut-Lomami	0	0
Kamituga	Sud-Kivu	0	0
Kamonia	KasaÃ¯	0	0
Kananga	KasaÃ¯-Central	0	0
Kaniama	Haut-Lomami	0	0
Kaoze	Tanganyika	26	1352
Kapanga	Lualaba	0	0
Kasaji	Lualaba	0	0
Kasangulu	Kongo-Central	4975	258700
Kasenga	Haut-Katanga	10	520
Kasongo	Maniema	0	0
Kasongo-Lunda	Kwango	4	208
Katako-Kombe	Sankuru	0	0
Katanda	KasaÃ¯-Oriental	0	0
Kazumba	KasaÃ¯-Central	0	0
Kenge	Kwango	45	2340
Kibombo	Maniema	0	0
Kikwit	Kwilu	0	0
Kimvula	Kongo-Central	0	0
Kindu	Maniema	0	0
Kinshasa	Kinshasa	786	40872
Kipushi	Haut-Katanga	0	0
Kiri	MaÃ¯-Ndombe	0	0
Kisangani	Tshopo	0	0
Kole	Sankuru	0	0
Kolwezi	Lualaba	0	0
Kongolo	Tanganyika	147	7644
Kungu	Sud-Ubangi	0	0
Kutu	MaÃ¯-Ndombe	1371	71292
Kwamouth	MaÃ¯-Ndombe	0	0
Libenge	Sud-Ubangi	0	0
Likasi	Haut-Katanga	1	52
Lisala	Mongala	0	0
Lodja	Sankuru	0	0
Lomela	Sankuru	0	0
Lubao	Lomami	1	52
Lubefu	Sankuru	0	0
Lubero	Nord-Kivu	289	15028
Lubudi	Lualaba	0	0
Lubumbashi	Haut-Katanga	0	0
Lubutu	Maniema	0	0
Luebo	KasaÃ¯	112	5824

Luilu	Lomami	0	0
Luiza	KasaÃ¯-Central	0	0
Lukalaba	KasaÃ¯-Oriental	0	0
Lukolela	Equateur	79	4108
Lukula	Kongo-Central	12	624
Luozi	Kongo-Central	0	0
Lupatapata	KasaÃ¯-Oriental	0	0
Lusambo	Sankuru	0	0
Madimba	Kongo-Central	0	0
Mahagi	Ituri	0	0
Makanza	Equateur	0	0
Malemba-Nkulu	Haut-Lomami	0	0
Mambasa	Ituri	0	0
Mangai	Kwilu	0	0
Manono	Tanganyika	197	10244
Masi-Manimba	Kwilu	0	0
Masisi	Nord-Kivu	187	9724
Matadi	Kongo-Central	0	0
Mbandaka	Equateur	0	0
Mbanza-Ngungu	Kongo-Central	0	0
Mbuji-Mayi	KasaÃ¯-Oriental	0	0
Miabi	KasaÃ¯-Oriental	0	0
Mitwaba	Haut-Katanga	12	624
Moanda	Kongo-Central	0	0
Moba	Tanganyika	646	33592
Mobayi-Mbongo	Nord-Ubangi	0	0
Mongwalu	Ituri	0	0
Monkoto	Tshuapa	0	0
Mushie	MaÃ¯-Ndombe	33	1716
Mutshatsha	Lualaba	10	520
Mweka	KasaÃ¯	234	12168
Mwene-Ditu	Lomami	0	0
Mwenga	Sud-Kivu	525	27300
Namoya	Maniema	0	0
Ngandajika	Lomami	0	0
Niangara	Haut-Uele	0	0
Nioki	MaÃ¯-Ndombe	0	0
Nyiragongo	Nord-Kivu	0	0
Nyunzu	Tanganyika	357	18564
OÃ¯cha	Nord-Kivu	0	0
Opala	Tshopo	0	0
Oshwe	MaÃ¯-Ndombe	123	6396
Pangi	Maniema	0	0
Poko	Bas-Uele	6	312

Popokabaka	Kwango	598	31096
Punia	Maniema	0	0
Pweto	Haut-Katanga	4154	216008
Rungu	Haut-Uele	0	0
Rutshuru	Nord-Kivu	25	1300
Sakania	Haut-Katanga	0	0
Sandoa	Lualaba	0	0
Seke-Banza	Kongo-Central	0	0
Shabunda	Sud-Kivu	0	0
Songololo	Kongo-Central	0	0
Tshela	Kongo-Central	3743	194636
Tshikapa	KasaÃ¯	0	0
Tshilenge	KasaÃ¯-Oriental	0	0
Tshimbulu	KasaÃ¯-Central	0	0
Tshumbe	Sankuru	0	0
Ubundu	Tshopo	0	0
Uvira	Sud-Kivu	0	0
Walikale	Nord-Kivu	3	156
Walungu	Sud-Kivu	0	0
Wamba	Haut-Uele	0	0
Watsa	Haut-Uele	1134	58968
Yahuma	Tshopo	0	0
Yakoma	Nord-Ubangi	0	0
Yangambi	Tshopo	0	0
Yumbi	MaÃ¯-Ndombe	3496	181792
Zongo	Sud-Ubangi	0	0

