Mapping artisanal and small-scale mining in northwest Tanzania

A survey on its nature, scope and impact

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EDITORIAL

Mapping artisanal and small-scale mining in northwest Tanzania:
A survey on its nature, scope and impact

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Front cover image: Mine site in Serengeti district, Mara region (2017 – Photo: IPIS)

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The **International Peace Information Service (IPIS)** is an independent research institute providing tailored information, analysis and capacity enhancement to support those actors who want to realize a vision of durable peace, sustainable development and the fulfilment of human rights.

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EXECUTIVE SUMMARY

Tanzania's abundant mineral wealth provides a key livelihood and business opportunity to numerous artisanal and small-scale miners. In the past decade, Tanzania made significant progress in developing policy documents and legislation that regulate artisanal and small-scale mining (ASM). Enforcement and compliance remain however challenging due to difficulties in grasping the complexity of this heterogenous and dynamic sector.

This report, and the accompanying interactive web map and open database seek to contribute to a better and more balanced understanding of the sector and its impacts. As a first step to more systematic data gathering, storage and analysis on ASM in Tanzania, IPIS piloted a dedicated mobile data collection campaign in 4 regions of northwest Tanzania, namely Geita, Shinyanga, Mara and Kigoma. **447 mining and processing sites** were mapped and surveyed. 337 of them are gold sites, 84 limestone, 11 salt, 5 diamonds, and 10 work on a variety of other minerals including copper, opal, galena and magnetite.

We estimate that between 75,600 and 92,400 **workers** were directly engaged in mining and processing in these 4 regions during the rainy season, when data collection was done. 98% of them work in gold mining and processing, which forms the predominant focus of this report. In the dry season, working conditions are more favourable, and worker numbers are estimated to rise to between 99,300 and 121,400. Adding auxiliary services such as transport, construction, commerce, restaurants, and guesthouses, we gauge the number of people that both directly and indirectly work in ASM at between 302,400 and 485,600 in these 4 regions.

Miners and processors are a highly dynamic group of people. Particularly in gold mining, there are a lot of rushes in northwest Tanzania that may see thousands of workers come and go in a matter of months. 1 in 3 workers arrived from a different region, and many others travel within these vast regions in pursuit of employment opportunities. Often, sites have no adequate infrastructure to deal with the influx of workers. Over half of workers operate on a site that has a makeshift camp where workers live and sleep, in 1 out of 4 cases with families. This **mobility** evidently complicates regulation and formalisation, with 77% of miners and processors in this area working on unlicensed sites.

To manage this mobility and spread investment and risk, multi-tiered models of **organisation** have been set up, with meticulous chains of command and systems to divide labour and share production. Further, over half of all workers have a cooperative active on their site and license holders are represented in regional miners' associations. Yet, severe organisational challenges exist, mainly due to poor management, diffused responsibilities, biased representation and access to finance. The latter also impacts the pace of mechanising the sector, with 55% of mining sites still operating purely by hand tools, such as shovels, pickaxes and hammers. The processing sector is developing more quickly, with less than 20% of sites currently operating without any form of mechanisation. In the absence of formal financing arrangements, the dire capital needs in ASM are filled mainly by powerful gold trader networks that pre-finance operations in return for a monopoly on buying (part of) the production. These arrangements make miners vulnerable to debt bondage, risk to implicate legitimate operations in iniquitous practices and complicate oversight.

Contractual relations and salaries are rare. Workers at various echelons of the ASM hierarchy get their **income** through informal production sharing arrangements or output-based payments. This leads to considerable differences across minerals and between mining and processing. Gold mining is most profitable, earning a worker USD 90 to 110 a month. Gold processors earn on average 10% less. Salt mining is least rewarding, partly due to the fact that many workers do not operate during the rainy season, with an average monthly worker income of USD 25 to 31.

Women benefit considerably less from this mineral wealth than men. They make up only 20% of the total workforce and generally remain stuck in lower-level positions. They are mainly engaged in processing activities such as crushing and panning, which earn up to 66% less than what an average miner gets. ASM remains a particularly patriarchal sector where men are protective of their positions. ASM sites are also

ill-adapted to women, with, for instance, only 11% of sites having separate sanitary facilities. Paradoxically, most sites would not be able to function without women, who provide the bulk of support services, such as serving food, selling drinks, maintenance and transporting supplies.

Many **children** live on and around mining and processing areas. In recent years a lot of initiatives have been set up to stop their involvement in mining operations. These appear to be paying off, as IPIS identified only 4 children below the age of 15 engaged in mining operations. Their involvement in processing remains however widespread, with 15% of processing sites still engaging children. On about half of sites with child labour, children were reported to work during school hours.

Health and safety form a pressing concern on most ASM sites. 30% of workers have no access to sanitary facilities on the site where they work, and for many others they are in poor condition or insufficient in number. Combined with the lack of clean drinking water, dust and noise pollution, this forms a breeding ground for numerous infections and diseases. In addition, over 17% of sites experienced an accident in the year preceding IPIS' site visits. These accidents injured at least 175 workers and killed 90. Pit collapses are accountable for nearly half of injuries and one third of deaths. Other key accident causes are workers falling or slipping while entering or exiting a pit and equipment failure. Safety awareness is low, with poor digging techniques and scant use of personal protective equipment. Helmets, for instance, are only used on 16% of all mining sites, often only by a selection of diggers.

The use of **mercury**, a highly toxic chemical, in gold processing constitutes another important health concern. Its use was identified on 98% of all gold processing sites. Despite numerous sensitisation and training campaigns promoting a more responsible use of mercury, 3 of the 4 worst practices, set out in the 2017 Minamata Convention on Mercury, are widespread in the region. Firstly, retorts are rarely used. The gold-mercury amalgam is generally burned in open air, thereby releasing its toxic fumes to the atmosphere. Secondly, 71% of sites using mercury are close to residential areas, where children live and play, women prepare food, and households do subsistence farming. Finally, cyanide leaching is a booming business in the region. Leaching plants purchase tailings from ASM and process them without removing mercury residues. Contact with cyanide renders the latter even more toxic and accelerates its evasion to water, soil and air.

ASM further impacts the environment in northwest Tanzania through water pollution, deforestation and land degradation. As over 2 in 3 workers operate on a site that is close to a residential area, the above nuisances evidently also affect **local communities**. While frictions are common, outspoken conflict is rare and affects only 2% of all workers. There are a number of reasons for this. For one thing, mining is embedded in many of these communities. Numerous inhabitants either directly or indirectly depend on the sector to sustain their income. Over half of all mining and processing sites moreover make corporate social responsibility (CSR) contributions to health, education, road and village infrastructure in neighbouring communities. Furthermore, various actors, including the regional miners' associations, mining and village authorities play an active role to prevent and mediate conflict.

In light of some of the above issues, it is clear that considerable work remains to be done in enforcing Tanzania's comprehensive legal framework on mining. At least 10 different **state** institutions are involved in **oversight**, and together visit 94% of mining and processing sites. They perform various inspections, including on safety, environment, and health, they collect taxes, royalties and fees, provide training and assistance, collect data, take care of security and law enforcement, and mediate conflicts. Yet, cooperation and information exchange among state actors remain at present ad hoc, as there exists no central coordination. Consequently, many sites are only visited occasionally, for one specific function, or without knowledge on prior practices or inspections. Structuring and systematising this coordination, with a clarified division of responsibilities and channel of communication, could considerably increase the frequency, efficiency, impact and follow-up of current oversight endeavours.

LIST OF ACRONYMS

ASM	artisanal and small-scale mining
IPIS	International Peace Information Service
CSR	corporate social responsibility
LSM	large-scale mining
NGO	non-governmental organisation
RMO	Resident Mines Office
CHRAGG	Commission for Human Rights and Good Governance
PML	Primary Mining License
EPP	Environmental Protection Plan
IIED	International Institute for Environment and Development
STAMICO	State Mining Corporation
SMMRP	Sustainable Management of Mineral Resources Program
GST	Geological Survey of Tanzania
USD	United States Dollar
TZS	Tanzanian Shilling
FEMATA	Federation of Miners Associations of Tanzania
ML	Mining License
PL	Prospecting License
SACCOS	Savings and Credit Cooperative Societies
REMA	regional miners' associations
PSA	production sharing agreement
ILO	International Labour Organisation
CSO	civil society organisation
HRW	Human Rights Watch
PPE	personal protective equipment
UNEP	UN Environment Program
UN	United Nations
VPO	Vice-President's Office
GCLA	Chief Government Chemist Agency
NEMC	National Environment Management Council
TRA	Tanzania Revenue Authority
OSHA	Occupational Safety and Health Authority
TFDA	Tanzania Food and Drug Authority
TFS	Tanzania Forest Service
EIA	Environmental Impact Assessment
UNIDO	United Nations Industrial Development Organization

1. BACKGROUND TO THE REPORT AND WEB MAP

1.1. Introduction

Artisanal and small-scale mining (ASM) is the activity of extracting and processing minerals and gemstones with high labour-intensity and low levels of investments, technology and mechanisation. In Tanzania, the term small-scale mining is often reserved for licensed operations, while artisanal mining refers to activities that are not covered by a (proper) license.

ASM emerged in the beginning of the 20th century in Tanzania and has been continuously evolving since. Due to the rapid development of large-scale mining (LSM) since the 2000s, ASM represents, at present, a relatively small share of the total mineral production. For gold, for instance, which is Tanzania's predominant mineral, a recurring estimate is 10-15%. Nonetheless, ASM constitutes an important livelihood and business opportunity for many Tanzanians, particularly in poor rural areas. In a country that ranks 151 out of 188 on the UN's Human Development Index, with endemic poverty, youth unemployment, and serious challenges in infrastructure and social services provision, ASM offers important opportunities for socio-economic advancement.

The dominant image of ASM in Tanzania is however one of a disorganised activity that adversely impacts health, safety and environment. This is also how the country's ASM sector mostly makes the headlines today.[1] This unbalanced conception is to a large extent due to the scarce evidence on the sector. While numerous studies and reports have unravelled specific geographic or thematic components of ASM in Tanzania (see bibliography), there exists at present no systematic, comprehensive or representative data on its nature, scope and impact on the socio-economic and human rights situation in the country. Many figures that circulate resemble more back-of-the-envelope than evidence-based calculations. Such knowledge gaps, in turn, hinder the development of efficient policies to improve the governance of the ASM sector and its contribution to local development.

In this light, the present report, and the accompanying interactive web map and open database, seek to contribute to filing data gaps on ASM in Tanzania. This is based on a pilot survey on the socio-economic and human rights impact of artisanal and small-scale mining in 4 regions of northwest Tanzania: Geita, Mara, Shinyanga and Kigoma. We believe that sharing our findings from these four regions will improve the understanding of the sector's nature, scope and impact. It is moreover our hope that this will form the basis for further systematic research on ASM, both by extension to other regions and deeper analysis of specific aspects that are of interest to the various stakeholders working on improving its governance.

We present the findings as follows. The remainder of this chapter provides more detail on the survey methodology and web map as well as the broader project within which this report fits. A sketch of the evolving legal and policy context within which ASM operates in Tanzania is provided in Chapter 2. This is followed by three main chapters that present distinct but related components of our findings and analyses.

Chapter 3 focuses on the modus operandi of ASM. A first section presents a bird's-eye view on the sector's nature and scope. This spans various issues including the commonalities and differences between regions, the various minerals covered, the extent to which sites are licensed, their overall proximity to residential areas, site infrastructure, worker numbers and mobility. A second section explains to what extent and how mining and processing is managed on sites and in representative bodies such as cooperatives and associations. A third section subsequently unravels the production processes for the main minerals covered in our focal area, namely gold, diamonds, limestone and salt. Finally, we set out how the trade of these minerals is organised from the site-level to the main commercial hubs in Tanzania.

1 See for instance: F. Ng'wanakilala, 'Collapse of illegal Tanzanian gold mine kills 19 people', *Reuters,* 17.04.2015, <*https://uk.reuters.com/article/uk-tanzania-mine/collapse-of-illegal-tanzanian-gold-mine-kills-19-people-idUKKBN0N81VY20150417*>; 'Geita court remands 4 Nyarugusu mine workers', *The Guardian*, 28.2.2018, <*https://www.ippmedia.com/en/business/geita-court-remands-4-nyarugusu-mine-workers*>.

The fourth chapter elaborates and opportunities on the various socio-economic and human rights issues we uncovered in our data collection. It includes revenue sharing, wealth spill-overs to local communities, the role and position of women, the involvement of children, interrelated environmental, health and safety challenges, and the relations of miners with their neighbouring communities.

These challenges raise the question of government oversight, which forms the subject of Chapter 5. It expands on how and by which government institutions oversight is organised, and what they undertake on the level of monitoring, revenue collection, training and assistance, data collection, law enforcement and conflict mediation. Subsequently, the report draws lessons on where the current shortcomings and obstacles lie.

The conclusions draw from these different chapters to make the state of affairs on ASM in northwest Tanzania, and sketch a nuanced picture on its socio-economic and human rights impact.

1.2. Data collection methodology

The methodology to collect and analyse data builds on IPIS' long-standing experience with mapping artisanal mines in the Democratic Republic of Congo.[2] While the mining and security context is very different in Tanzania, many of the socio-economic and human rights challenges related to ASM are similar.

The data collection for this research was done by 8 civil society surveyors that were selected and seconded from non-governmental organisations (NGOs) in the four focal regions. IPIS equipped them with mobile phones and open-source mobile data collection applications to capture coordinates, take pictures and complete dedicated questionnaires. The surveyors were extensively trained by IPIS to survey mining and processing sites during a number of field missions. Through a combination of semi-structured interviews and observations, surveyors collected quantitative and qualitative data on a wide range of indicators, spanning the site's context, organisation of work, operational aspects of mining, processing and trade, and socio-economic and human rights impacts. The mobile data collection tools enabled hands-on follow-up by the Tanzanian project manager based in Mwanza and IPIS staff in Belgium.

Group picture with CSO surveyors representing the following NGOs: Rafiki Social Development Organisation, Foundation Help, Tanzania Women Empowerment in Action (TAWEA), Action for Democracy and Human Rights (ADLG), Mining and Environment Transformation for Development Organisation (METDO), Governance Links, Tanzania Health Care and Environmental Conservation (TAHECECO) and Kigoma and Ujiji Non-Governmental Organisations Network (KIUNGONET) (Mwanza, October 2017, Photo: IPIS)

2 See for instance: Y. Weyns, L. Hoex and K. Matthysen, *Analysis of the interactive map of artisanal mining areas in eastern DR Congo, 2015 update* (IPIS, Antwerp, 2016), 41p.; G. de Brier and H. Merket, *Monitoring report: Artisanal Gold Monitoring Pilot in Mambasa, Ituri, DRCongo* (IPIS, Antwerp, 2017), 46p.

The data was contextualised and cross-checked in various ways. This includes qualitative surveyor mission reports, various exchanges with field offices of the Ministry for Minerals (Resident Mines Offices) and the regional miners' associations, as well as follow-up visits by IPIS researchers to a selection of sites in all 4 regions. Moreover, IPIS organised a number of feedback workshops with surveyors and representatives from the Tanzanian authorities (Ministry for Minerals, Commission for Human Rights and Good Governance (CHRAGG) Mineral Resources Institute (MRI), Geological Survey of Tanzania (GST), State Mining Corporation (STAMICO) and the Vice-President's Office), the regional small-scale miners' associations and civil society.

Launch workshop of the data collection with representatives from the Ministry for Minerals, STAMICO, MRI, Geita Gold Mine, regional miners' associations, CHRAGG and civil society (Mwanza, October 2017 - Photo: IPIS)

One of the feedback workshops with representatives from the Ministry for Minerals, MRI, GST and the Vice-President's Office (Dodoma, April 2018 - Photo: IPIS)

1.3. Guide to web map

This section aims to assist users in exploring the different features of the interactive web map.[3]

The **search function**, in the upper left corner of the map, enables the user to search on the name of mining and processing sites, villages or towns.

Example of a pop-up window displaying site-specific socio-economic indicators

A **pop-up window** appears when clicking on a mining or processing site, displaying a picture of the site and key indicators organised under five tabs:

- *Site information*: visit date; presence of a cooperative; number of active pits;
- *Minerals*: mineral(s) mined and/or processed; worst practices of mercury and cyanide use in gold processing;
- *Socio-economic*: number of workers directly engaged in mining and processing, number of women workers in mining and processing; proximity to residential areas; engagement of the site in corporate social responsibility; type of on-site buildings; presence of on-site camp, number of residents and presence of workers' families; incidents that occurred during the past year;
- *Health and safety*: presence and type of sanitary facilities; number of wounded and deaths in site accidents, and the causes of these accidents; number of children below the age of 15 engaged in mining and processing tasks, and the kind of tasks they execute; number of children below the age of 15 engaged in other auxiliary tasks, and the kind of tasks they execute;
- *State service visits*: the different state services visiting the site in the course of the past year, as well as the frequency and function of their visits.

Part of the interactive menu on the right-hand side of the map

Through an **interactive menu** on the right-hand side of the map, the user can apply several filters to the data, allowing to tweak the map to specific interests. These filters allow to select sites based on the kind of minerals, mining and/or processing activity, worker numbers, state services visiting, use of mercury, cyanide leaching, and the occurrence of accidents causing injuries or fatalities in the past year. It also allows the user to select additional map layers, such as the geological Greenstone belt and data from the World Resources Institute on protected areas.

3 See: http://ipisresearch.be/mapping/webmapping/tza/v1.

1.4. Project background

This study forms part of a 30-month project, which started in January 2017, on "Mapping the socio-economic and human rights impact of small and large-scale mining in northwest Tanzania". Funded by the Belgian development cooperation as part of a program on Human Rights and Digitalisation, the project uses digital technologies to bridge information gaps around mining in Tanzania. This is done in two main phases.