Annex 2: Madagscar ASM distribution by region

ADM0_EN	Region/Province_ADM1_EN	District_ADM2_EN	NUMPOINTS	active ASM sites	ASMs in an area
Madagascar	Analamanga	1er Arrondissement	307	92	368
Madagascar	Analamanga	2e Arrondissement	318	95	382
Madagascar	Analamanga	3e Arrondissement	136	41	163
Madagascar	Analamanga	4e Arrondissement	12	4	14
Madagascar	Analamanga	5e Arrondissement	3	1	4
Madagascar	Analamanga	6e Arrondissement	871	261	1045
Madagascar	Analamanga	Antananarivo Avaradrano	2390	717	2868
Madagascar	Analamanga	Ambohidratrimo	11988	3596	14386
Madagascar	Analamanga	Ankazobe	11034	3310	13241
Madagascar	Analamanga	Manjakandriana	12727	3818	15272
Madagascar	Analamanga	Anjozorobe	17888	5366	21466
Madagascar	Analamanga	Andramasina	2351	705	2821

Madagascar	Analamanga	Antananarivo Atsimondrano	3617	1085	4340
Madagascar	Vakinankaratra	Antsirabe I	623	187	748
Madagascar	Vakinankaratra	Betafo	7573	2272	9088
Madagascar	Vakinankaratra	Ambatolampy	5627	1688	6752
Madagascar	Vakinankaratra	Antanifotsy	18642	5593	22370
Madagascar	Vakinankaratra	Faratsiho	3347	1004	4016
Madagascar	Vakinankaratra	Antsirabe II	6904	2071	8285
Madagascar	Vakinankaratra	Mandoto	7396	2219	8875
Madagascar	Itasy	Arivonimamo	12234	3670	14681
Madagascar	Itasy	Miarinarivo	11362	3409	13634
Madagascar	Itasy	Soavinandriana	5227	1568	6272
Madagascar	Bongolava	Tsiroanomandidy	30897	9269	37076
Madagascar	Bongolava	Fenoarivobe	13222	3967	15866
Madagascar	Haute Matsiatra	Fianarantsoa I	1310	393	1572
Madagascar	Haute Matsiatra	Ambalavao	6805	2042	8166
Madagascar	Haute Matsiatra	Ambohimahasoa	14419	4326	17303
Madagascar	Haute Matsiatra	Ikalamavony	5228	1568	6274
Madagascar	Haute Matsiatra	Lalangina	7741	2322	9289
Madagascar	Haute Matsiatra	Vohibato	13106	3932	15727
Madagascar	Haute Matsiatra	Isandra	4977	1493	5972
Madagascar	Amoron I Mania	Ambatofinandrahana	7058	2117	8470
Madagascar	Amoron I Mania	Ambositra	8963	2689	10756
Madagascar	Amoron I Mania	Fandriana	10628	3188	12754
Madagascar	Amoron I Mania	Manandriana	2520	756	3024
Madagascar	Vatovavy Fitovinany	Ifanadiana	7041	2112	8449
Madagascar	Vatovavy Fitovinany	Nosy-Varika	4514	1354	5417
Madagascar	Vatovavy Fitovinany	Mananjary	7710	2313	9252
Madagascar	Vatovavy Fitovinany	Manakara Atsimo	21994	6598	26393
Madagascar	Vatovavy Fitovinany	Ikongo	7361	2208	8833
Madagascar	Vatovavy Fitovinany	Vohipeno	3739	1122	4487
Madagascar	Ihorombe	Ihosy	8669	2601	10403
Madagascar	Ihorombe	Ivohibe	4298	1289	5158
Madagascar	Ihorombe	Iakora	0	0	0
Madagascar	Atsimo Atsinanana	Farafangana	21765	6530	26118
Madagascar	Atsimo Atsinanana	Vangaindrano	23102	6931	27722
Madagascar	Atsimo Atsinanana	Midongy-Atsimo	1722	517	2066
Madagascar	Atsimo Atsinanana	Vondrozo	3360	1008	4032
Madagascar	Atsimo Atsinanana	Befotaka	2059	618	2471
Madagascar	Atsinanana	Toamasina I	94	28	113
Madagascar	Atsinanana	Brickaville	5889	1767	7067
Madagascar	Atsinanana	Vatomandry	7183	2155	8620
Madagascar	Atsinanana	Mahanoro	12520	3756	15024
Madagascar	Atsinanana	Marolambo	5533	1660	6640
Madagascar	Atsinanana	Toamasina II	13063	3919	15676
Madagascar	Atsinanana	Antanambao Manampontsy	330	99	396
Madagascar	Analanjirofo	Sainte Marie	879	264	1055
Madagascar	Analanjirofo	Maroantsetra	15170	4551	18204
Madagascar	Analanjirofo	Mananara-Avaratra	5988	1796	7186
Madagascar	Analanjirofo	Fenerive Est	9643	2893	11572
Madagascar	Analanjirofo	Vavatenina	8123	2437	9748
Madagascar	Analanjirofo	Soanierana Ivongo	7499	2250	8999
Madagascar	Alaotra Mangoro	Amparafaravola	13152	3946	15782

Madagascar	Alaotra Mangoro	Ambatondrazaka	28223	8467	33868
Madagascar	Alaotra Mangoro	Moramanga	25391	7617	30469
Madagascar	Alaotra Mangoro	Andilamena	19861	5958	23833
Madagascar	Alaotra Mangoro	Anosibe-An'ala	1770	531	2124
Madagascar	Boeny	Mahajanga I	456	137	547
Madagascar	Boeny	Soalala	12	4	14
Madagascar	Boeny	Ambato Boeni	19506	5852	23407
Madagascar	Boeny	Marovoay	27414	8224	32897
Madagascar	Boeny	Mitsinjo	18456	5537	22147
Madagascar	Boeny	Mahajanga II	17854	5356	21425
Madagascar	Sofia	Port-Berge (Boriziny-Vaovao)	7280	2184	8736
Madagascar	Sofia	Mandritsara	13652	4096	16382
Madagascar	Sofia	Analalava	15143	4543	18172
Madagascar	Sofia	Befandriana Nord	16131	4839	19357
Madagascar	Sofia	Antsohihy	3947	1184	4736
Madagascar	Sofia	Bealanana	23355	7007	28026
Madagascar	Sofia	Mampikony	4195	1259	5034
Madagascar	Betsiboka	Maevatanana	17145	5144	20574
Madagascar	Betsiboka	Tsaratanana	1701	510	2041
Madagascar	Betsiboka	Kandreho	959	288	1151
Madagascar	Melaky	Besalampy	19392	5818	23270
Madagascar	Melaky	Ambatomainty	60	18	72
Madagascar	Melaky	Antsalova	5527	1658	6632
Madagascar	Melaky	Maintirano	23468	7040	28162
Madagascar	Melaky	Morafenobe	1576	473	1891
Madagascar	Atsimo Andrefana	Toliary-I	0	0	0
Madagascar	Atsimo Andrefana	Beroroha	6970	2091	8364
Madagascar	Atsimo Andrefana	Morombe	4467	1340	5360
Madagascar	Atsimo Andrefana	Ankazoabo	3461	1038	4153
Madagascar	Atsimo Andrefana	Betioky Atsimo	9301	2790	11161
Madagascar	Atsimo Andrefana	Ampanihy Ouest	1913	574	2296
Madagascar	Atsimo Andrefana	Sakaraha	4405	1322	5286
Madagascar	Atsimo Andrefana	Toliary-II	3074	922	3689
Madagascar	Atsimo Andrefana	Benenitra	946	284	1135
Madagascar	Androy	Beloha	266	80	319
Madagascar	Androy	Tsihombe	544	163	653
Madagascar	Androy	Ambovombe-Androy	273	82	328
Madagascar	Androy	Bekily	791	237	949
Madagascar	Anosy	Taolagnaro	11981	3594	14377
Madagascar	Anosy	Betroka	8085	2426	9702
Madagascar	Anosy	Amboasary-Atsimo	2348	704	2818
Madagascar	Menabe	Manja	6525	1958	7830
Madagascar	Menabe	Morondava	3173	952	3808
Madagascar	Menabe	Mahabo	21573	6472	25888
Madagascar	Menabe	Belo Sur Tsiribihina	7951	2385	9541
Madagascar	Menabe	Miandrivazo	11843	3553	14212
Madagascar	Diana	Antsiranana II	2719	816	3263
Madagascar	Diana	Antsiranana I	0	0	0
Madagascar	Diana	Ambilobe	19014	5704	22817
Madagascar	Diana	Nosy-Be	675	203	810
Madagascar	Diana	Ambanja	11583	3475	13900
Madagascar	Sava	Antalaha	9298	2789	11158

Madagascar	Sava	Sambava	7906	2372	9487
Madagascar	Sava	Andapa	11664	3499	13997
Madagascar	Sava	Vohemar	4143	1243	4972
Total ASM					1177460