The first phase consists of a broad mobile survey on the socio-economic and human rights impact of both small and large-scale mining. The data on small-scale mining is presented in this report and the accompanying map and open database. On large-scale mining, IPIS surveyed all communities around 6 selected mines in northwest Tanzania on their perceptions regarding the impact of these operations. The findings of this data collection will be published in the coming months.

Building on this data, a second phase consists of piloting a mobile incident detection mechanism. A selected number of trained key informants in the 4 focal regions can report incidents through IVR (interactive voice recording, or automated calls). These incidents are registered on an online platform that enables anonymous case handling and visualises key incident indicators in real-time on a map and various infographics. This incident detection mechanism was launched in October 2018. IPIS will report on the findings and lessons learned in the first half of 2019.

2. EVOLVING POLICY AND LEGAL FRAMEWORK

ASM has travelled a long way in Tanzania, from the impromptu development of the sector by European settlers in the late 1800s, to today's intricate governance in various acts and regulations. This chapter provides a concise scan of the main evolutions in the legal framework, professionalisation and formalisation efforts and the recent changes set in the policy and legal framework.

2.1. ASM in an evolving legal framework

Following the neglect of small-scale mining in the colonial mining laws, it was discouraged upon independence as it did not fit the state-centralised approach to economic development.[4] The **1979 and 1998 Mining Acts** recognised ASM and opened some avenues for its formalisation. The latter is the umbrella term used for all efforts that seek to bring ASM in line with the applicable rules and regulations and thereby integrate it in the formal economy. The 1998 Mining Act most importantly introduced specific titles for Tanzanian small-scale miners, namely Primary Mining Licenses (PMLs). However, the respectively socialist and neoliberal inspiration of these laws meant that in 1979 the predominant focus was on establishing strong state control and ownership over the sector, while the emphasis in 1998 was on attracting large-scale foreign investment.[5]

Nonetheless, the downturn in agricultural commodity prices and the demise of many state-owned (mining) enterprises during the 1980s, stimulated a great number of Tanzanians to try their luck in ASM. The World Bank estimates that, between 1987 and 1997, ASM accounted for 95% of the country's mineral production. As the authorities did not put a lot of effort in informing artisanal miners about their rights and duties, the bulk of this development occurred outside government procedures.

The vain hope of shared prosperity from large-scale mining incited a contentious and still unresolved debate about the contribution of exploiting Tanzania's natural resources to the country's development. In 2007, this led to the appointment of a Presidential Mining Review Committee, under the chairmanship of former Attorney General Bomani. In their 2008 report, the committee identified key policy, legal and practical gaps, challenges and risks, and formulated concrete proposals to leverage the economic potential of the extractive sector.[6] Some of these proposals were integrated in the 2009 Mineral Policy, the **2010 Mining Act** and a number of accompanying regulations.[7]

The amended legal framework included a number of small but relevant **changes for small-scale mining**, which it defines as prospecting or mining operations with a PML "whose capital investment is less than USD 5 million".[8] Three of these changes are worth mentioning. First, applying for PMLs was facilitated, among others by decentralising administration to Zonal and Resident Mining Offices. Moreover, in an attempt to reduce the risk of nepotism, licenses were from now on granted on a 'first come, first serve' basis. Second, those who obtain a PML were now required to submit an Environmental Protection Plan (EPP). Third, the Act establishes designated areas for small-scale mining (see Map 1). To date there

4 For more on the history of (gold) mining in Tanzania, see for instance: S.L. Chachage, 'The meek shall inherit the earth but not the mining rights: the mining industry and accumulation in Tanzania', in P. Gibbon, *Liberalised Development in Tanzania: Studies on accumulation processes and local institutions* (Nordiska Afriainstitutet, Uppsala, 1995), pp. 37-108; T. Lissu, 'In Gold We Trust: The Political Economy of Law, Human Rights and the Environment in Tanzania's Mining Industry', *Law Social Justice and Global Development Journal,* 2001, 2; S. Lemelle, *Capital, State and Labour: A History of the Gold Mining Industry in Colonial Tanganyika, 1890-1942* (PhD Thesis, University of California, 1986), 425p.

5 Society for International Development, *The Extractive Resource Industry in Tanzania: Status and Challenges of the Mining Sector* (SID, Nairobi, 2009), pp. 21-26.

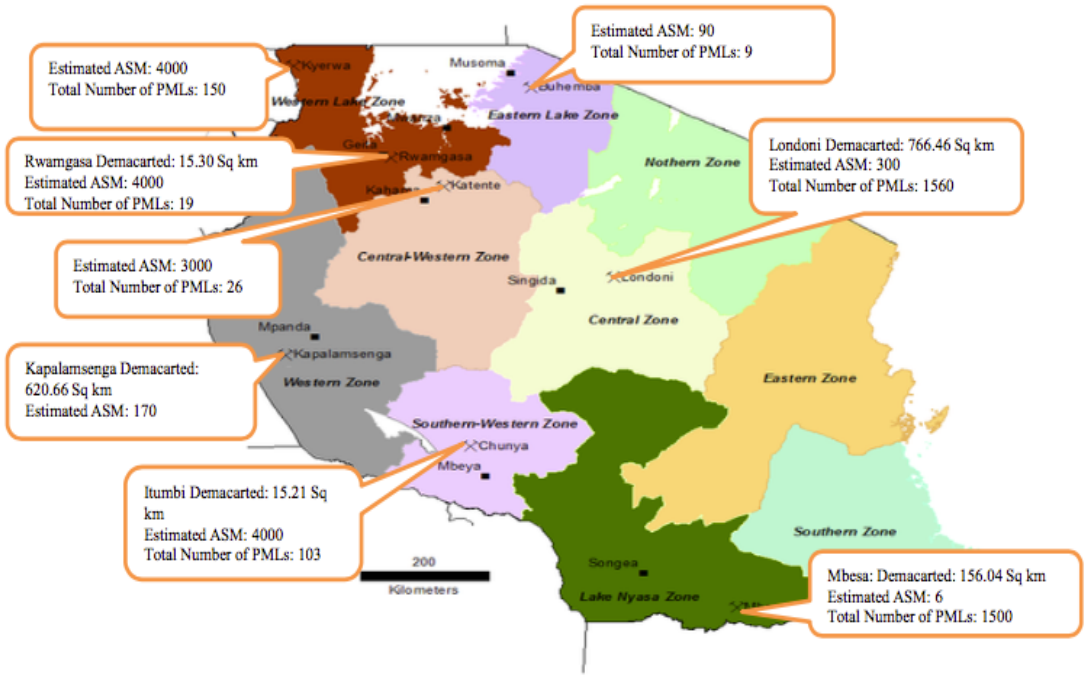
6 This Committee built further on the work undertaken in 2004 and 2006 by respectively the Kipokola and Masha Committees; United Republic of Tanzania, *Report of the presidential mining review committee to advise the government on oversight of the mining sector (Bomani Report)*, 2008.

7 These included regulations on issues related to mineral rights, mineral trading, mineral beneficiation, safety and occupational health, environmental protection, and radioactive minerals (United Republic of Tanzania, Mining Act, Supplement No. 14, 3.4.2010).

8 This was initially USD 100,000, but raised to USD 5 million in a 2015 amendment to the Mining Act. The precise meaning of 'capital investment' is nowhere defined.

are 36 such areas, representing a total of over 280,000 hectares. The number of PMLs rose from a mere 35 in 1999[9] to an annual average of approximately 5,500 between 2010 and 2017.[10] Such developments illustrate that these legal changes are gradually pulling ASM into formality.

It is remarkable that the mining legal framework equates small-scale mining with primary license holders. The small-scale mining workforce is nowhere mentioned in the legislation, and thus has no rights to claim, or responsibilities to uphold. The near complete absence of employment contracts (see further Chapter 3), and the lack of individual miners' licenses, means that the bulk of the ASM workforce remains therefore informal. This tends to put them in the same basket with all unlicensed mining activities. The neglect of those who are actually doing the mining, evidently weakens professionalisation and formalisation efforts.



Designated areas for small-scale mining in the country's 10 mining zones

Source: M. Barry (World Bank), Challenging of measuring results for artisanal and small-scale mining, presented at 10th ICGLR-OECD-UN GoE Joint Forum on Responsible Mineral Supply Chains, OECD Conference Centre, Paris, France (10-12 May 2016).

2.2. Professionalisation and formalisation efforts

These legal changes were accompanied by a number of **practical interventions** to support, professionalise and formalise ASM. First, in 2014, the mandate of the State Mining Corporation (STAMICO) was extended beyond overseeing government interests and investments in mining, to include coordinating the transformation of ASM into a well-organized, mechanised, productive and environmentally responsive subsector. Under the supervision of STAMICO, the government established a small-scale mining facility to microfinance the mechanisation of ASM operations. In 2016 this facility disbursed around USD 3 million to 111 PML holders in different mining zones. The facility is however struggling to have a lasting impact. During the data collection for this project we came across a number of big investments that were

9 World Bank, *International Development Association Project Paper on a Proposed Additional Credit to the United Republic of Tanzania for the Sustainable Management of Mineral Resources Project* (Report No: PAD 1177, World Bank, 2015), p. 5.

10 Based on data presented in W. Mutagwaba et al., *Artisanal and small-scale mining in Tanzania: Evidence to inform an 'action* dialogue (IIED, 2018), pp. 29-30.

gathering dust, because of shortage of capital to finalise or repair the installation, or a lack of knowledge on how to operate it. Various miners complained that application procedures were overtly stringent[11] and that the resources mainly went to the lucky and well-connected few that already owned the most advanced operations. In August 2018, the Minister for Minerals suspended the system, admitting that the grants had too often fallen into the wrong hands or been assigned to the wrong investments.[12]

Further, with the support of the World Bank's Sustainable Management of Mineral Resources Program (SMMRP), the government is building seven mineral processing demonstration centres.[13] Besides technical and capacity support, these centres aim to curb the polluting and often dangerous processing taking place on ASM sites, and contribute to a better monitoring of ASM production. In a similar fashion, with the support of the Multi-Stakeholder Partnership Initiative (MSPI) on ASM-LSM Coexistence, the government established two demonstration mines in Rwamgasa (Geita region) and Tarime (Mara region). These strive to improve working and livelihood conditions for small-scale miners, reduce environmental impact and improve ASM-LSM co-existence. Further, STAMICO and the Geological Survey of Tanzania (GST) have started a geological exploration campaign in a number of ASM zones to improve the efficiency of operations.[14]

So far, these top-down technical interventions have only benefited a minority of small-scale miners. The crucial challenge remains to align this support, and by extension the legal framework as a whole, to the heterogenous and amorphous nature of ASM, in order to have a more wide-ranging and lasting impact.

A key obstacle in this endeavour is the **licensing** of ASM. The drive to catch up with the reality on the ground is hampered by a number of factors. A first stumbling block reported by many small-scale miners is the high cost of applying for Primary Mining Licenses (PMLs). This includes an application fee of TZS 50,000 (USD 22), processing fee of TZS 50,000, travel costs to launch and follow-up on procedures, annual rent of TZS 80,000 (USD 35) per hectare, and a renewal fee of TZS 100,000 (USD 43) after 7 years. More important than these costs, is the lack of awareness and understanding among miners of their rights and duties, the status of the land and the complex and bureaucratic licensing procedures. The mining authorities are making efforts to sensitise ASM stakeholders and disseminate information (see Chapter 5), but lack the resources and capacity to do this on a sufficiently wide scale. At the end of 2015, they launched an Online Mining Cadastre Transactional Portal, which enables web-based applications for licenses, verification of existing licenses, secured payments, sending work performance reports and finding geological maps and mineral data. However, the vulgarisation of this platform has not been particularly successful, not the least because it is only accessible in English. The information asymmetry favours well-connected, typically urban, political and economic elites, who are often quick to secure claims upon new mineral discoveries or mining rushes, or for mere speculation.

Such speculation, as well as the high mobility of small-scale miners (see further section 3.2.1.), implies that only a minority of PMLs is active at any moment in time. According to STAMICO, only 626 out of 4,737 PMLs (or 13%) in the 36 demarcated ASM zones were active in 2017.[15] These inactive licenses, in combination with the large swaths of land held by large-scale investors for mining and prospecting, leads many small-scale miners to complain that few profitable areas are left for them to exploit. In a move to free up more land for ASM, a government audit in 2017 led to the cancellation of 2,153 licenses that were laying idle.[16]

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11 These requirements include a "valid license approved by the Commissioner for Oaths; copies of the certificate of registration of a company or association, and its constitution certified by Commissioner for Oaths; copies of receipts for payment of the annual government fees, royalties, Taxpayer Identification Number (TIN) and taxes within the preceding six months; environmental management plan approved by the ZMO; … quarterly report of production for the preceding six months … at least two years' experience in operations; the existence of production activities in a project; a plan that meets the level of grant requested; and measurable indicators of sustainability without disruption to or relocation of communities" (Ibid., p. 76).

12 M. Nkwame, 'Government suspends small-scale mining subsidies', *Daily News,* 03.08.2018, <*https://dailynews.co.tz/news/2018-08-035b64053dafda7.aspx*>.

13 In Buhembe (Mara), Mpanda (Katavi), Katente (Geita), Kyerwa (Kagera), Chunya (Mbeya region), Maweni (Tanga) and Kilwa (Lindi).

14 These include Bukombe (Geita), Chunya (Mbeya), Mpanda (Katavi region) and Buhemba (Mara region).

15 Mutagwaba et al. (2018), p. 61.

16 Ibid., p. 62.

2.3. Recent legal and institutional reforms

With the election of John Magufuli as President in November 2015, Tanzania appears to have a leadership that is friendlier towards ASM and considerably more critical of LSM, and its allegedly substandard contribution to national development. In December 2016, Magufuli set the tone by reversing a decision from the Ministry for Minerals to expel artisanal miners from a license held by the UK-listed Acacia Mining in Shinyanga. Instead, he ordered to revoke the industrial licence, justifying the choice for ASM as follows: "They mined the area for more than 10 years and then someone who has money comes and buys the land plus issuing a 10-day ultimatum to the more than 15,000 people in those areas to leave … I say no to this during my presidency".[17]

Following a strained dispute with industrial miners (mainly Canadian Barrick Gold, parent company of Acacia Mining) over alleged underreporting of gold and copper exports, the Government imposed a ban on exporting mineral concentrates and pushed through a number of **legislative amendments** to the mining code. Under a certificate of urgency, three bills were tabled in June and adopted in July **2017**.[18] These changes focused on capturing more revenues from large-scale mining.[19]

A number of changes are also relevant for ASM. Two important reforms are of **institutional** and administrative in nature. Firstly, the Mining Advisory Board, the Tanzania Minerals Audit Agency (TMAA) and the Zonal Mines Offices were dissolved. All their functions, as well as most of those of the Commissioner for Minerals, were assigned to a new Mining Commission. The latter saw the light of day in April 2018 and is charged with wide-ranging tasks and responsibilities, including decision-making on awarding and revoking mineral rights, monitoring and auditing mining operations, and establishing market and clearing centres for minerals across Tanzania. This high-ranking body has a full-time chair[20] as well as an executive secretary, and consists of six commissioners, including 4 permanent secretaries of key ministries, the Deputy Attorney General and the Chief Executive Officer of the Federation of Miners Associations of Tanzania (FEMATA). In October 2017, in the aftermath of these changes, the Ministry for Energy and Minerals was moreover split in two separate Ministries, one for Energy and another for Minerals.

Secondly, Mines Resident Officers (MRO) will be appointed by the Commission "in every mining site where mining operations take place" to continuously monitor the production process and verify records.[21] Quite confusingly, the Act does not explain how this function differs from that of the already existing Resident Mines Offices (RMO), which are mentioned separately in the Act, and used to cover part of a mining zone under the now abolished Zonal Mines Office's responsibility. Neither does the Act specify what constitutes a mining site. Will Mines Resident Officers perhaps only be appointed to large (and medium) scale mines, or does size not matter? Appointing such an officer to every PML would in any case involve an enormous and unprecedented decentralisation exercise. It seems more likely that the MROs will be organised on the model of the former strategic audit stations of the TMAA,[22] which were set up on-site in large mines and close to processing facilities.

Other changes that **impact ASM** are the increase in royalty rates on diamonds and gemstones from 5 to 6 % and on metallic minerals from 4 to 6% of gross value; the introduction of a 1% clearing fee for mineral

17 'Tanzania: Marching Orders for Meat Factory, Mining Investors', *Daily News*, 13.01.2017, <https://allafrica.com/stories/201701130123.html>.

18 These consisted of the Written Laws (Miscellaneous Amendments) Act 2017 ("Amendments Act"), the Natural Wealth and Resources (Permanent Sovereignty) Act 2017 ("Sovereignty Act") and the Natural Wealth and Resources (Review and Re-Negotiation of Unconscionable Terms) Act 2017 ("Contract Review Act"). In addition, seven Regulations, amended at the beginning of 2018, give further body to these changes: Mining (Mineral Rights) Regulations No. 1, Mining (Minerals and Mineral Concentrates Trading) Regulations No. 2; Mining (Local Contents) Regulations No. 3, Mining (Radioactive Minerals) Regulations No. 4, Mining (Mineral Beneficiation) Regulations No. 5, Mining (Geological Survey) Regulations No. 6, Mining (Audit and Inspection of Records) Regulations No. 7.

19 See further: N. Woodroffe, M. Genasci and T. Scurfield, 'Tanzania's New Natural Resources Legislation: What Will Change?', *NRGI Briefing*, August 2017; T. Jacob and R.H. Pedersen, 'New resource nationalism? Continuity and change in Tanzania's extractive industries', *The Extractive Industries and Society*, 2018, 5(2), pp. 287-292.