Annex 3. Malawi population Size estimates of ASM by districts

District Name	Number Of ASM Points Detected	Number Of Active ASM Sites	Total Number Of ASM
Nkhotakota	4405	1321.5	75629
Mzimba	3821	1146.3	65603
Karonga	2878	863.4	49412
Nkhatabay	2673	801.9	45893
Salima	1623	486.9	27865
Rumphi	1284	385.2	22045
Machinga	962	288.6	16517
Nsanje	895	268.5	15366
Chitipa	843	252.9	14473
Kasungu	657	197.1	11280
Mangochi	526	157.8	9031
Zomba	518	155.4	8894
Lilongwe	442	132.6	7589
Balaka	412	123.6	7074
Ntchisi	333	99.9	5717
Mchinji	261	78.3	4481
Chikwawa	196	58.8	3365
Dowa	195	58.5	3348
Ntcheu	130	39	2232
Dedza	41	12.3	704
Mulanje	36	10.8	618
Thyolo	22	6.6	378
Mzuzu City	13	3.9	223
Lilongwe City	1	0.3	17
Likoma	0	0	0
Chiradzulu	0	0	0
Blantyre	0	0	0
Mwanza	0	0	0
Phalombe	0	0	0
Neno	0	0	0
Zomba City	0	0	0
Blantyre City	0	0	0
Grand Totals	23,167	6950.1	397,754

Annex *4. Approximate numbers of ASM in Mozambique*

ADM2_PT	ADM1_PT	NUMPOINTS	Active sites	average number of ASMs per site	number_ASMs
Alto Molocue	Zambezia	128	89.6	10	896
Ancuabe	Cabo Delgado	370	259	10	2590
Angoche	Nampula	8983	6288.1	10	62881
Angonia	Tete	0	0	10	0
Balama	Cabo Delgado	457	319.9	10	3199
Barue	Manica	1120	784	10	7840
Bilene	Gaza	33	23.1	10	231
Boane	Maputo	1926	1348.2	10	13482
Buzi	Sofala	0	0	10	0
Cahora Bassa	Tete	0	0	10	0
Caia	Sofala	82	57.4	10	574
Changara	Tete	0	0	10	0
Chemba	Sofala	237	165.9	10	1659
Cheringoma	Sofala	0	0	10	0
Chibabava	Sofala	0	0	10	0
Chibuto	Gaza	6257	4379.9	10	43799
Chicualacuala	Gaza	0	0	10	0
Chifunde	Tete	78	54.6	10	546
Chigubo	Gaza	0	0	10	0
Chimbonila	Niassa	0	0	10	0
Chinde	Zambezia	0	0	10	0
Chiure	Cabo Delgado	575	402.5	10	4025

Chiuta	Tete	10	7	10	70
Chokwe	Gaza	321	224.7	10	2247
Chongoene	Gaza	2756	1929.2	10	19292
Cidade Da Beira	Sofala	0	0	10	0
Cidade Da Matola	Maputo	109	76.3	10	763
Cidade De Chimoio	Manica	5	3.5	10	35
Cidade De Inhambane	Inhambane	0	0	10	0
Cidade De Lichinga	Niassa	50	35	10	350
Cidade De Maputo	Maputo City	88	61.6	10	616
Cidade De Nampula	Nampula	105	73.5	10	735
Cidade De Pemba	Cabo Delgado	1	0.7	10	7
Cidade De Quelimane	Zambezia	2278	1594.6	10	15946
Cidade De Tete	Tete	0	0	10	0
Cidade De Xai-Xai	Gaza	28	19.6	10	196
Cuamba	Niassa	5	3.5	10	35
Derre	Zambezia	0	0	10	0
Doa	Tete	10	7	10	70
Dondo	Sofala	0	0	10	0
Erati	Nampula	549	384.3	10	3843
Funhalouro	Inhambane	0	0	10	0
Gile	Zambezia	629	440.3	10	4403
Gondola	Manica	401	280.7	10	2807
Gorongosa	Sofala	56	39.2	10	392
Govuro	Inhambane	0	0	10	0

Guija	Gaza	1205	843.5	10	8435
Guro	Manica	26	18.2	10	182
Gurue	Zambezia	438	306.6	10	3066
Homoine	Inhambane	748	523.6	10	5236
Ibo	Cabo Delgado	68	47.6	10	476
Ile	Zambezia	1534	1073.8	10	10738
Ilha De MoÃ§ambique	Nampula	1183	828.1	10	8281
Ilha Licom	Niassa	0	0	10	0
Ilha Risunodo	Niassa	0	0	10	0
Inharrime	Inhambane	90	63	10	630
Inhassoro	Inhambane	0	0	10	0
Inhassunge	Zambezia	0	0	10	0
Jangamo	Inhambane	588	411.6	10	4116
Lago	Niassa	0	0	10	0
Lago Niassa	Niassa	0	0	10	0
Lalaua	Nampula	0	0	10	0
Larde	Nampula	67	46.9	10	469
Limpopo	Gaza	384	268.8	10	2688
LiÃºpo	Nampula	6	4.2	10	42
Luabo	Zambezia	0	0	10	0
Lugela	Zambezia	29	20.3	10	203
Mabalane	Gaza	0	0	10	0
Mabote	Inhambane	18	12.6	10	126
Macanga	Tete	0	0	10	0
Macate	Manica	516	361.2	10	3612
Machanga	Sofala	0	0	10	0
Machaze	Manica	320	224	10	2240
Macomia	Cabo Delgado	1311	917.7	10	9177
Macossa	Manica	19	13.3	10	133