20 The former Vice-Chancellor of the University of Dodoma Idris Kikula.

21 2017 Amendments Act, Article 29(1).

22 G. Schoneveld et al., *The new face of informality in the Tanzanian mineral economy: Transforming artisanal mining through foreign investment?* (IIED, London, 2018), p. 42.

exports; and the imposition of strict liability for pollution damage on any license holder, as well as those conducting mining operations without a license.

Despite the changing rhetoric on ASM and the growing importance of the sector, it is striking that the 2017 and 2018 legislative amendments hardly address small-scale mining. The only dedicated reference to small-scale miners is that PML holders can now contract foreigners for technical support (upon recommendation from the RMO and approval by the Mining Commission). The 2017-2018 legal reforms did not grasp the opportunity to better exploit the socio-economic development potential of ASM. Another important void in the legal framework for mining is its human rights impact. Even though this forms a key component of the 2009 Africa Mining Vision (AMV), to which Tanzania fully subscribes,[23] none of the above acts and regulations directly seeks to improve the human rights impact of mining.

23 In 2014, with the support of the UN Development Program (UNDP) and the African Minerals Development Centre (AMDC), the Government of Tanzania engaged in a process to translate the AMV into a Country Mining Vision.

3. MODUS OPERANDI OF ASM IN NORTHWEST TANZANIA

Although chaotic and impenetrable at first sight, ASM in northwest Tanzania constitutes a non-centrally planned and organically grown microcosm with strikingly typifying and recurring organisational models and processes. A first section presents a bird's-eye view of ASM in northwest Tanzania. Secondly, we will go deeper into how small-scale miners and processors organise themselves on-site and in representative bodies such as cooperatives and associations. The production process for the four main minerals in our focal area, namely gold, alluvial diamonds, limestone and salt is set out in a third section. The chapter ends with a presentation of the mineral trade patterns.

3.1. Bird's-eye view on ASM in northwest Tanzania

The general description of ASM as 'labour-intensive and capital-, mechanisation- and technology-poor'[24] involves a wide variety of operations. Northwest Tanzania consists of sites that are big and small, organised and scattered, formal and informal, licensed and unlicensed, and all the various appearances that lie between these broad categories. Our sample includes vibrant mining rushes that put up to 11,000 people to work in the dry season, as well as two farmers operating a pit on their land for a few months each year. It covers sites with and without PML, small-scale operations on large-scale mining or prospecting licenses, as well as industrial medium-scale mining on (parts of) small-scale licenses. We have identified different operations within a single license, as well as various licenses forming one operation. On some sites only mining (digging, drilling, loading) is done, others host solely processing activities (crushing, grinding, milling, washing) and yet others combine both.

This section therefore first of all defines the units of analysis that were used to bring order in the tangle of mining and processing sites (subsection 3.1.1.). In a second instance we rely on these definitions to explore the nature (subsection 3.1.2.) and scope (subsection 3.1.3.) of artisanal and small-scale mining and processing in northwest Tanzania.

3.1.1. Units of analysis: mining, processing and combined sites

As it is easy to lose oversight in mapping the myriad of sites, we decided to distinguish three different units of analysis: mining sites, processing sites and combined (mining and processing) sites.

We define a **mining site** for the purposes of this mapping as the highest single management system that groups mining activities in a delimited area. In other words, all workers who form part of the same chain of command in a single geographic location make up one mine site. Specifically, if adjacent licenses are operated by the same management, we consider this as one mine site. If a license holder sublets part of his license to another operator with its own chain of command, these are seen as two distinct mines. Two non-adjacent sites operated by the same management are also mapped separately.

If we would take the same approach for mapping **processing sites**, we would end up with thousands of small overlapping entities, particularly for gold processing. This subsector consists of numerous small entrepreneurs who install processing units close to mine sites, villages or water sources and engage a few laborers. They tend to operate independently without an overarching management structure. In this light, we opt to define processing sites in spatial terms, as the whole of adjacent processing units in one geographic location.

24 International Council on Mining and Metals, *Working together: How large-scale mining can engage with artisanal and small-scale miners* (ICMM, London, 2010), p. 5.

Various gold processing sites (Shinyanga, Mara and Geita, 2018 - Photo: IPIS)

Regularly, such processing units are scattered across mining sites under diverse arrangements with the mine management (see section 3.2.1.). With workers shifting from mining to processing from one shift to the next, it does not make sense to distinguish both activities. Therefore, we define these as **combined** (mining and processing) **sites**.

In this informal and highly dynamic sector, there are evidently grey zones where it becomes hard to apply these units of analysis stringently. Management structures evolve constantly and are not always clear to workers, let alone to IPIS surveyors. Mining and processing sites grow organically and the distinction between adjacent and combined sites is not always easy to make. We take these caveats into account in interpreting the data throughout this report. For one thing, the focus will be on the total picture rather than the specifics of individual sites. For another, given that identifying sites can be arbitrary, we disaggregate the data both in terms of site and worker numbers.

3.1.2. Main characteristics of ASM sites in Geita, Shinyanga, Mara and Kigoma

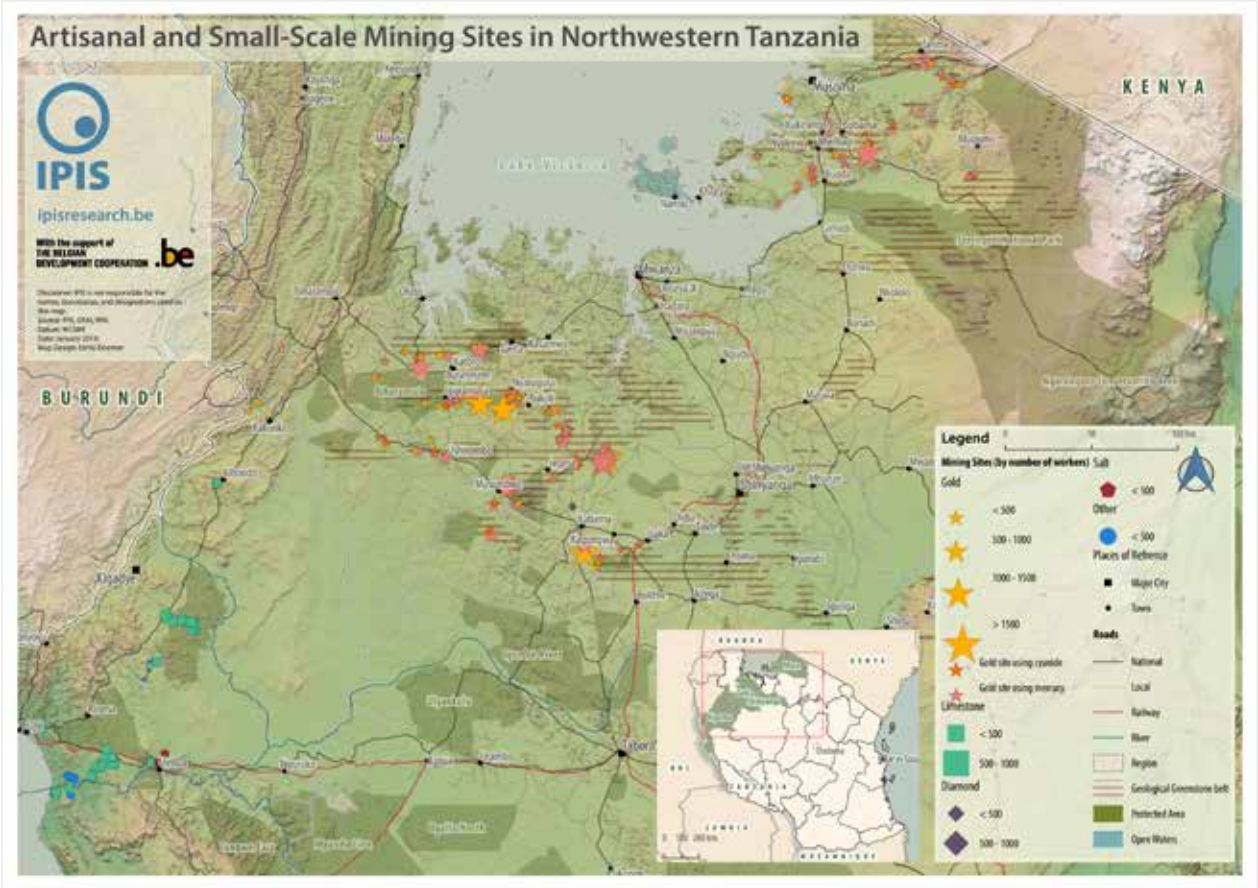
IPIS' mobile data collection campaign covered 4 of Tanzania's 26 regions, namely **Geita, Shinyanga, Mara** and Kigoma, with a combined size of 97,755 km^2.[25] Geita is one of Tanzania's most known ASM regions. Together with Shinyanga and Mara it forms part of the Lake Victoria Greenstone Belt, which further passes through Mwanza, Simiyu and Tabora. Since gold was discovered by German settlers in 1898, this gold-rich belt has attracted countless miners. On top of this lasting gold rush, diamonds were discovered in Shinyanga in 1939 by the Canadian geologist Dr John Williamson. The large-scale mine he founded is

25 Their combined surface is comparable to Hungary, South Korea, or 3 times the size of Belgium.

still operational to date, currently under a joint venture between UK-listed Petra Diamonds and the Tanzanian government. These three regions are further home to 4 major industrial gold mines: Geita Gold Mine (operated by the South African AngloGold Ashanti), and Buzwagi, Bulyanhulu and North Mara Gold Mines (operated by Acacia Mining, which has the Canadian Barrick Gold as majority shareholder).

Kigoma is less known for mining. Despite its Lake Tanganyika port and railway connection to Dar es Salaam giving it a rich history as transit hub to countries like the Democratic Republic of Congo, Burundi, Rwanda, Uganda and Zambia, it is at present one of Tanzania's poorest and least developed regions. It has known deposits of various minerals, but only limestone, salt and to a lesser extent gold, copper, and opal are commercially extracted by small-scale miners. Salt mining around the town of Uvinza has the longest history in Kigoma. German records from the end of the 19th century indicate that up to 20,000 workers were active in the sector, reaching a notable annual production of 350 tons of salt.[26] The mining of limestone also dates from colonial times, with several of the old kilns (i.e. heating chambers) still in use today. Industrial minerals (also referred to as development minerals) like salt and limestone have considerable potential in Tanzania, but their low value-to-volume ratio puts considerable strain on profit margins.

In these 4 regions we **surveyed 447 sites**. 337 of them are gold sites, 84 limestone, 11 salt, 5 diamond, and several others (including 4 copper, 4 opal, 1 galena and 1 magnetite site). 75% of sites in our sample thus focus on gold. These employ 98% of all surveyed miners and processors, making gold extraction evidently the predominant focus of this research.[27] On the bulk of sites, miners exploit a single mineral. On 4 sites only did a small fraction of workers dig for a second mineral.[28]

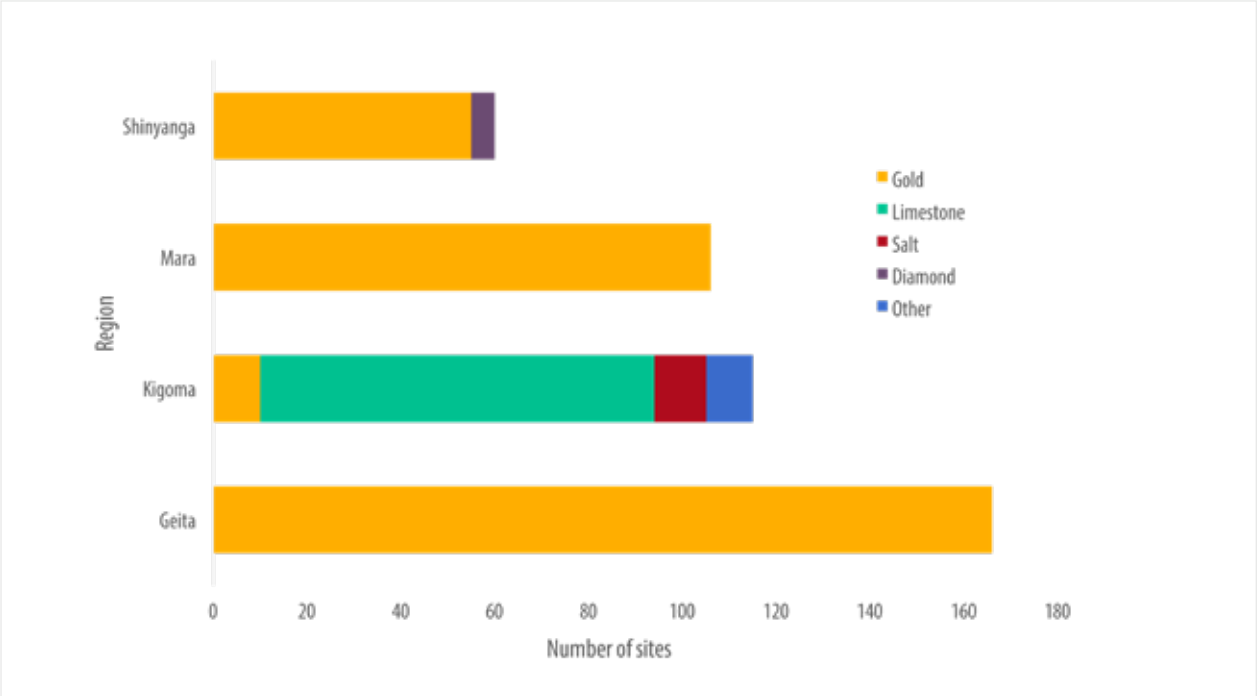


26 P. Lane, 'Iron Age (Later): East Africa: Salt', in K. Shillington, *Encyclopaedia of African History* (Taylor and Francis, New York, 2005), p. 698.

27 This is not representative for Tanzania as a whole. A 2012 study commissioned by the Ministry of Energy and Minerals estimated that 58% of ASM workers is active in gold, 24% in building materials, 12% in coloured stones, 2% in diamonds, 2% in salt and another 2% in copper (Ministry of Minerals and Energy, *ASM Baseline Survey, 2012*).

28 This includes 3 gold mines where respectively copper, limestone and opal are extracted, and 1 mine digging for 3 types of opal. A number of gold sites has known deposits of iron and copper, but there was no interest to exploit these.

Graph 1: Number of sites for each mineral, by region



44% of all surveyed sites (representing 22% of workers) were reported to have a Primary Mining **License**. 5 surveyed mines operate on a Mining License (ML), which allows capital investments up to USD 100 million (whilst PMLs are limited to USD 5 million).[29] Holders of an ML or PML have the right to process the minerals they extract on their licensed area. However, if they want to process elsewhere, or if somebody without a mining license wants to engage in mineral processing, they should apply for a license.[30] This is poorly enforced, as only 30% of processing sites were reported to have a license, compared to 60% of mines and 54% of combined sites. 74% of licenses are reportedly owned by private persons, 15% by co-operatives, 7% by companies, and 6% by associations or community-based organisations.[31]

233 sites, employing 77% of all surveyed workers, have no license or operate illegally on a Prospecting License (PL), with or without permission from the license holder. Either they don't know how or don't see the need to apply for a license, do not have the knowledge or resources, or first want to be sure that it is worth the effort. Several miners moreover noted that they had applied for a PML, but did not yet receive a reply as the process was put on hold in July 2017, awaiting the assignment of the new Mining Commission. In May 2018, less than a month after all members were appointed, the Commission approved 7,000 of the 8,000 pending license applications, of which 70% were PMLs.[32]

67% of workers operate on sites that are **close to residential areas**. This number rises to 80% if we only include sites where processing is done. There are a number of reasons for this coalescence of processing and residential areas. Firstly, just like human settlements, processors are drawn to water sources. Secondly, the proximity to villages gives processors a comparative advantage in terms of labour force, transport and trade. Thirdly, ASM is a key driving force in the rapid expansion and proliferation of rural areas across Tanzania.[33]

29 Contrary to PMLs, MLs are not limited Tanzanians (except for gemstones where foreign investments require ministerial approval) and are granted for 10 instead of 7 years.

30 Some processing sites were reported to be working on a PML, others on a processing license and yet others on a business license.

31 In terms of worker numbers cooperatives hold the biggest licenses (with an average of 214 workers), followed by associations and CBOs (170 workers), companies (69 workers) and private persons (33 workers).

32 L. Kasumuni, 'Tanzania Mining Commission approves 7,000 licenses', *The Citizen,* 29.5.2018, <*https://www.thecitizen.co.tz/News/Commission-approves-7-000-licences/1840340-4584660-kqvsrv/index.html*>.

33 For an elaborate analysis: D. F. Bryceson, J.B. Jønsson, C. Kinabob and M. Shand, 'Unearthing treasure and trouble: mining as an impetus to urbanisation in Tanzania', *Journal of Contemporary African Studies,* 2012, 30(4), pp. 631-649.

Camps of limestone miners in Makere, Kigoma (2018 - Photo: IPIS)

Regularly, mining and processing sites become places of residence of their own. 53% of workers operate on a site that has its own camp where workers live and sleep. These camps often consist of makeshift shelters. Several surveyors reported that workers were sleeping inside pits and shafts in the absence of tents. In nearly 1 in 4 camps workers live with their spouses and children. 69% of the people living in these camps are close to a residential area, so remoteness is not the mainspring. Rather it seems that the high worker mobility, and the fact that many towns and villages are bursting at the seams, pushes numerous workers towards these camps.

There are big differences between sites in terms of **infrastructure**. 5% of the labour force in our sample works on – mainly small – sites without any infrastructure. 60% has only makeshift structures in their workspace, 32% has a combination of makeshift and permanent infrastructure and 3% works on sites that are fully equipped with permanent buildings. Kigoma's sites are least developed, with only 9% of workers having permanent buildings on their site, and 32% having no infrastructure at all.