Maganja Da Costa	Zambezia	17265	12085.5	10	120855
Magoe	Tete	0	0	10	0
Magude	Maputo	1862	1303.4	10	13034
Majune	Niassa	0	0	10	0
Malema	Nampula	46	32.2	10	322
Mandimba	Niassa	33	23.1	10	231
Mandlakaze	Gaza	7268	5087.6	10	50876
ManhiÃ§a	Maputo	3722	2605.4	10	26054
Manica	Manica	1146	802.2	10	8022
Mapai	Gaza	5	3.5	10	35
Maquival	Zambezia	8	5.6	10	56
Marara	Tete	0	0	10	0
Maravia	Tete	1449	1014.3	10	10143
Maringue	Sofala	39	27.3	10	273
Marracuene	Maputo	14	9.8	10	98
Marromeu	Sofala	0	0	10	0
Marrupa	Niassa	0	0	10	0
Massangena	Gaza	1200	840	10	8400
Massinga	Inhambane	0	0	10	0
Massingir	Gaza	0	0	10	0
Matutuine	Maputo	93	65.1	10	651
Maua	Niassa	440	308	10	3080
Mavago	Niassa	0	0	10	0
Maxixe	Inhambane	10	7	10	70
Mecanhelas	Niassa	1123	786.1	10	7861
Meconta	Nampula	562	393.4	10	3934
Mecuburi	Nampula	72	50.4	10	504
Mecufi	Cabo Delgado	0	0	10	0
Mecula	Niassa	130	91	10	910
Meluco	Cabo Delgado	116	81.2	10	812

Memba	Nampula	251	175.7	10	1757
Metarica	Niassa	108	75.6	10	756
Metuge	Cabo Delgado	421	294.7	10	2947
Milange	Zambezia	226	158.2	10	1582
Moamba	Maputo	39	27.3	10	273
Moatize	Tete	170	119	10	1190
Mocimboa Da Praia	Cabo Delgado	1436	1005.2	10	10052
Mocuba	Zambezia	1	0.7	10	7
Mocubela	Zambezia	169	118.3	10	1183
Mogincual	Nampula	3189	2232.3	10	22323
Mogovolas	Nampula	2099	1469.3	10	14693
Molumbo	Zambezia	0	0	10	0
Moma	Nampula	466	326.2	10	3262
Monapo	Nampula	750	525	10	5250
Montepuez	Cabo Delgado	12	8.4	10	84
Mopeia	Zambezia	0	0	10	0
Morrumbala	Zambezia	7	4.9	10	49
Morrumbene	Inhambane	0	0	10	0
Mossuril	Nampula	4002	2801.4	10	28014
Mossurize	Manica	519	363.3	10	3633
Muanza	Sofala	0	0	10	0
Muecate	Nampula	197	137.9	10	1379
Mueda	Cabo Delgado	1435	1004.5	10	10045
Muembe	Niassa	0	0	10	0
Muidumbe	Cabo Delgado	1415	990.5	10	9905
Mulevala	Zambezia	20	14	10	140
Murrupula	Nampula	3	2.1	10	21
Mutarara	Tete	3744	2620.8	10	26208

Nacala	Nampula	0	0	10	0
Nacala-A-Velha	Nampula	2	1.4	10	14
Nacaroa	Nampula	443	310.1	10	3101
Namaacha	Maputo	93	65.1	10	651
Namacurra	Zambezia	32	22.4	10	224
Namarroi	Zambezia	276	193.2	10	1932
Namuno	Cabo Delgado	996	697.2	10	6972
Nangade	Cabo Delgado	2	1.4	10	14
Ngauma	Niassa	0	0	10	0
Nhamatanda	Sofala	0	0	10	0
Nicoadala	Zambezia	178	124.6	10	1246
Nipepe	Niassa	123	86.1	10	861
Palma	Cabo Delgado	17	11.9	10	119
Panda	Inhambane	507	354.9	10	3549
Pebane	Zambezia	0	0	10	0
Quissanga	Cabo Delgado	3348	2343.6	10	23436
Rapale	Nampula	268	187.6	10	1876
Ribaue	Nampula	0	0	10	0
Sanga	Niassa	0	0	10	0
Sussundenga	Manica	898	628.6	10	6286
Tambara	Manica	0	0	10	0
Tsangano	Tete	0	0	10	0
Vanduzi	Manica	502	351.4	10	3514
Vilankulo	Inhambane	0	0	10	0
Zavala	Inhambane	46	32.2	10	322
Zumbu	Tete	0	0	10	0
Total ASMs					708470

Annex 5, ASM distribution by region and constituency in Namibia

REGION	CONSTITUENCY	#POINTS	# active ASM sites	# ASMs per site	total Number of ASMs
Erongo	Karibib	2044	920	11	10116
Erongo	Daures	1502	676	11	7437
Kunene	Epupa	557	251	11	2759
Kavango East	Mukwe	367	165	11	1818
Kunene	Sesfontein	332	149	11	1641
Kunene	Khorixas	153	69	11	759
Otjozondjupa	Tsumkwe	146	66	11	723
Kunene	Opuwo Rural	140	63	11	693
Kunene	Kamanjab	134	60	11	663
Karas	Karasburg East	131	59	11	647
Kavango East	Ndonga Linena	109	49	11	540
Oshana	Okatyali	107	48	11	532
Hardap	Mariental Rural	102	46	11	503
Oshana	Ompundja	96	43	11	475
Hardap	Gibeon	82	37	11	405
Omusati	Ogongo	78	35	11	387
Omaheke	Otjombinde	73	33	11	362
Ohangwena	Eenhana	71	32	11	351
Erongo	Omaruru	70	31	11	344
Omusati	Okalongo	66	30	11	329
Karas	Orangemund	65	29	11	323
Omusati	Etayi	61	27	11	302
Khomas	Windhoek Rural	59	27	11	294

Oshana	Okaku	56	25	11	275
Omusati	Elim	55	25	11	274
Omusati	Tsandi	55	25	11	271
Ohangwena	Epembe	53	24	11	263
Ohangwena	Ongenga	52	23	11	256
Karas	Berseba	49	22	11	243
Zambezi	Sibbinda	47	21	11	234
Kavango East	Mashare	44	20	11	220
Kavango West	Musese	42	19	11	206
Oshana	Oshakati West	42	19	11	206
Oshana	Ongwediva	37	17	11	182
Ohangwena	Engela	34	16	11	171
Omusati	Otamanzi	32	15	11	161
Kavango East	Ndiyona	31	14	11	155
Oshikoto	Olukonda	31	14	11	154
Hardap	Rehoboth Rural	28	13	11	139
Omusati	Ruacana	28	12	11	137
Ohangwena	Ohangwena	25	11	11	123
Hardap	Rehoboth West Urban	24	11	11	118
Oshikoto	Omuntele	23	10	11	113
Omusati	Oshikuku	22	10	11	111
Karas	Karasburg West	22	10	11	110
Oshikoto	Onyaanya	22	10	11	108
Oshana	Ondangwa Urban	20	9	11	101
Kavango West	Mpungu	20	9	11	100
Oshana	Ondangwa Rural	20	9	11	98
Ohangwena	Oshikunde	19	9	11	95

Kavango West	Tondoro	18	8	11	88
Kunene	Outjo	18	8	11	88
Ohangwena	Omundaungilo	17	8	11	86
Kavango East	Rundu Urban	16	7	11	79
Oshikoto	Katima Mulilo Rural	16	7	11	78
Oshana	Uukwiyu	14	6	11	69
Otjozondjupa	Grootfontein	13	6	11	63
Oshana	Oshakati East	13	6	11	63
Omusati	Okahao	13	6	11	63
Hardap	Daweb	13	6	11	63
Omaheke	Gobabis	11	5	11	55
Khomas	Windhoek West	10	5	11	50
Ohangwena	Endola	10	4	11	49
Karas	!Nami -= Nus	9	4	11	46
Karas	Keetmanshoop Rural	9	4	11	45
Oshikoto	Eengondi	9	4	11	43
Ohangwena	Omulonga	8	4	11	41
Zambezi	Kabbe South	8	3	11	38
Oshikoto	Tsumeb	7	3	11	33
Omusati	Anamulenge	6	3	11	32
Oshikoto	Nehale LyaMpingana	6	3	11	30
Otjozondjupa	Otjiwarongo	5	2	11	27
Erongo	Swakopmund	5	2	11	26
Zambezi	Katima Mulilo Urban	5	2	11	24
Khomas	Windhoek East	4	2	11	19
Karas	Keetmanshoop Urban	4	2	11	18
Omaheke	Epukiro	3	1	11	14
Hardap	Mariental Urban	2	1	11	12