Pit shelters (1), Mining rush turning into a makeshift village with shops, guesthouses and restaurants (2), Permanent explosive storage building (3)

3.1.3. Scope of ASM: worker numbers and mobility

As in many countries, it is **hard to find good data** on ASM in Tanzania. Whereas STAMICO, the small-scale mining division of the Ministry for Minerals and the RMOs all monitor ASM, there is at present no central data gathering and storage system. A nation-wide survey in 2011-2012 by the Ministry for Energy and Minerals gauged the number of people directly working in ASM at 680,385, 58% of which working in the gold sub-sector.[34] Other estimates range from 500,000[35] over 700,000[36] to 1.5 million ASM workers.[37]

Keeping track of worker numbers is particularly hard for a number of reasons. Decent site-level records are rare and – particularly on large mines – the site management itself has often no clue of how many people are working on their claim. Besides the informal manner in which labour is organised (see section 3.2.1.), this is due to the high labour mobility. Workers move constantly between mining and processing, and from one site to another. Local authorities do not keep track of such incoming or outgoing migration either.

Taking into account these complexities, **IPIS** surveyors developed **estimations** for worker numbers on each site as precisely as possible. They only covered people directly engaged in mining and processing, excluding support services such as small businesses, vendors, taxi drivers, and holders and staff of restaurants and guesthouses. On large sites, with often numerous miners working underground and a sizeable non-mining or non-processing population, workers could evidently not be counted physically. Surveyors were trained to develop approximations by multiplying the average number of workers per pit or processing unit by the total number of pits or units, and adding other operational functions such as inspectors, managers and administrative staff.

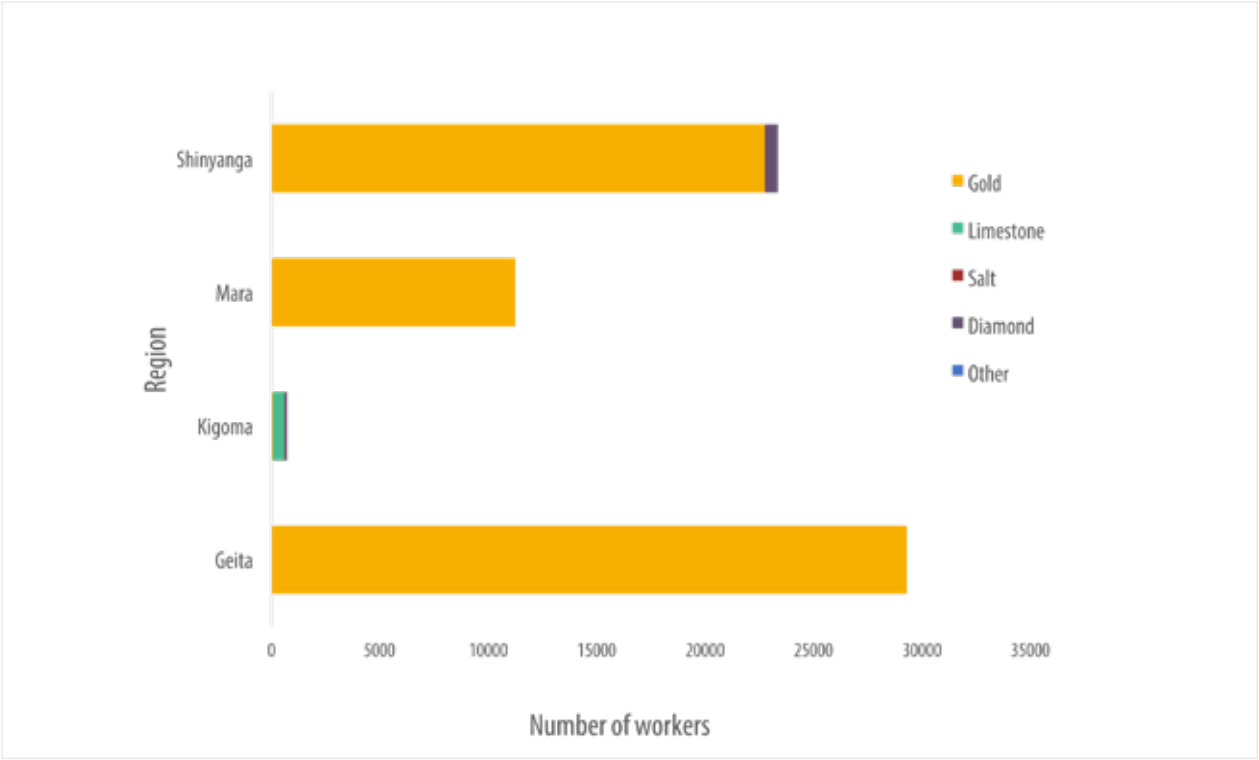
In this manner, we counted a total of 64,618 workers on 447 mining, processing and combined sites. It should be noted that data collection was done during the rainy season. Because the often long and heavy rains complicate mining, processing as well as transport, and as many miners turn to agriculture during those wet months, worker numbers tend to be considerably lower. Therefore, we asked on every site how many workers were active before the rainy season started. The total reported dry season worker number is 84,902, or 31% higher. Salt and limestone mining are particularly dependent on dry weather as processing relies on evaporation for salt, and burning and drying for limestone (see section 3.3.). Unsurprisingly they have the largest increase in worker numbers during the dry season: respectively 112% and 63%. The table below sets out how workers are divided over the different regions, minerals and site types.

34 Mutagwaba et al. (2018), pp. 29-30.
35 J. Carstens et al., *Implementing Transparency in the Artisanal and Small Scale Mining Sector* (Resources Consulting Services, Bad Vilbel, 2009), 110p.
36 World Bank (2015), pp. 4-5.
37 G. Hilson, *Artisanal and small-scale mining and agriculture Exploring their links in rural sub-Saharan Africa* (IIED, London, 2016), p. 7.

Table of site and worker numbers per region, mineral and site type

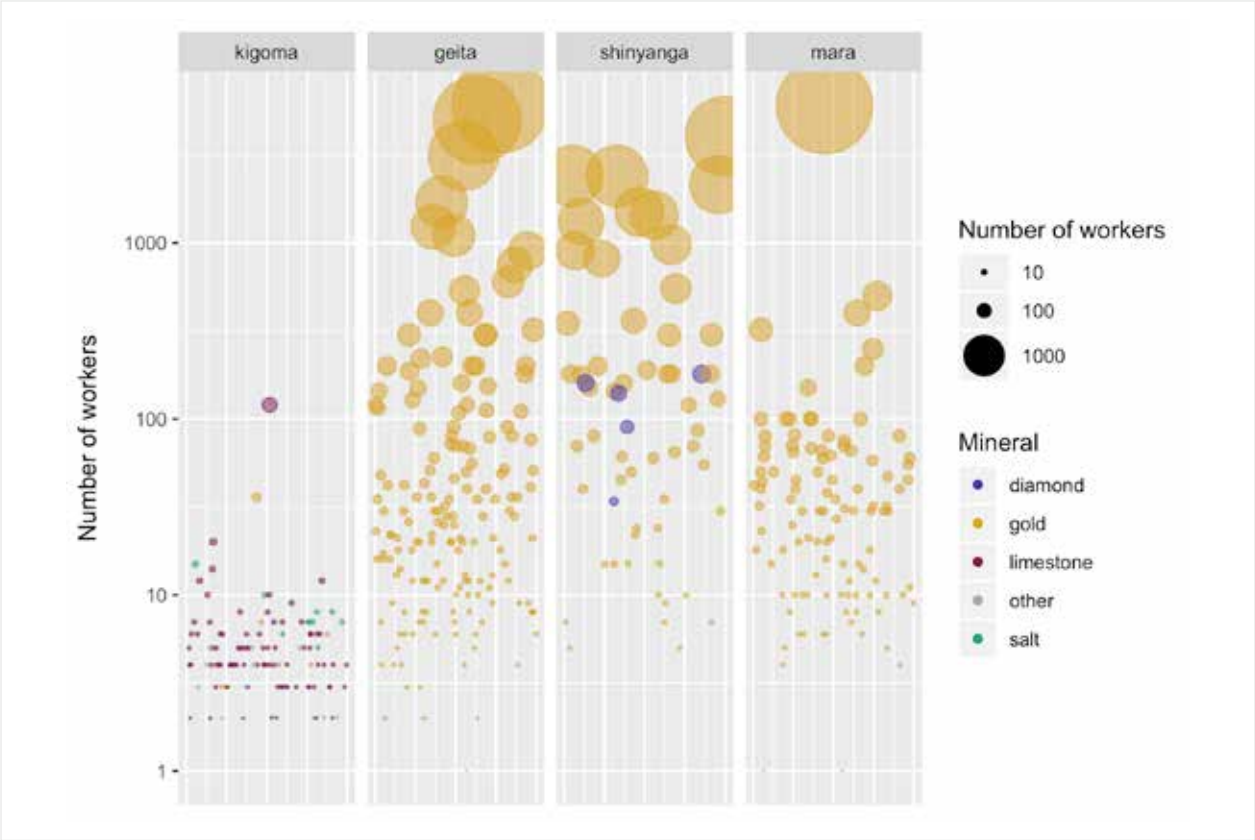
	Sites - total	Workers rainy - total	Workers rainy - average	Workers dry -total	Workers dry - averages
Regions					
Geita	166	34,925	210	37,137	224
Shinyanga	60	23,700	395	25,122	419
Mara	106	11,293	107	21,277	201
Kigoma	115	651	6	1,366	12
Minerals					
Gold	337	69,384	206	82,999	247
Diamonds	5	604	121	704	141
Limestone	84	460	6	878	10
Salt	11	82	7	174	16
Other	10	39	4	147	15
Type					
Mining	150	25,272	168	26,954	180
Processing	131	18,868	144	20,508	157
Combined	166	26,429	159	37,440	226

Graph 2: Number of workers in mining/processing for each mineral, by region (during rainy season site visits)



The average site in these 4 regions had 145 workers during IPIS rainy season visits. Gold sites are biggest and put on average 206 people to work. IPIS mapped the highest number of sites in Geita. Shinyanga has fewer but bigger sites with on average 395 workers. As shown on the graph below, Kigoma is spotted with many small sites. This is due to the predominant activity of limestone and salt mining, which are less profitable and do not attract rush miners.

Graph 3: Overview of all sites scaled by number of workers, per region



Seasonal variations are not the only factor driving ASM **labour migration**. Northwest Tanzania is covered with countless mineral deposits. News of new discoveries spreads rapidly, as supplies, workers and traders need to be attracted. Jønsson and Brycesson have moreover demonstrated that the time of arrival at a new site is a critical determinant for how much can be earned.[38] Consequently, in the early days of a mineral – and particularly gold – rush, workers can arrive by the hundreds or even thousands, and new pits spring up like mushrooms. Whilst gold deposits may be countless, most of them are hard to extract beyond the sub-surface layer. IPIS surveyors observed in many cases that operations slow down as pits get deeper, because the rock hardness and groundwater increase. This not only makes the process more time-consuming, it also requires more capital to buy equipment such as jackhammers, explosives, water pumps and generators. Many miners forgo these complexities and move on to the next site.

That mining and processing sites are indeed cosmopolitan places is confirmed by the fact over 1 in 3 workers in our sample arrived from a different region. Many others travel within these vast regions to find work in mining or processing. The most important regions of origin are all in the Lake Victoria zone, namely Simiyu, Mwanza, Mara, Singida, Kagera, Geita, Shinyanga, Kigoma and Tabora.

In such an informal and dynamic sector, it is hard to say with certainty how comprehensive our data collection has been. Based on regular checks and exchanges with mining authorities and small-scale miners' associations, we are confident to have covered the bulk of mining and processing sites that had over 100 workers during the time of our site visits (November 2017-March 2018). Smaller sites are not always on the radar of authorities and associations, and it is likely that we missed a higher number in this range. Moreover, in Geita, Mara and Shinyanga the focus of our data collection was on gold (and in Shinyanga also on diamonds). The various workers digging in these regions on small and constantly moving sites for industrial minerals like sand and aggregates were not covered by our research. Finally, IPIS only mapped

38 J.B. Jønsson and D.F. Brycesson, 'Going for gold: Miners' mobility and mining motivation', in D.F. Brycesson, E. Fisher, J.B. Jønsson and R. Mwaipopo, *Mining and Social Transformation in Africa: Mineralizing and Democratizing Trends in Artisanal Production* (Routledge, London, 2014), pp. 24-43.

46 cyanide leaching plants. We roughly estimate that around 200 of these plants are currently active in the four focal regions. Yet, their mushrooming in recent years means that nobody has a precise idea of their number and location. Many of them do moreover not (yet) have the proper licenses, leading to tense relations with authorities, and a restraint to allow visitors.

On the basis of these reflections, we consider to have visited at least 70% of all mining and processing activity in terms of worker numbers. On each visited site we moreover contemplate a 10% margin of error in counting workers. Based on these assumptions, we approximate the **total number of ASM workers for the 4 surveyed regions** at between 75,600 and 92,400 during the rainy season, and between 99,300 and 121,400 during the dry season. The latter figure should however be treated with more care as it is based on self-reporting by miners, which could not be fully verified by IPIS. The World Bank estimates that ASM generates 4 jobs for every person involved.[39] On this basis, we approximate that ASM roughly accounts for at least 302,400 and at most 485,600 direct and indirect jobs in Geita, Mara, Shinyanga and Kigoma.

Our estimates of direct ASM employment are significantly lower than those in the above-mentioned 2012 Ministry baseline survey. The latter for instance gauges the number of ASM gold workers in Geita 40% above our highest estimate; for Mara this is nearly 60%. A more comprehensive and structured mapping and data collection exercise is needed to make such comparisons to or statements on nation-wide estimates with a reasonable degree of certainty.

3.2. Organisation of small-scale mining and processing sites

Contrary to the entrenched notion of ASM as a purely poverty-driven, economically irrational and disorganised activity, it is governed by complex organisational models (3.2.1.) and representation through cooperatives and regional associations (3.2.2.).

3.2.1. Site organisation models

Only on a small minority of sites did we identify hardly any organisational model. Typically, such sites are largely abandoned, with a limited number of workers still digging in discarded pits or going through old tailings and waste material. On the opposite end of the spectrum is a small group of highly organised sites – mainly capital-intensive mining and processing operations – that are operated in line with applicable rules and regulations. Contrary to the bulk of ASM operations, these sites tend to have the right paper work, including licenses, employment contracts, payslips, insurances, environmental protection plans and production records.

Between these two opposites lies the large majority of operations, with various levels of management intensity. They all share the total absence of formal or contractual arrangements. Terms are orally agreed and relations are based on reciprocal dependence and a mutual lack of control. On the one hand, managers cannot progress without a satisfied workforce, nor can the workforce achieve good results without management and coordination. On the other hand, workers have limited leverage over the observance of informal commitments, nor can management control the coming and going of workers. On the whole, this at first sight fragile informality functions without constant or major troubles. However, if disagreements do arise, the informality advantages those higher in the chain of command.

There are considerable differences between the organisation of mining and **processing**. Gold processing sites are commonly made up of a multitude of minor units, without overarching management structure. These units are formed by small entrepreneurs who buy and install a number of sluices[40], pans, hammers, tarpaulins and often a ball mill. Generally, the only permanent – albeit non-contractual – employees are a machine operator and site supervisor. Others are day-labourers engaged for crushing, grinding, washing

39 World Bank (2015), pp. 4-5.

40 Sluices are narrow slides covered by carpets or riffles, onto which water mixed with grinded ore is poored to capture the heavy gold particles.

and panning. Limestone processing operations are more easily discernible as small enterprises with a single management system, that oversees a number of workers with clear tasks that range from crushing over packaging to transporting (see section 3.3.3.).

Mining sites tend to have more complex organisational models. The recurring pattern is a **three-tiered** organisation led by a site management – whether or not controlled by (a) license holder(s) –, a number of pit owners and their respective teams of workers.[41] This pattern is not always clearly discernible as people can act on more than one tier (members of the management might for instance be simultaneously pit owners), move positions over time or between sites, and enter into partnerships across tiers to spread investments and risks.

First, the **site management** takes responsibility over handling and coordinating the entirety of operations. This tier has various shapes and sizes. Some managements are one-man shops, others have intricate chains of command, with a director, management committee and a range of other administrative, operational and technical functions.

For over two thirds of workers on mining and combined sites this support staff includes guards. Their main function is to prevent conflict and violence as well as theft by intruders and site workers. They are particularly present on mines that produce high value-to-volume minerals like gold and diamonds, as it is easy for workers to withhold part of the production and thereby avoid paying the shares that are due to their superiors. A few big sites even have small prisons to lock up misbehaving miners before they are reported to the authorities. Other management functions are (operational or safety) inspectors (existing for 60% of workers on mining and combined sites), secretaries or treasurers (20%), environmental staff (20%), health staff (13%) and various other positions such as production supervisors, mine relationship officers, etc. Normally these are permanent functions, but sometimes several of them are combined in one person or team, and on a number of sites miners take turns in performing these overarching tasks. Holding such a function does not imply or require that a person is trained for that purpose, but simply that she or he holds responsibility over this aspect of the operations.

Inspector overlooking a team of miners pulling up one of their colleagues from the pit (Mara, 2017 – Photo: IPIS)

On licensed mines, the management consists of or is controlled by license holders. It is the legal expectation that the latter take responsibility to ensure compliance with all relevant regulations, including on labour rights, health, safety and environment, keep track of workers and production, and pay taxes and royalties. This legal expectation is however hardly enforced (see further chapter 5). It is not even rare for license holders to be entirely absent from the site and delegate all responsibilities to the management, occasionally overseen by a relative or confidant.