Khomas	Moses ||GaroÃ«b	2	1	11	10
Omaheke	Okorukambe	2	1	11	9
Kavango West	Nkurenkure	2	1	11	8
Erongo	Walvis Bay Urban	1	1	11	7
Ohangwena	Okongo	1	1	11	6
Otjozondjupa	Okahandja	1	0	11	5
Omaheke	Otjinene	1	0	11	5
Kavango West	Kapako	1	0	11	4
Khomas	Tobias Hainyeko	1	0	11	3
Oshikoto	Onayena	0	0	11	2
Otjozondjupa	Otavi	0	0	11	2
Oshana	Uuvudhiya	0	0	11	2
Kavango West	Ncamagoro	0	0	11	2
Khomas	Katutura East	0	0	11	2
Omusati	Onesi	0	0	11	1
Omusati	Outapi	0	0	11	1
Oshana	Okatana	0	0	11	0
Kavango East	Rundu Rural	0	0	11	0
Ohangwena	Ondobe	0	0	11	0
Otjozondjupa	Okakarara	0	0	0	0
Oshikoto	Guinas	0	0	0	0
Omaheke	Kalahari	0	0	0	0
Khomas	Katutura Central	0	0	0	0
Khomas	Khomasdal	0	0	0	0
Otjozondjupa	Omatako	0	0	0	0
Oshikoto	Omuthiyagwiipundi	0	0	0	0
Oshikoto	Oniipa	0	0	0	0
Khomas	John Pandeni	0	0	0	0
Erongo	Walvis Bay Rural	0	0	0	0

Khomas	Samora Machel	0	0	0	0
Kunene	Opuwo Urban	0	0	0	0
Kavango West	Mankumpi	0	0	0	0
Kavango West	Ncuncuni	0	0	0	0
Zambezi	Kongola	0	0	0	0
Zambezi	Judea Lyaboloma	0	0	0	0
Hardap	Aranos	0	0	0	0
Hardap	Rehoboth East Urban	0	0	11	0
Erongo	Arandis	0	0	11	0
Zambezi	Kabbe North	0	0	11	0
Omaheke	Aminuis	0	0	11	0
Ohangwena	Oshikango	0	0	11	0
Zambezi	Linyanti	0	0	11	0
Oshikoto	Okankolo	0	0	11	0
Total					38431

***Annex 6*. ASM distribution by District in Tanzania**

NAME_2	NUMPOINTS	Active ASM sites	ASM
Dodoma Urban	1	0	3
Lake Victoria	1	0	3
Chunya	1	0	3
Kisarawe	1	0	3
Arumeru	30	9	99
Masasi	100	30	330
Mbeya Urban	165	50	545
Kongwa	403	121	1330
Mbeya Rural	604	181	1993
Iringa Rural	983	295	3244

Morogoro Urban	1037	311	3422
Kondoa	2677	803	8834
Monduli	2679	804	8841
Rungwe	3772	1132	12448
Tarime	6106	1832	20150
Kyela	8024	2407	26479
Temeke	12533	3760	41359
Mbozi	21704	6511	71623
Kilombero	30451	9135	100488
Mvomero	32138	9641	106055
Morogoro Rural	47950	14385	158235
Kilosa	48050	14415	158565
Mbarali	66261	19878	218661
Ulanga	167427	50228	552509
Total			1495223

Annex 7. Zambia ASM distribution by district

Region	District	average number of ASM per site	# possible ASM sites	# of Active ASM sites	#ASM numbers
Central	Chibombo	25	3075	1230	30750
Central	Kabwe	25	560	224	5600
Central	Kapiri Mposhi	25	3695	1478	36950
Central	Mkushi	25	3186	1274.4	31860
Central	Mumbwa	25	3435	1534	38535
Central	Serenje	25	5101	2040	51007
Copperbelt	Chililabombwe	25	619	247.6	6190
Copperbelt	Chingola	25	2473	989.2	24730
Copperbelt	Kalulushi	25	650	260	6500
Copperbelt	Kitwe	25	1533	613.2	15330
Copperbelt	Luanshya	25	350	140	3500
Copperbelt	Lufwanyama	25	1850	740	18500
Copperbelt	Masaiti	25	448	179.2	4480

Copperbelt	MPongwe				
Copperbelt	Mufulira	25	586	234.4	5860
Copperbelt	Ndola	25	538	215.2	5380
Eastern	Chadiza	25	190	76	1900
Eastern	Chipata	25	6	2.4	60
Eastern	Katete	25	4	1.6	40
Eastern	Lundazi	25	3075	1230	30750
Eastern	Mambwe	25	0	0	0
Eastern	Nyimba	25	0	0	0
Eastern	Petauke	25	0	0	0
Luapula	Chiengi	25	0	0	0
Luapula	Kawambwa	25	0	0	0
Luapula	Mansa	25	5567	2227	55667
Luapula	Milenge	25	0	0	0
Luapula	Mwense	25	2783	1113	27833
Luapula	Nchelenge	25	0	0	0
Luapula	Samfya	25	0	0	0
Lusaka	Chongwe	25	44	17.6	440
Lusaka	Kafue	25	103	41.2	1030
Lusaka	Luangwa	25	0	0	0
Lusaka	Lusaka	25	0	0	0
Muchinga	Chama	25	541	216.4	5410
Muchinga	Chinsali	25	0	0	0
Muchinga	Isoka	25	0	0	0
Muchinga	Mpika	25	134	53.6	1340
Muchinga	Nakonde	25	0	0	0
North-Western	Chavuma	25	0	0	0
North-Western	Kabompo	25	0	0	0
North-Western	Kasempa	25	2550	1020	25503

North-Western	Mufumbwe	25	0	0	0
North-Western	Mwinilunga	25	3695	1478	36950
North-Western	Solwezi	25	1918	767	19177
North-Western	Zambezi	25	0	0	0
Northern	Chilubi	25	0	0	0
Northern	Kaputa	25	0	0	0
Northern	Kasama	25	0	0	0
Northern	Luwingu	25	199	79.6	1990
Northern	Mbala	25	0	0	0
Northern	Mporokoso	25	0	0	0
Northern	Mpulungu	25	0	0	0
Northern	Mungwi	25	0	0	0
Southern	Choma	25	0	0	0
Southern	Gwembe	25	0	0	0
Southern	Itezhi-Tezhi	25	0	0	0
Southern	Kalomo	25	0	0	0
Southern	Kazungula	25	0	0	0
Southern	Livingstone	25	0	0	0
Southern	Mazabuka	25			
Southern	Monze	25	182	72.8	1820
Southern	Namwala	25	521	208.4	5210
Southern	Siavonga	25	0	0	0
Southern	Sinazongwe	25	1311	524.4	13110
Western	Kalabo	25	0	0	0
Western	Kaoma	25	0	0	0
Western	Lukulu	25	0	0	0
Western	Mongu	25	0	0	0
Western	Senanga	25	0	0	0
Western	Sesheke	25	0	0	0

Western	Shangombo	25	0	0	0
Total					512 064

Annex 8. Zimbabwean ASM distribution by district

District	# Possible ASM sites	# Active ASM sites	Average number of ASM per site	total ASM
Bulawayo	154	92	23	2125
Harare	670	402	23	9246
Buhera	1500	900	23	20700
Chimanimani	476	286	23	6569
Chipinge	1829	1097	23	25240
Makoni	2257	1354	23	31147
Mutare	2823	1694	23	38957
Mutasa	701	421	23	9674

Nyanga	1183	710	23	16325
Bindura	1688	1013	23	23294
Centenary	1756	1054	23	24233
Guruve	3199	1919	23	44146
Mazowe	2953	1772	23	40751
Mount Darwin	1221	733	23	16850
Rushinga	519	311	23	7162
Shamva	1202	721	23	16588
Chikomba	241	145	23	3326
Goromonzi	440	264	23	6072
Marondera	126	76	23	1739
Mudzi	209	125	23	2884
Murehwa	23	14	23	317
Mutoko	3453	2072	23	47651
Seke	144	86	23	1987
UMP	855	513	23	11799
Wedza	1489	893	23	20548
Chegutu	976	586	23	13469
Hurungwe	508	305	23	7010
Kadoma	3728	2237	23	51446
Kariba	180	108	23	2484
Makonde	664	398	23	9163
Zvimba	824	494	23	11371
Bikita	241	145	23	3326
Chiredzi	590	354	23	8142
Chivi	881	529	23	12158
Gutu	833	500	23	11495
Masvingo	387	232	23	5341
Mwenezi	1212	727	23	16726
Zaka	807	484	23	11137
Binga	77	46	23	1063
Bubi	0	0	23	0

Hwange	67	40	23	925
Lupane	315	189	23	4347
Nkayi	155	93	23	2139
Tsholotsho	301	181	23	4154
Umguza	9	5	23	124
Beitbridge	366	220	23	5051
Bulilima (North)	15	9	23	207
Gwanda	1716	1030	23	23681
Insiza	828	497	23	11426
Mangwe (South)	54	32	23	745
Matobo	816	490	23	11261
Umzingwane	454	272	23	6265
Chirumhanzu	1169	701	23	16132
Gokwe North	821	493	23	11330
Gokwe South	437	262	23	6031
Gweru	883	530	23	12185
Kwekwe	3685	2211	23	50853
Mberengwa	1042	625	23	14380
Shurugwi	4541	2725	23	62666
Zvishavane	1325	795	23	18285
Total				