The management, in turn, informally sub-leases responsibility over operations to a number of **pit owners,** further obfuscating legal accountability. Pit owners bare most of the investment and risk, as they are

41 D.F. Brycesson and J.B. Jønsson, 'Pursuing an artisanal mining career: downward success', in D.F. Brycesson, E. Fisher, J.B. Jønsson and R. Mwaipopo, *Mining and Social Transformation in Africa: Mineralizing and Democratizing Trends in Artisanal Production* (Routledge, London, 2014), pp. 45-46.

the ones who provide equipment and machinery, hire workers and cover their meals and other related expenses during the production process.

The third and final tier is that of **workers** or diggers. They are engaged on pit-level by the respective owner. The complexity of the division of labour on this level depends on the mineral and exploitation type. Alluvial diamond and gold mining as well as limestone mining is rather straightforward and does not require much specialisation. Pits are generally shallow and teams divide the work or take turns to hammer, drill and transport. Hard-rock gold mining operations tend to be more complicated. In their most basic form work is divided between drillers and pullers. The former work underground to break the rocks with hammers and chisels, the latter remove the ore and waste material from the pits by carrying or hoisting heavy bags. The more mechanised operations become, the more specialisation arises with pit technicians, explosive experts, machine operators, etc.

3.2.2. Cooperatives and regional associations

Across northwest Tanzania miners and processors have organised themselves into **cooperatives and Savings and Credit Cooperative Societies (SACCOS)** to pool resources for purchasing equipment, obtain licenses, attract investment and share organisational burdens.[42] 44% of all workers operate on a site where a cooperative or SACCOS is active. 88% of these cooperatives are reportedly registered with the authorities.

The situation is more or less the same for mining and processing. The main explanatory factor is the size of the site: the bigger the site, the more likely that there will be a cooperative, as the capital needs and organisational burdens rise. Strikingly there is hardly any correlation between the presence of a license and a cooperative.

Besides pooling resources and sharing organisational responsibilities, cooperatives in our sample play a role in income distribution, mediating tensions and conflicts, and representation and advocacy towards authorities, investors and traders. Many of them face considerable financial and organisational challenges. Often, they are set up for one specific purpose, such as the application for a PML or public grant, or the purchase of large equipment. Once that is done, members lose interest, stop paying their contributions, and thereby incite a downward spiral for the cooperative.

A key shortcoming of cooperatives is their limited representation among workers. Typically, only license holders, management and several pit owners are member, thereby neglecting the bulk of the workforce. Many miners that were interviewed during data collection on sites with a cooperative were either unaware of its existence or saw it as a vehicle of the elites. Women, in particular, complained that cooperatives are a men's affair with a poor gender balance and affinity.

Representation across sites is assumed by **regional miners' associations** (REMAs), which operate under the national umbrella of the Federation of Miners' Associations in Tanzania (FEMATA). In this project's four focal regions these are Gerema, Shirema, Marema and Kigorema. In the 1980s, the government called for the creation of these regional associations to coordinate between small-scale miners and authorities, facilitate formalisation, assistance, capacity-building and awareness-raising and attract investment.[43] As key ASM interlocutor in each region, they represent small-scale miners in various fora and workshops and have contributed to diverse sensitisation and training campaigns on issues such as child labour, women rights and mercury use. Moreover, they often arbitrate on land and title issues.

REMAs are plagued by the same challenges that face cooperatives, namely lack of finances, management issues and balanced representation. Two key challenges are inherent to their design. First of all, given that REMAs were called into being to encourage formalisation, membership is largely limited to PML holders.

42 E. Fisher, 'Occupying the margins: Labour integration and social exclusion in artisanal mining in Tanzania', *Development and Change*, 2007, 38(4), pp. 735-760.

43 F. Hruschka, *Comparative analysis of ASM strategies in four countries of Africa, Asia and Latin America (Ghana, Tanzania, Peru and Philippines)* (Estelle Levin Ltd., Pact and IPIS, 2015), pp. 37-38.

This does not only exclude unlicensed operations, also the workforce on licensed sites is ignored. Second, the function of these associations as gatekeeper for donor funding and investments has led to the criticism that leaders pursue personal rather than common interests. These challenges have led members to lose faith and stop paying contributions. Marema, for instance, reportedly has 200 registered members, but only 80 pay their annual dues (TZS 100,000 or USD 43). This declining support hollows out the already limited resources and facilities of associations, which in turn prevents them from having a better coverage across these large regions. While Gerema, Marema and Shirema have to coordinate all work from a small representation in the region's capital, Kigorema does not have any office space at all.

3.3. Production process

Just like the organisational model, the nature and advancement of the production process varies across sites, minerals and regions. In this section we will analyse the recurring production patterns in mining and processing with a focus on gold (3.3.1.), and brief examinations of diamonds (3.3.2.), limestone (3.3.3.) and salt (3.3.4.) Ultimately, we will assess the level of ASM mechanisation in northwest Tanzania (3.3.5.).

3.3.1. Gold mining and processing

Prospecting is the start of every gold **mining** operation, but also where it frequently goes wrong for ASM. Various miners complained that geological data is not available and decent exploration unaffordable. Most operations are therefore based on a trial and error process, nicknamed "local laboratory", which consists of manually sampling small amounts of sand and rock to assess gold concentration.

This regular sampling guides the mining activities on each site. It determines the nature, closure, start and direction of digging operations. While a few small sites consist only of surface digging, typically along riverbeds, the large majority involves underground operations. Digging is typically done in cycles. One cycle consists of extending the pits or shaft by a few meters, carving and breaking gold-bearing rock and earth, loading this in bags, hoisting these bags to the surface, and storing them until it is decided to end the phase and distribute the production. This phase ends either when the envisaged number of bags for distribution is reached, when workers lose their motivation, when it is no longer safe to continue, or when the pit owner runs out of cash to cover meals, supplies and equipment. The duration of one cycle ranges from several days to a few months.

Of the 235 gold mining and combined sites in our sample, 65 are purely alluvial operations where miners dig for placer deposits of gold particles that eroded from their primary ore source. 95 are hard-rock mining operations and 75 a combination of both. On average 11 workers operate per pit. On very productive sites, pits may be operated 24/7 in several shifts. In total IPIS surveyors counted 3,298 active gold pits, or an average of 14 per site.

After extraction, the bags of ore are taken to **processing** sites according to various arrangements. Many miners sell their share of bags directly upon distribution, as they need the cash after weeks of digging or want to focus on mining only. Other bags are already assigned to processors before they leave the ground according to pre-financing arrangements (see section 3.3.5). Processing site owners or their workers skim mining sites to collect or buy bags. Depending on transport means and road quality, bags are transported on foot, by pack animal, bike, motorbike, car or truck. Prices are based on negotiation and quick sampling. There is evidently considerable room for chance (as the concentration may vary from one bag or even rock to another) and cheating (for instance by putting the highest density rocks on top of a bag). For this reason, many people try to build trust in longer-term relationships.

Bags of ore being transported by bike and donkeys (Geita/Shinyanga, 2018 – Photo: IPIS)

Regularly, miners rent a unit to process the bags themselves, on payment or in exchange for a percentage of the gold they produce. Some owners of processing units even allow people to process ore for free, particularly in times of low production, in return for the tailings, which they can in turn sell to cyanide leaching plants for further processing (see below). Miners may also pay workers at each stage of the process a negotiated fee, including for manual crushing, grinding in ball mill, sluicing and panning, including mercury amalgamation.

Owners of processing units have an interest in being as closely as possible to the point of extraction to attract production. Some mine site managements allow such units to be established on their site, frequently in return for a share of their yield. Other mine managements, as well as pit owners, invest in ball mills and sluices themselves to maximise profits. These tendencies are leading to an increased integration of mining and processing. Of the 337 gold sites in our sample 40% are combined, while sites where only mining and processing is done each account for 30%.

Another important reason for this integration is the burgeoning of **cyanide leaching plants** in northwest Tanzania. This evolution has turned tailings from waste material into a valuable commercial product.[44] The rudimentary ASM processing techniques of sluicing, panning and mercury amalgamation leave at least 60% of the gold uncaptured. In the late 2000s, investors, mainly from Zimbabwe, saw a business opportunity in this undervaluation of tailings and started setting up cyanide leaching plants in Tanzania. As the market is saturating, many of these investors, meanwhile also including foreigners from China, Europe and the Middle East, are starting their own mining operations to fight declining profit margins and tailing supplies. Given that many of these cyanide leaching plants operate informally, precise data on their number and size is not available. Based on our data collection and exchanges with regional miners' associations we estimate that there are around 200 cyanide plants in the four focal regions.

44 Schoneveld et al. calculated that the price of tailings quadrupled in Mbeya between 2013 and 2017 from TZS 30,000 to 130,000 per metric ton (Schoneveld et al. (2018), p. 33).

Cyanide leaching plant under construction (Mara, 2017 – Photo: IPIS)

Cyanide leaching occurs on various scales of investment. A model plant consists of a number of vats or tanks, often in brick, that are connected below the surface by pipes. Tailings are loaded into these tanks and mixed with cyanide and lime. The former is a noxious chemical that converts gold into a water-soluble complex, the latter serves to control the pH value of the mixture to avoid the evaporation of the highly toxic hydrogen cyanide gas (Chapter 4 will go deeper into the environmental and health risks). Subsequently the mixture passes through the pipes to a cemented basin consisting of several chambers with carbon beds that absorb the gold.

Once saturated, the activated carbon is offloaded and transported to **elution plants** for desorption and electrowinning. While there were only a few such elution plants a few years back, their number is steadily increasing. They are mainly based in big towns such as Mwanza, Musoma, Geita and Kahama. Mwanza used to be the centre of gold elution around Lake Victoria. Reportedly, however, new regulations that forbid trade of activated carbons across regional boundaries, and restrict processing to the region of origin, is badly affecting this market, as there is limited gold mining activity in Mwanza region itself.

3.3.2. Alluvial diamond mining

IPS identified small-scale alluvial diamond mining in two areas of Shinyanga region. The first is close to the town of Nyambula in Kahama Urban District, where one highly mechanised small-scale diamond mine was surveyed. The second is around the town of Maganzo, in the proximity of the industrial Mwadui Williamson Mine, where IPIS surveyors identified 4 different artisanal sites. The latter have limited top-down coordination and management, as they consist of small groups of miners that work under various investors. These investors are often diamond traders who provide them food and some basic hand tools, such as shovels and sieves, in return for a significant share of production. Given the low capital needs of these small operations, there is less need for miners to set up overarching site managements.

Alluvial diamond miners in Shinyanga (2018 – Photo: IPIS)

Miners form small teams, of typically between 3 and 5 workers, and dig shallow pits of maximum 3 metres deep with shovels and spades to reach the gravel layer. They subsequently wash and sieve the gravel in search for diamonds. In total, IPIS surveyors counted 174 active pits, or an average of 35 per site, and countless abandoned ones. Not seldom, they work for weeks or months without finding a single diamond, but the hope of finding a big precious stone one day keeps them going.

3.3.3. Limestone mining and processing

ASM in Kigoma is mainly about limestone. It is concentrated in Kasulu and Uvinza districts, but we equally identified a number of sites in Kibondo and Kigoma Rural districts. IPIS mapped 84 limestone sites, most of them rather small with an average of 6 workers per site. On 40% of these sites only mining is done, on 35% only processing and 25% combine both. The **mining** is relatively straightforward. Workers dig in mostly open pits using chisels and pickaxes to break out the limestone.

Processing is more diverse and can be grouped in 4 main categories. A first processing type consists of crushing limestone rock, mainly manually, into aggregates for construction. As this requires hardly any investment, this is the most profitable processing activity, but the market is limited.[45]

A second form of processing consists of rudimentary burning the limestone on huge woodpiles. One burning session last several days, until only a pile of stones, called quicklime, is left. Workers subsequently pour water over this quicklime, which breaks it down into a coarse white powder called slaked lime, or also caustic lime or builders' lime. The powder is then loaded in unbranded, mostly recycled washing powder, bags, which sell for between TZS 1,500 and 1,800 (USD 0.65 – 0.78) per 25kg on-site. This process is all but efficient due to the high consumption of water and firewood. In particular, such limestone piles fail to use the heat that is created effectively. Calcination of limestone occurs at 900-1000 °C. Excessive heat however creates dead-burned lime that does not mix with water and is therefore useless. On these stacks of wood, the inner circle of stones often has to be discarded as it was exposed to excessive heat, while the outer circle needs to burned again as temperatures were insufficient there. Generally, only 60 to 70% of stones are effectively calcinated.

45 At the time of research there was a small peak in demand due to constructions by UNHCR in Nyarugusu refugee camp.




Workers crushing limestone into aggregates (1), Truck picking up aggregates for construction (2), Worker adding limestone on top of a woodpile (3), A pile of coarse slaked lime (4) (Kigoma, 2018 – Photo: IPIS)

Thirdly, in order to better capture the heat, various miners burn limestone in kilns (i.e. burning chambers). Some use colonial constructions from the 1930s, others build new kilns in brick and a small minority is experimenting with more modern gas-fuelled kilns. There are two main ways to operate a kiln: intermittently and perpetually. In an intermittent kiln, limestone is loaded on top of a bottom layer of coal or firewood that is kept alight for several days, until all lime is burnt. In a perpetual kiln, usually in brick, the firewood or coal is layered with limestone. The burnt lime can continuously be extracted at the bottom of the kiln, while new limestone and wood is added on top. This process can be continued for 1 or 2 months. These kilns use the heat more efficiently, but still consume huge amounts of firewood. The quality of the lime is generally better. One kiln can produce between 1,000 and 1,500 25kg bags per month. These mostly unbranded bags sell for TZS 3,000 to 3,5000 (USD 1.3 - 1.5) on-site.

While all the above operations are not mechanised and require little capital, a small number of entrepreneurs has invested in transportation, storing, milling and packaging equipment. Some also engage in mining and burning, but most of them buy the unbranded bags from the above operations for processing. They mill the coarse lime into fine and pure white powder and package it in branded bags, which sell for TZS 4,500 to 8,000 (USD 2 - 3.5). This lime is mainly used for construction buildings and roads.



Brick limestone kiln (5), Lime milling (6), Lime packaging in branded bags (7) (Kigoma, 2018 – Photo: IPIS)

3.3.4. Salt mining

Uvinza is the home of salt mining in Kigoma. We identified 11 small sites, with on average 7 workers, along the Ruchugi river. Miners pump up brine from underground wells, some of these were cemented by German colonials, into a number of basins on top of small kilns. Fires are lit within the kilns to evaporate the water and extract the salt. Every stove has one operator. The latter organise themselves into cooperatives to manage overarching tasks such as fetching firewood and (un)loading salt.


A brine well supplying sites on both river shores (1), Evaporation of the brine in salt kilns (2, 3) (Kigoma, 2018 – Photo: IPIS)

1 kiln can produce 60-100kg of salt in 3 days. A 25kg bag sells for TZS 30 to 35,000 (USD 13 - 15). After evaporation, the salt is mixed with iodine, which is distributed without charge by district health workers.

This serves to prevent iodine deficiency which causes goitre (swelling of the thyroid gland) as well as intellectual and developmental disorders. Salt mining mainly takes place in the dry season as the rains hinder the evaporation and drying process, and decrease the underground salt concentration of brine.

3.3.5. Level of mechanisation

> ***"Our operation costs are too high. We don't have electricity, we use diesel in running the machines, which costs a lot of money. It is five years since we started and we still got nothing, but we believe that God will one day give us what we want"*** (site manager in Buzimba, Geita region)

Whilst ASM is known for its rudimentary techniques, mechanisation is gradually increasing in northwest Tanzania. In **mining**, the most common mechanised tools are generators, compressors and water pumps. Generators are essential to any form of mechanisation given the poor connection of mines to the electricity grid. Compressors serve to power pneumatic tools such as jackhammers and hoists. Water pumps prevent operations from closing down if they reach ground water levels or during the rainy season. This is followed by jackhammers, used on about 25% of mines, and electric winches and metal detectors, which are both used on around 10% of mines. Excavators and dumpers are rare and used on respectively 5 and 1% of mines.

On 55% of mining sites, workers still operate without any form of mechanisation, using only hammers, chisels and hand-operated hoists. Kigoma is lagging most behind with 88% of mines operating by hand. This is reflected in terms of minerals, with 100% of salt mines and 98% of limestone mines operating without any form of mechanisation. Also for diamonds, 4 of the 5 mines in our sample operate by hand. Only gold mining is steadily mechanising, with just 44% of mines operating manually. It is important to note that mechanisation is different from pit to pit, as it depends on the investment by the pit owner and other financiers. Therefore, if tools are observed on a site, it does not mean that all pits dispose of them, although those who own equipment will often rent it out to others.

Mechanisation is more common in **processing**. 82% of gold and 18% of limestone sites are equipped with ball mills for grinding. Cyanide leaching plants notwithstanding, other forms of mechanisation, such as shaking tables or centrifugal concentrators, do not occur.

In the absence of a ball mill miners grind the ore manually (1), Foreign investment on a PML (2) (Mara, 2017, Photo: IPIS)

The higher the mechanisation, the harder it becomes for the pit owner to carry the operating cost of a pit on his own. This is all the more true given that hardly any banks are willing to provide loans for ASM operations.[46] A pit owner in Geita complained: "Our banks don't recognise us. While they provide good loans for farmers, they are ignorant about mining and refuse to engage, or only under impossible

46 F. Weldegiorgis and A. Buxton, 'Informing dialogue on artisanal and small-scale mining in Tanzania: A thematic review of challenges and solutions', *IIED Discussion Paper* (International Institute for Environment and Development, London, 2017), p. 10.

conditions. We ask the government to set up affordable terms of loans".[47] **Informal financiers** have stepped in to fill this void with unregulated, quick and easy access to finance. These financiers form a diverse group of people. Some are small players with some capital on the side who invest to get their share of the pit's production. Others are processors who thereby obtain the right to process (part of) the production on their site. An important group consists of dealers and brokers who pre-finance mining operations in return for a monopoly on buying the production (see section 3.4.).

These invisible shareholders bring along a number of important challenges. First, the intricate conditionalities of their support render it even more complicated for authorities to monitor transactions across the supply chain. Second, it makes miners in dire need of capital vulnerable to abuse and debt bondage. Finally, this practice risks to implicate otherwise legitimate ASM operations in iniquitous practices such as money laundering, smuggling and corruption.

> ***"Our banks don't recognise us. While they provide good loans for farmers, they are ignorant about mining and refuse to engage or only under impossible conditions. We ask the government to set up affordable terms of loans."*** (license holder in Nyakagwe, Geita region)

Other ASM operations have fulfilled their need for capital by renting out part of their licenses to **foreign investors**. This has led to the remarkable emergence of a number of small but highly industrialised mining operations on PMLs. Rather than investing in ASM, many of these foreign investors run their own operations, with hardly any skills or knowledge transfer to Tanzanian small-scale miners. While this practice of subletting PMLs to foreign investors is not in line with the Mining Act (the 2017 amendments only allow PML holders to contract foreigners for technical support), it is largely condoned by authorities. Schoneveld et. al. convincingly argue that genuine regulation of foreign investments in ASM could aid considerably in professionalising and formalising the sector.[48]

Our site visits showed indeed that there is a dire need for training and accessible information on mechanisation. Many miners that were able to start mechanising, purchased oversized equipment that not only drained their budget upon acquisition, but continues to do so due to excessive fuel consumption and reparation costs. One miner in Geita divulged: "the operation cost is too high. We don't have electricity, we use diesel in running the machines, which costs a lot of money. It is five years since we started and we still got nothing, but we believe that God will one day give us what we want".[49]

3.4. Trade patterns

The Mining Act distinguishes between two kinds of traders: **dealers and brokers**. Brokers are allowed to trade domestically, while dealers also have the right to export. Only Tanzanians can become licensed brokers or dealers, but non-Tanzanians may obtain undivided participating shares for less than 75% in dealer licenses. In 2012, there were 128 registered dealers in Tanzania.[50] This top of the mineral supply chain is dominated by a small number of big dealers, mainly from Indian and Pakistani descent. The latter are mostly based in Dar es Salaam, Arusha or Mwanza, and have various partners, stores or buying houses in mining towns like Geita and Shinyanga. In addition, a number of powerful traders based in Nairobi reportedly operate sizeable gold smuggling networks across the border.[51] Brokers mainly work on the order of powerful dealers in order to spread financial and safety risks and benefit from economies of scale.

Just like ASM, the trade of its production occurs to a great extent informally. As traders are even less spatially bound than miners, their operations are particularly concealed and opaque. Law and reality are

47 Conversation with license holder in Nyakagwe, Geita region, December 2017.
48 Schoneveld et al. (2018), 77p.
49 Conversation with site manager in Buzimba, Geita region, November 2017.
50 Human Rights Watch, *Toxic Toil: Child Labor and Mercury Exposure in Tanzania's Small-Scale Gold Mines* (HRW, New York, 2013), p. 76.
51 The national umbrella organisation is the Tanzanian Mineral Dealers Association (TAMIDA), based in Arusha. This body is dominated by gemstone dealers and has limited relevance among other mineral traders.

far apart. According to the Mining Code solely licensed brokers, licensed dealers and mineral right holders are allowed to trade in minerals, and brokers can only buy from "authorised" miners.[52] The biggest obscurity exists on the level of brokers, where there is hardly any enforcement of the above rules. In big mining areas numerous shopkeepers, businessmen, traders and miners buy and sell minerals, with only a fraction of them holding a license. Most of them make no distinction between trade from licensed and unlicensed mines and rarely declare transactions.

> ***"the gold market is completely unpredictable. In the morning one gram can get you TZS 70,000, in the evening this might drop to TZS 55,000"*** (miner in Mawemeru, Geita region)

For **gold**, the highest number of transactions occurs in small quantities, on-site or in neighbouring villages, given that many miners prefer to have cash quickly and avoid the risk of being robbed. While on-site prices are lower than those in mineral trading towns, these small quantities are not worth the time and resources of travel. Only site bosses, successful pit owners or miners lucky to work nearby can afford to sell their production directly in trading towns.

The biggest gold trading hubs identified in our area of research are Geita, Katoro, Rwamgasa and Nyarugusu in Geita region, Kahama, Shinyanga and Kakola in Shinyanga, and Tarime and Musoma in Mara region. The biggest volumes are traded in cities like Mwanza, Musoma, Geita and Kahama as this is also where gold elution plants are based. In large gold mining areas competition between traders is high. In Nyarugusu for instance, our research shows that there at least 20 jeweller shops dealing in gold and over 200 mainly informal brokers that skim mining and processing sites for gold. The latter, called "*kota*" locally, operate as agents of big brokers or dealers. They pre-finance operations to attract sellers and secure their gold supply.

Despite the growing internet coverage, many miners still indicate that they have no knowledge of global mineral prices. Gold purity equally remains subject of negotiation rather than actual measurement. Combined with the resource dependency of miners, this gives *kota*, and essentially the big dealers for whom they or their bosses work, considerable control over the **terms of the trade**. This opens the door to unfair prices and abusive arrangements. A miner in Mawemeru, Geita region, aptly lamented that "the gold market is completely unpredictable. In the morning one gram can get you TZS 70,000, in the evening this might drop to TZS 55,000".[53] In some remote areas, prices indeed go as low as TZS 55,000 (USD 24) per gram of unrefined gold. In Geita and Mwanza, where competition is high and gold typically arrives in a more refined form, the price can go up to TZS 90,000, or over 95% of the world market price. Most prices reported by miners are in the TZS 60-80,000 (USD 26 - 35) range. In order to better regulate the trade, many miners call on the government to set up formal gold markets, as is currently being established in Mwanza.

Trade networks for **other minerals** in our focal area are much smaller. Diamond trade is particularly secretive and dominated by a network of mainly Lebanese brokers that directly pay miners to dig for diamonds and export mainly to India, United Arab Emirates and Belgium. More than for other minerals, there were recurring complaints of debt bondage and even slavery. Limestone is mainly traded directly by PML holders. The most important trading towns in Kigoma are Makere, Mwamila and Kigoma town. From there, the lime is often taken to Mwanza and sold across northwest Tanzania. Some license holders have secured market access to neighbouring countries like Burundi and DRC, but transport costs, export and import permits and taxes, bad exchange rates and weak foreign currencies make it hard to keep this profitable. Salt is mainly traded informally by women and children at bus stops and in local markets in Uvinza and Kigoma for food seasoning and preservation. Some big traders also transport to Tabora, Mwanza and neighbouring countries.

52 2010 Mining Act, Part V.
53 Conversation with miner in Mawemeru, Geita region, January 2018.

Bags of salt sold by women at a bus stop in Uvinza (Kigoma, 2018 – Photo: IPIS)

4. SOCIO-ECONOMIC AND HUMAN RIGHTS IMPACT

This chapter will look into the diverse socio-economic and human rights issues that came to light in our data collection on ASM in northwest Tanzania. These span matters of distribution of wealth, the role and position of women, the involvement of children, interrelated environment, health and safety issues, and the impact of ASM on the social fabric of surrounding communities.

4.1. Distribution of wealth

The informal and often obscured organisation of most ASM sites, implies that it is not easy to follow the money and understand who benefits how much. In this section, we aim to unravel this complexity and unveil the predominant revenue sharing systems in both mining (4.1.1.) and processing (4.1.2.), in order to get a better idea of average incomes, as well as wealth spill-overs to local communities (4.1.3.).

4.1.1. Informal production sharing agreements in mining

In the absence of labour contracts, distribution of revenue in mining is arranged informally. Salaries are exceptional and have only been reported on a limited number of sites with neat management structures and high levels of investment. The large majority of payments is based on production sharing agreements (PSAs), whereby each actor gets an informally agreed share of the production. Several factors explain the preponderance of this output-based remuneration system. First, PSAs are a self-regulatory system of management in an informal sector characterised by limited oversight and high worker mobility. Second, they are a risk-minimising strategy, compensating for geological uncertainties, high investments and personal hazards. Finally, the hopes of rich strikes, particularly in gold and diamond mining, makes most miners prefer the unpredictability of PSAs over the comfort of fixed wages.

While the precise distribution formula settled in such PSAs is site or even pit-specific, the rule of thumb – based on the median for all surveyed mining sites – is 30% for the site management and/or license holder(s), 40% for the pit owner and 30% to be distributed among miners. On 50 sites the cooperative is included in the PSA and gets a median value of 10%. On 138 (or 44% of) mining sites, part of the production is shared with landowner(s), who get a median value of 10%. To keep oversight of distribution, some managements of big sites have developed a system whereby only bags that are tagged and dated by a management representative can leave the site for processing.

The **pit owner** gets the biggest slice of the pie, given that he tends to make most of the investments and thus bares the highest risk. The pit owner indeed covers the running costs of the operation, including meals and equipment. Occasionally, when money is running out, miners may decide to collectively sell a small part of the production prior to distribution. In some cases, pit owners do not cover meals, but instead allocate miners a small daily allowance of between TZS 3,000 and 5,000 (USD 1.3 - 2.2).

This system of risk and profit-sharing trickles further down to the broad categories of site management and miners. The share of the **site management** is used to pay overarching operational staff such inspectors, guards, health and environment staff, and administrative personnel. Such payments are normally also dependent on production volumes.

Miners, on their part, distribute their share of production according to intricate systems that consider skill, risk and investment. Those who are working underground or operate machines will for instance get a higher share. Often miners, and other investors, can make random contributions to the operating capital of a pit. Records of these investments are kept by the pit owner and will determine how production is shared.

In gold mining, production sharing is mainly done prior to processing. This means that shares are converted in (typically 50kg) bags of ore. While quick sampling is generally done throughout the production

process to check the market value, it largely remains a game of chance. The selection of bags is therefore often a tense event, whereby an appeal to magic through sacrificing livestock or seeking advice from diviners is not uncommon.[54] Somewhat paradoxically, miners tend to prefer this lottery over the seemingly more straightforward distribution of processed gold, because they find it more transparent. Given that the actual amount of gold in their total ore production is unknown, it would be too easy for the party overseeing the processing to underreport the total volume and add to his own share. Moreover, the distribution of ore gives miners the freedom to decide whether they want to process themselves or sell their share, to whom they sell, and at what price.

Miners checking the ore quality (Shinyanga, 2018 – Photo: IPIS)

It is clear from the above that is hard to calculate the **average monthly income of miners**. A team can be working hard for several months without any income and then all of a sudden strike a good vein. Many variables influence the revenue from such strikes, including the ore grade, the applicable PSA, the decision to process or sell, the negotiated price, etc. Considering these complexities, we can only make rough estimations. There are moreover notable differences depending on the mineral that is being mined.

> ***"artisanal miners are like hunting dogs, once they catch the pray the hunter decides on the dog's share"*** (miner in Nyakagwe, Geita)

Unsurprisingly, **gold** mining, which has been termed "the most lucrative off-farm income in many rural areas",[55] is the most profitable activity. Workers on average earn between USD 90 and 110 (TZS 208,000 and 254,000) per month.[56] Despite the high value of **diamonds**, this resource is strikingly less rewarding for miners. It provides them an average monthly income of between USD 52 and 64 (TZS 119,000 and 145,000). This can be explained by the general absence of mechanisation and technical know-how, as

54 J. B. Jønsson and N. Fold, 'Dealing with ambiguity: Policy and practice among artisanal gold miners', in D.F. Brycesson, E. Fisher, J.B. Jønsson and R. Mwaipopo, *Mining and Social Transformation in Africa: Mineralizing and Democratizing Trends in Artisanal Production* (Routledge, London, 2014), p. 122.

55 J.B. Jønsson and N. Fold, 'Mining 'from below': Taking Africa's artisanal miners seriously', *Geography Compass*, 2011, 5(7), pp. 479-93.

56 This is in line with Bryceson and Jønsson's estimate of USD 99 as average gold mining income in Tanzania (D.F. Brycesson and J.B. Jønsson (2014), p. 50).

well as the lack of knowledge on diamond valuation among miners. It should also be considered that a big strike in diamond mining can compensate for many months or even years of unrewarding work.

Limestone miners in northwest Tanzania have an estimated monthly income of between USD 39 and 47 (TZS 90,000 and 109,000). Those digging out the limestone tend to earn more (up to TZS 150,000) than those loading and unloading the kiln (up to TZS 120,000 per month). **Salt** mining, finally, seems the least rewarding business. It earns miners on average between USD 25 and 31 (TZS 58,000 and 71,000) a month. These low revenues are also due to the fact that many limestone and salt workers do not mine for several months each year. In good months, limestone and salt mining do however offer a more stable and predictable source of income compared to gold and diamonds. They are affected by seasonal but much less by geological uncertainties. Still, several salt and limestone site managers reported difficulties in attracting and keeping workers.

Notably, with the exception of gold mining, these averages are below the government-set minimum monthly wage of TZS 200,000 (USD 87) for employees on PML's.[57] This suggests that many operations would become less profitable for license holders if they exchange these PSAs for a formal salary system in line with legislation.

Revenue sharing often gives rise to **tensions**. This plays on two main levels: between pit holders and license owners, and between workers and site management. Various pit holders are frustrated that PML owners get 30% of the production while they are in many cases not even present on the mine but just hold the paperwork. License holders, on the other hand, suspect pit owners of underreporting production and therefore regularly delegate people to check on them, further augmenting tensions. Workers' main frustration is that site managers often fail to honour commitments. In essence, the lack of labour contracts and the often-high competition for jobs means that the bosses dictate the terms. We heard several reports of miners being withheld part of their agreed PSA share, because management decided to invest in new equipment or in the site's maintenance. On one site, the management went as far as claiming an additional 10% 'witchcraft contribution' to increase production. A miner in Geita put it as follows: "artisanal miners are like hunting dogs, once they catch the pray the hunter decides on the dog's share".[58]

4.1.2. Ad hoc payments in processing

The processing business is not governed by the same encompassing production sharing agreements. Given that processing sites are made up of small units, with mostly day-laborers, there is **less need for such self-regulating PSAs** and more room for ad hoc arrangements. Workers are typically paid in cash, rather than in mineral outputs.

> ***"We work as elephants but are paid as mice"*** (miner in Nyakagwe, Geita)

In small-scale **gold** processing, workers get either a daily fee or an output-based remuneration. Gold processors in our sample on average earn between USD 82 and 100 (TZS 188,000 - 230,000) per month, or nearly 10% less than their colleagues working in gold mining. One processor in Geita complained that "we work as elephants, but are paid as mice".[59] This overall estimate hides a variety of pay scales, depending on their roles and position in the processing chain.

Ball mill operators, depending on the location and rock hardness, charge between TZS 1,000 and 3,000 (USD 0.4 - 1.3) per 50kg bag of ore. In productive months, the average ball mill operator in northwest Tanzania in this way earns up to USD 132 (TZS 300,000).

Before rocks are loaded into a ball mill, they are manually crushed into small pieces. This crushing, which

57 United Republic of Tanzania, *Labour Institutions Wage Order*, Supplement No. 24, 28.06.2013.
58 Conversation with miner in Nyakagwe, Geita region, July 2017.
59 Conversation with miner in Nyakagwe, Geita region, December 2017.

is mainly done by women (see section 4.2.), is paid between TZS 2,500 and 5,000 (USD 1.1 - 2.2) per 50kg bag of ore. Depending on productivity, availability of ore and working hours, one person can crush 2 to 3 bags per day. In some cases, crushers get a daily fee of between TSZ 7,000 and 10,000 (USD 3 - 4.3). In times of low productivity there might only be work for a few days per week or a few hours per day. Based on estimates of all surveyed gold processing sites, we gauge the average monthly income of manual crushers in times of good production between USD 54 and 70 (TZS 125,000 and 162,000). Washing and panning, another activity where women are omnipresent, yields between TZS 3,000 and 6,000 (USD 1.3 - 2.6) a day.

Gold leaching plants are generally more organised and pay monthly wages for permanent staff and daily wages for temporary workers. Depending on the scale of operation, tank operators tend to earn between USD 65 and 217 (TZS 150,000 - 500,000) and (laboratory) technicians between USD 174 and 434 (TZS 400,000 - 1,000,000) per month.

Small-scale **lime** processors on average earn between USD 39 and 48 (TZS 90,000 and 110,000) per month. This is roughly the same as those mining limestone. This figure is however not based on a comprehensive PSA agreed beforehand with the site management, but results from cumulating various output-based payments. Processors typically get between TZS 60 and 80 for filling a 25kg bag with lime, between TZS 40 and 60 for closing the bag using plastic needles, and between TZS 30 and 50 for loading or unloading the bag on a truck. In some more professional lime processing operations, workers get both a monthly salary and an output-based bonus per bag.

4.1.3. Wealth spill-overs to local economies

Whereas ASM generally has a bad reputation as instigator of chaos, crime, violence, accidents, environmental degradation and human rights abuses, various studies have demonstrated a strong **positive impact on local economies**.[60] As Brycesson and Jønsson put it: "artisanal mining averts the pitfalls of the mineral resource curse …, boosting labour absorption in national economies, raising purchasing power and enhancing the multiplier effect in local economies of mineral resource-rich areas".[61] The mining and processing site-level data of this project does not allow general conclusions on this sector's broader impact on local economies, but gives a number of indications that confirm the above findings.

First of all, the mining sector offers a **key livelihood and business opportunity** to a significant part of the population in resource-rich areas. The estimated average income from gold mining and processing in our focal area lies between USD 82 and 110 per month, or USD 2.7 to 3.7 per day. This is more than double the average wage for agricultural labour in Tanzania, which is estimated by the Food and Agriculture Organisation (FAO) at USD 1.6 a day.[62]

According to the Artisanal Gold Council, around 70% of the world market value of ASM gold remains in-country.[63] This is **consumed and invested locally** in houses, motorcycles, cars, bars, restaurants, hotels, and businesses, which moreover function as important generators of auxiliary employment (see above section 3.1.3.). In the gold-rich areas near Lake Victoria, mining has led to the expansion of a great number of towns, or even the emergence of entirely new ones.

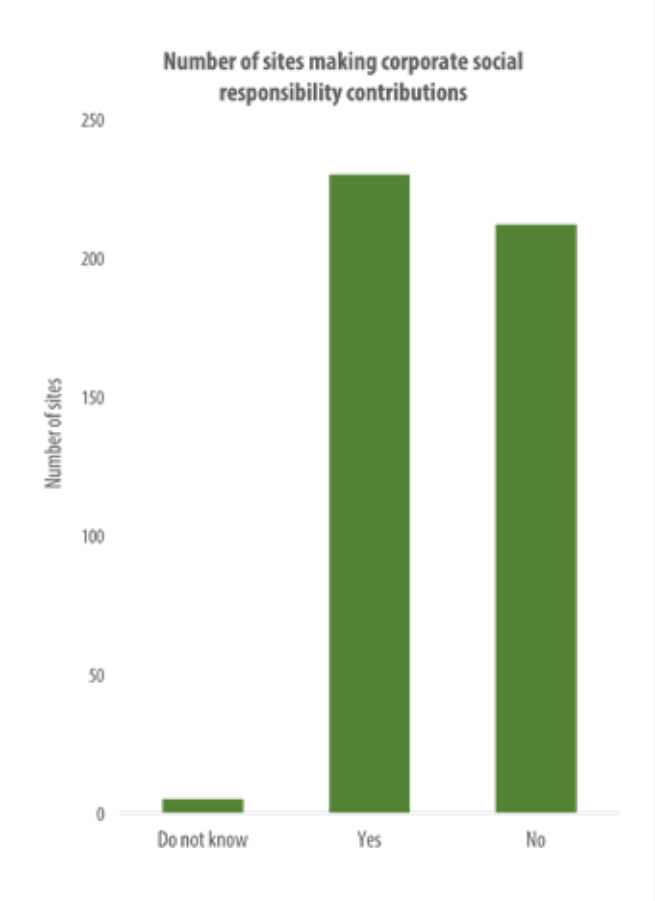
60 Bazillier and Girard found, for instance, that households located close to artisanal gold mines in Burkina Faso consumed 15% more during a gold boom, while there was no impact for local communities around industrial mines (R. Bazillier and V. Girard, "The gold digger and the machine. Evidence on the distributive effect of the artisanal and industrial gold rushes in Burkina Faso", *LEO Working Papers / DR LEO 2545* (University of Orleans, 2017), 53p). Another example is Kinabo who demonstrated that communities close to ASM operations in Tanzania are wealthier than those that have only agricultural activities (C. Kinabo, 'A socio-economic Study of Small-Scale Mining in Tanzania', in G. M. Hilson, *The Socio-Economic Impacts of Artisanal and Small-Scale Mining in Developing Countries* (CRC Press Technology and Engineering, 2006), pp. 271-293).

61 D.F. Brycesson and J.B. Jønsson, 'Mineralizing Africa and artisanal mining's democratizing influence', in D.F. Brycesson, E. Fisher, J.B. Jønsson and R. Mwaipopo, *Mining and Social Transformation in Africa: Mineralizing and Democratizing Trends in Artisanal Production* (Routledge, London, 2014), p. 1.

62 G. Rapsomanikis, *The economic lives of smallholder farmers: An analysis based on household data from nine countries* (Food and Agriculture Organisation, Rome, 2015), p. 25.

63 K. Telmer, *World Artisanal Gold Production* (*Artisanal Gold Council, Victoria, 2011*), <http://www.artisanalgold.org/publications/articles/world-artisanal-gold-production/>.

Graph 4: Corporate social responsibility by ASM sites



Whereas **corporate social responsibility (CSR)** is mainly associated with industrial miners, ASM also delivers an important contribution. Such investments are often asked by village authorities (see section 5.1.2.). CSR by ASM ranges from in-kind support, such as donations of cement by lime producers, over small contributions of several hundreds of dollars for school desks, iron sheets, or medical supplies, to larger grants of thousands of dollars for building roads, village offices, teachers houses, class rooms, dispensaries, etc. 51% of all surveyed mining and processing sites made some form of CSR contribution in the past two years. There are a number of factors that influence the likelihood that a site makes a CSR contribution, namely the presence of a license, the involvement of a cooperative and the proximity to a residential area.

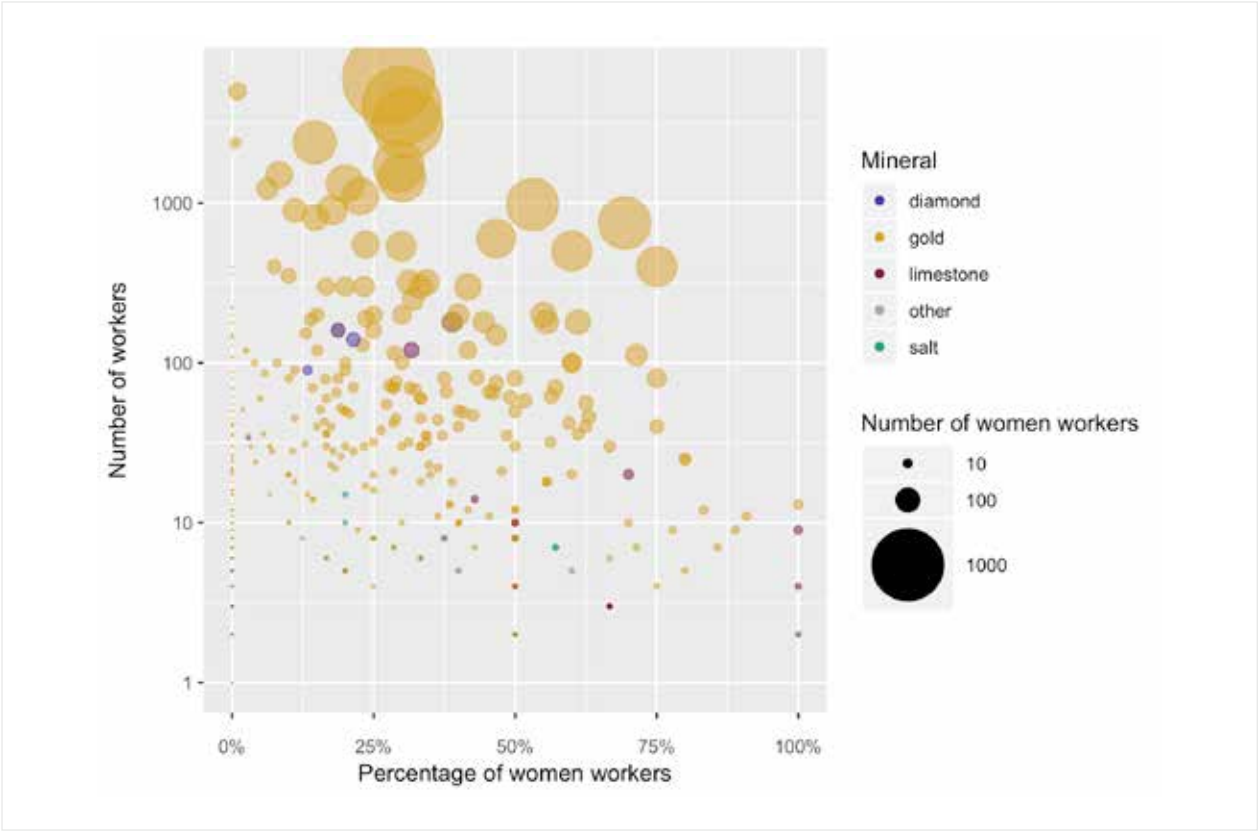
Examples of CSR contributions by individual ASM sites

- Donation of TZS 20 million (USD 8,686) for building teachers houses at Zahanati primary school in Nyarugusu, Geita (February 2017)
- Regular donation of iron sheets, cement, bricks and timber to build the village dispensary in Magunga, Mara (throughout 2016-2017)
- Donation of TZS 300,000 (USD 130) to local communities on World Food Day in Ililika, Geita (October 2017)
- Contribution of TZS 53 million (USD 23,018) to dig a well in the village, construct a dam and build a bridge in Kakola, Shinyanga (2017)
- Support of TZS 4 million (USD 1,737) to provide electricity in Mwenge primary school in Rwamgasa, Geita (2017)

4.2. Women's role and position

Entering ASM is relatively easy for women. Compared to many other sectors, it does not require a lot of capital, knowledge or technical skills to engage in small-scale mining or processing. Women are directly involved in operational activities on 59% of all sites and represent 20% of the total workforce in our focal area.[64] Women are quite equally represented across all minerals, except for salt mining where they represent up to one third of all workers.

Graph 5: Overview of where women are working by visualising all sites as dots scaled to the number of women working there, and placing them on axes of the total number of workers and the percentage of female workers at the site



Women face considerable **difficulties in climbing up the ASM ladder**. The large majority remains stuck in lower-level jobs. On 76% of all sites where women are engaged in operational activities, their work is limited to crushing and panning (often using toxic mercury – see section 4.4.3.). As seen in the previous section, these jobs are unstable and earn less than half of what the average miner gets. Mining remains indeed the most male-dominated activity, where women represent only 5% of the workforce, compared to 30% on processing sites (and 22% on combined sites). Better paid positions like technicians only involve women on 3% of all sites. There are a number of factors explaining this poor gender balance.

64 This is slightly below the finding in a 2012 baseline by the Ministry for Minerals that women make up 27,6% of people directly employed in ASM; as well as the global estimation of Hinton et al. that women make up 25% of the ASM workforce (J. Hinton et al., 'Women and Artisanal Mining: Gender Roles and the Road Ahead', in G. Hilson et al. (eds.), *The Socio-Economic Impacts of Artisanal and Small Scale Mining in Developing Countries*, (CRC Press, London, 2003), pp. 149-188.

Women crushing stones (Shinyanga, 2017 – Photo: IPIS)

First, there is an obstinate societal expectation for women to take care of the household. This evidently makes it hard for them to build a career in mining. Some can only accept occasional employment, others accompany their husbands when there is a high demand for work, and still others have no other choice than to bring their children along while mining or processing. Several surveyors observed women working whilst carrying a child on their back.

Second, even though financial resources are not a precondition to enter the sector, they are the main stumbling block in reaching more profitable positions. Women's access to capital is still severely hampered by traditional inheritance systems and customary marriage laws, making it hard for them to build up savings to invest in the sector.[65]

Third, mining is a particularly patriarchal sector where men are exceedingly protective of their positions. Various women purchasing gold ore from ASM sites for processing, reported that they are asked to pay higher prices than their male counterparts. Others lamented that women are more easily fired if they raise their voice against injustices. The argument that the nature of the work is too demanding for women is also often used as an excuse to shield the better paid positions from them. In the same manner, traditional beliefs – whilst gradually disappearing – still make several pit owners and site managers prohibit women from working underground, or in some cases even from entering the mining area, as their presence would bring bad luck.[66]

Finally, these male-dominated environments are ill-adapted to women's needs. Only 11% of all sites have separate sanitary facilities for women, as required by the Organisational Health and Safety Act.[67]. Several women testified about the inconveniencies of having to run home quickly in between or during shifts to

65 World Bank, *International Development Association Program Document on a Proposed Development Policy Credit in the amount SDR 65.2 Million to the United Republic of Tanzania for a Second Power and Gas Sector Development Policy Operation* (Report No. 84028 -TZ, World Bank, 2014), p.21.

66 H. Verbrugge and S. Van Wolputte, 'Just picking up stones: Gender and technology in a small-scale gold mining site', in A. Coles, L. Gray, and J. Momsen (eds.), *The Routledge Handbook on Gender and Development* (Taylor and Francis, Abingdon, 2015), pp. 173-184.

67 United Republic of Tanzania, *Organisational Health and Safety Act*, Supplement No. 5, 13.2.2003, Article 55§2.

change sanitary towels when they get their menstruation. Furthermore, a number of women described their fear for sexual harassment and violence in these male-dominated environments, where alcohol often flows abundantly, prostitution is widespread, and state oversight is limited.

A minority of women does succeed in breaking through these cultural and practical barriers.[68] Particularly in Geita and Shinyanga, various women managed to become investors. Whilst not digging, they buy themselves into one or several pits to get their share of production. A number of women made it to the position of pit owner, site manager, processing site owner or license holder.

Besides these operational activities, many women find **indirect job opportunities** on and around mining and processing sites. As many of these women are more mobile than miners, not seldom visiting several sites in a single day, it is even harder to get a good idea of their number. IPIS surveyors counted over 11,562 women engaged in such auxiliary activities on 58% of all sites. Their actual number is likely to be much higher, all the more given that this estimate does not include women providing these services for miners in nearby villages and towns.[69] These women perform a variety of functions, such as preparing and serving food or holding a bar or restaurant (on 54% of all sites), selling drinks, bites and cigarettes (19%), maintenance or cleaning (11%), or transporting food, drinks and other supplies to sites (7%). On big or well-organised sites, such shopkeepers and restaurant holders often pay a fee to license holders to operate their business on that site.

4.3. Children in mining and processing

Child labour has long been a major problem in Tanzania's ASM sector. Many children grow up in mining areas. They live close to or on sites, and regularly accompany their parents while they work. From the age of 7 children are reported to start mining. The 2012 ASM baseline survey by the Ministry for Minerals estimated the prevalence of child labour on mining sites at 1.8%.[70] In 2014, the National Bureau of Statistics gauged the number of children between 5 and 17 years engaged in ASM at 30,827, or 5% of the total workforce.[71]

Tanzania's 2009 Law of the Child Act prohibits any engagement of a person below 18 years of age in hazardous work, explicitly listing mining and quarrying.[72] The accompanying National Action Plan (NAP) for the Elimination of Child Labour commits to develop and periodically review "standard protocols, procedures, and guidelines for dealing with … children working in mines".

In 2013, Human Rights Watch put the spotlight on the precarious situation of children in Tanzanian mines.[73] This outcry[74] accelerated sensitisation programs by government actors, civil society and miners' associations across Tanzania. There are indications that these efforts are gradually leading to a reduction in the number of children involved in mining.

68 The Tanzania Women Miners Association (TAWOMA) has been working since 1997 to achieve this empowerment.
69 Eftimie et al. estimate that in Tanzania 2.5 times as many women are engaged in indirect roles (such as hauling and food and water provision) compared to direct mineral production (A. Eftimie et al., *Gender Dimensions of Artisanal and Small-Scale Mining: A Rapid Assessment Toolkit* (World Bank, 2012), pp. 7-8.
70 Ministry of Minerals and Energy, *ASM Baseline Survey, 2012*.
71 Tanzania National Bureau of Statistics, *Tanzania Integrated Labour Force Survey*, 2014.
72 United Republic of Tanzania, *The Law of the Child Act*, Supplement No. 21, 20.11.2009, Art. 82.
73 HRW (2013), 96p.
74 See also: K. Mahr, 'Tanzania struggles to end child labor from the lure of gold', *Reuters,* 4.4.2017, <https://www.reuters.com/article/us-tanzania-mining-children-feature/tanzania-struggles-to-end-child-labor-from-the-lure-of-gold-idUSKBN176007>.



Children accompanying their mothers on mining and processing sites (Mara/Geita, 2018 – Photo: IPIS)

For the purpose of data accuracy, and in line with the ILO Minimum Age Convention,[75] IPIS decided to only capture first-hand observations of children below the age of 15 working directly in mining and processing. Above this age, it becomes difficult to discern with a sufficient degree of certainty whether someone is adult or not. The snapshot observations by the CSO surveyors are unlikely to provide the full picture, but give an indication of the current **nature and scope** of the phenomenon in northwest Tanzania. Surveyors counted 324 children working in mining and processing on 46 sites. While this represents only 0.5% of the total workforce, it is striking that over 1 out of 10 sites still employ children younger than 15. Considerably more child workers were counted in Mara (144) and Shinyanga (132), compared to Geita (44). The latter was most clearly named and shamed in the HRW report and has seen more awareness-raising campaigns.

> ***"how am I supposed to pay for my boy's food and clothing if he does not help me?"***
> (women processing gold in Makungu, Geita)

Sensitisation has moreover focussed on mining and largely overlooked processing sites. This is reflected in the data, with only 4 children observed while working on a mine, compared to 140 on processing and 180 on combined sites. The hazardous involvement of minors in underground digging was only reported on 1 site. This form of child labour is evidently easy to hide and the actual number might be higher. 15% of sites where processing takes place engage children. They were observed while crushing stones on 20 sites, sluicing on 25, and panning on 9. In 5 cases, IPIS surveyors directly witnessed how children were using mercury, which is particularly harmful to minors (see further in section 4.4.3.). Some adults indicated that they expressly engaged children in panning because their young eyes would be better at detecting small particles of gold. Further, children were observed while transporting ore or water on 11 sites, operating machines on 1 and surface digging on 3.

Many children are pushed towards mining and processing due to poverty. As one mother processing gold with her son in Makungu, Geita bemoaned "how am I supposed to pay for my boy's food and clothing if he does not help me?".[76] Children are moreover pulled by bosses who see them as a source of cheap labour due to their weak negotiating position. In some cases, they earned up to three times less than adults in a similar position.

75 ILO, *Convention concerning Minimum Age for Admission to Employment (No. 138),* entry into force: 19 Jun 1976, Article 2.
76 Conversation with women processing gold in Makungu, Geita, February 2018.

Children working in mineral processing (Mara/Shinyanga, 2018 – Photo: IPIS)

Children are also attracted to mining and processing sites for other commercial opportunities. IPIS surveyors counted 1,115 children younger than 15 on 38 different sites, mainly engaged in small commerce, but also in transportation and serving food and drinks. As explained in the previous section, the highly mobile nature of many of these vendors means that this number only serves as an indication of the phenomenon.

There is international consensus to target efforts at the so-called **worst forms of child labour**.[77] This is "work which, by its nature or the circumstances in which it is carried out, is likely to harm the health, safety or morals of children".[78] While underground digging and mercury use undoubtedly fall in that category, gold mining and processing sites are generally hazardous environments for children. This is painfully highlighted by an accident that occurred in September 2017 on a mine site in Mara, whereby a child of 14 years slipped when stealthily entering a pit under renovation, got stuck and eventually died due to a lack of oxygen.

Besides the hard and demanding work, these dusty and noisy environments, scattered with often undelimitated (abandoned) pits, poor health and safety standards, and prone to sexual harassment and violence, pose considerable risks to children. The most common risks are respiratory and lung diseases, bacterial infections, musculoskeletal problems, skin infections, injuries, accidents and violence. Engagement in mining and processing moreover leads children to miss important educational opportunities. On about half of all sites that employ children, the latter were reported to be working during school time. A 2017 USAID-funded study points to increased school dropout in Tanzanian mining communities due to high rates of broken marriages leading to household poverty, unstable income patterns, mobility of miners, peer influence, the lure of fast cash, and limited parental supervision.[79]

4.4. Environment, health and safety

Numerous mining and processing sites in northwest Tanzania are plagued by interrelated and mutually destructive challenges related to health and hygiene (4.4.1.), safety conditions (4.4.2), mercury use (4.4.3.) and environmental degradation (4.4.4.).

77 See for instance: OECD, *Due Diligence Guidance for Responsible Chains of Minerals from Conflict-Affected and High-Risk Areas*, 2011.

78 ILO, *Convention concerning the Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labour (No. 182)*, entry into force: 19 Nov 2000, Article 3.

79 Ifakara Health Institute, *Pathways and Experiences of Children and Adolescents Who Engage in Artisanal and Small-Scale Gold Mining- Related Activities in Tanzania* (USAID Kizazi Kipya Project, November 2017), pp. 13-17.

4.4.1. Health and hygiene

Pit latrine on a mine site in Shinyanga (2017 – Photo: IPIS)

On many sites **hygiene** leaves much to be desired. 30% of miners and processors in our sample work on sites that have no sanitary facilities. 81 out of 197 sites without sanitary facilities (or 42%) are licensed mines. The 2003 Occupational Health and Safety Act requires license holders to provide sufficient, suitable and clean sanitary conveniences.[80] 56% of workers have access to pit latrines, 31% to flush toilets and 12% to showers. However, many of these facilities are in poor condition, insufficient in number, remote, reserved for management, or not free of charge. Consequently, many workers go in the bush or use empty bottles which are littered around mines.

Access to clean drinking water is limited in mining areas. Often water for cooking and drinking is fetched from rivers which miners are themselves polluting due to improper liquid waste management systems, or from unsafe standing pools in abandoned pits. Many mining and processing sites therefore form a breeding ground for bacterial, viral and parasitic **infections** such as dysentery, typhoid, or urinary tract infections. Such conditions are moreover disastrous to fight potential outbreaks of epidemics like cholera, particularly in the rainy season. The high numbers of sex workers and low protection behaviour do moreover lead to an elevated prevalence of HIV on and around many mining and processing sites.[81]

Another key source of infections and diseases is **dust**. The entire process, from drilling, blasting, loading, crushing, grinding to transportation, generates huge amounts of dust. Smoke is equally a big problem, particularly in limestone and salt mining that consume high volumes of firewood. The cumulative effect of inhaling dust and smoke day in, day out, over long periods of time, significantly increases the risk of respiratory and lung diseases, such as pneumonia, silicosis and tuberculosis.

Further, the incessant exposure to loud **noise**, mainly from ball mills, but also from drilling and crushing is harmful for miners, processors and neighbouring communities. Besides permanent hearing loss, it can incite non-auditive harm such as stress, fatigue, testiness or dizziness. Given that many processing sites are close to residential areas, some villages in our focal area have enacted by-laws prohibiting the use of ball mills between 7pm and 6am.

4.4.2. Safety

Former Commissioner for Minerals Samaje called ASM sites "death traps" after 27 miners had lost their lives in Tanzanian mines in the first five months of 2017.[82] **Risks** arise due to inadequate safety training, poor digging techniques, improper shaft support, malfunctioning or absent ventilation systems, negligent use of explosives, etc. Not seldom miners start off well by carefully reinforcing the mouth of a pit, but loosen precautions underground in the absence of control and in their drive to produce as much and as quick as possible. Long working hours moreover lead to loss of focus and care.

80 *Organisational Health and Safety Act*, Article 55.
81 D. F. Bryceson, J. B. Jønsson and H. Verbrugge, "For Richer, for Poorer: Marriage and Casualized Sex in East African Artisanal Mining Settlements", *Development and Change,* 2013, *45(1)*, pp. 79-104.
82 H. Omar, 'Tanzania: 27 Perish in Mines Within Five Months', *Daily News*, 29.05.2017, <https://allafrica.com/stories/201705290189.html>.

Abandoned pits scattered across a mine (Mara, 2017 – Photo: IPIS)

Accidents are unfortunately not rare. The Ministry for Minerals recorded 181 accidents, causing 263 deaths, on small-scale mines in the past ten years (2008-2017).[83] 125 of these accidents with 123 fatalities occurred on PML's, while 56 accidents caused 140 fatalities on unlicensed sites. This data suggests both a higher dead toll and lower registration of accidents on unlicensed sites.

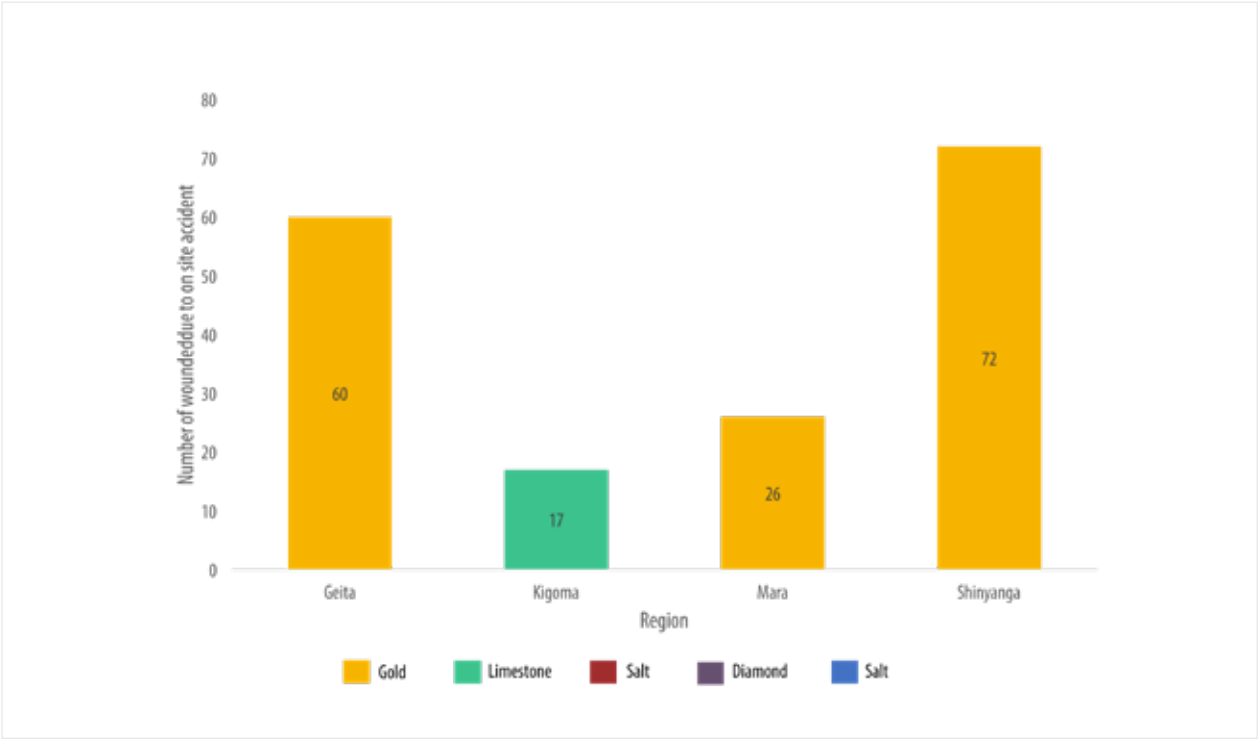
In our sample, accidents were reported on 78 mining and processing sites in the year preceding IPIS surveyor visits. In total, these accidents led to 175 wounded and 90 fatalities. Mining is clearly most hazardous. 21% of sites where mining takes place were struck by accidents, compared to 8% of sites where there is merely processing activity.

First aid amenities at mining sites (Mara/Geita, 2017/2018 – Photo: IPIS)

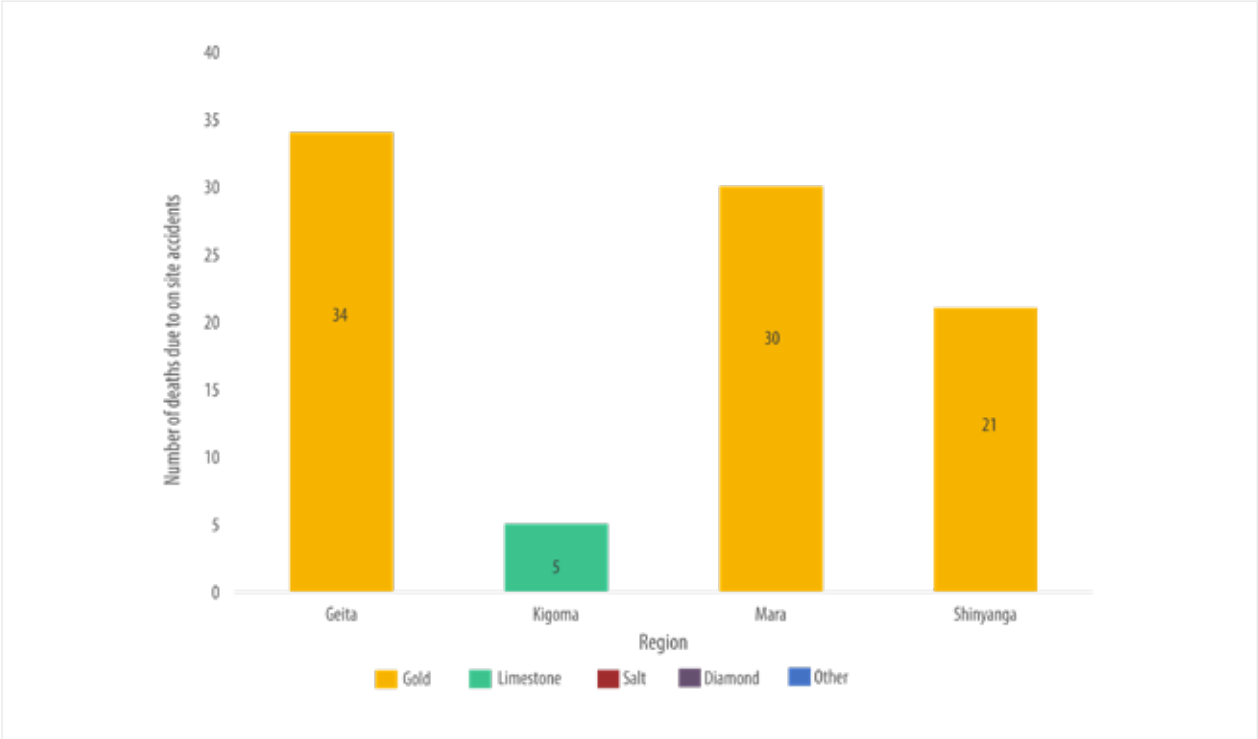
83 Mutagwaba et. al (2018), p. 42.

The actual accident rate is likely to be even higher. This is mainly because miners are disincentivized to report accidents as this might lead to (temporary) closure of the site by mining authorities (see chapter 5). A few respondents indicated cases of miners being buried in pit collapses without any mention to authorities. The limited availability of first aid amenities, let alone medically trained staff, and often remote health care facilities, render mining environments all the more harmful.

Graph 6: Number of wounded due to on-site accidents per mineral, by region



Graph 7: Number of deaths due to on-site accidents per mineral, by region



Pit collapses are the most common type of accident, accountable for 81 of those wounded and 32 of those killed. Poorly constructed and reinforced pits and shafts in the earthquake-prone Great Rift Valley are clearly a very serious concern. At worst, people are buried alive under earth and rocks, others get stuck for days and may suffer from dehydration, malnutrition or hypothermia. These risks are further exacerbated by the frequent use of explosives. On 41% of sites where mining is done, representing 55% of workers on these sites, explosives are used to break rocks for excavation, often without proper storage or evacuation plans.

Another main type of accident occurs when miners fall or slip while entering or leaving a pit. Pit depths range from a few feet to over 100 meters and miners are either let down by rope or climb down themselves. This risky process led to 34 wounded and 21 killed. Similarly, uncovered abandoned pits constitute a serious risk.[84] These are shattered across mine sites and can be partly overgrown by vegetation, making them hard to see. Often, such pits have been abandoned because they became unsafe. Nonetheless, some people decide to take the chance and secretly enter them, not seldom at night. In various ways, such abandoned pits have cost the lives of at least 2 people and led to 15 getting wounded in the year preceding IPIS visits.

Miners descending in pits (Geita/Mara, 2017/2018 – Photo: IPIS)

Intoxication by alcohol or drugs during or after shifts obviously heightens the chance of accidents in these risk-prone areas. It was the main explanatory factor for 18 people getting killed and 1 person getting wounded on mining and processing sites. Further, 42 people got injured and 9 died while operating machines. The most common problems are electrocution or undiligent use. Other accident causes include oxygen deprivation, fire outbreaks and landslides.

Safety is widely seen as an individual responsibility. At best, site managements pay hospital or funeral costs. Sometimes, even this is not granted and miners depend on the support and generosity of their colleagues, friends and family. Compensation for lost income is very uncommon. One mine site manager in Geita claimed that "the cost of treating an injured worker is simply too big to carry. It would force me to dishonour payment commitments towards other miners".[85]

This individual safety perception also manifests itself in the **use of protective equipment**. In spite of the abundant risks, personal protective equipment (PPE) is mostly seen as a personal responsibility. This implies that miners should judge and purchase themselves what they need. Unsurprisingly therefore, PPEs are scantly used and awareness on health and safety risks is low. Helmets were in use on 16% of mining and combined sites. Yet, only rarely were there enough helmets for the whole team, and miners pass them on to those undertaking the riskiest work at that moment. Strikingly, on many sites, helmets are a kind of insignia to mark those that obtained the rank of inspector (and therefore rarely descend underground), rather than serving as protection. Other PPEs such as facemasks, gloves, safety glasses and earmuffs are even more scarce.

84 In November 2018, Tanzanian media reported that 2 girls died after falling in an abandoned pit in Chunya, Mbeya region ('DC acts on abandoned pits', *Daily News*, 26.11.2018, <https://dailynews.co.tz/news/2018-11-265bfb8af29e932>).

85 Conversation with mine site manager in Nyang'homango, Geita, December 2017.

"The cost of treating an injured worker is simply too big to carry. It would force me to dishonour payment commitments towards other miners"
(mine site manager in Nyang'homango, Geita region)

4.4.3. Mercury use and impact

Despite its highly toxic character, mercury is widely used by artisanal and small-scale gold processors in Tanzania because of its ease, affordability and availability. Mercury contaminates water, soil and air. It accumulates in the human body after inhaling its vapour or fumes, by contact, or by consuming mercury-contaminated fish, meat or crops.[86] Mercury poisoning is a slow process that builds up over months or years and gradually attacks the central nervous system. Foetuses and infants are especially vulnerable.[87] Known symptoms include speech impediments, decreased cognitive functions, memory loss, muscular atrophy, failure of muscular coordination, body imbalances, tremors, contraction of visual fields, disturbance in smooth eyeball movements, and enteral hearing loss. Artisanal and small-scale gold mining is the world's largest producer of mercury emissions.[88]

4.4.3.1. Policies and regulations

As in most countries, mercury use is legal in Tanzania. The import, export, transport, storage and dealing of mercury is governed by the 2003 Industrial and Consumer Chemicals Act and needs approval from the Chief Government Chemist Agency (GCLA).[89] Yet, most of the mercury enters the country illegally and thereby escapes GCLA control.[90] In 2010, Mercury Watch, an interactive monitoring system for global mercury use, named Tanzania as third highest mercury emitter in Africa, releasing an estimated volume of 45 tons of mercury per year, mainly by ASM.

Various measures and initiatives have been taken in Tanzania to contain and control mercury use by artisanal gold processors, such as trainings, sensitisation campaigns, promotion of retorts (devices that capture, condensate and recycle mercury during burning) and building protected amalgamation ponds. In 2009 the Government published a National Action Plan for Mercury Management, including strategies to sensitize on the harms and risks of mercury use and introduce mercury-free technologies to process gold. In October 2013, Tanzania was among the first signatories of the Minamata Convention on Mercury. This international treaty, which entered into force in August 2017, aims to protect human health and the environment by reducing anthropogenic emissions and releases of mercury. Tanzania did not yet complete the ratification process. Meanwhile, the UN Environment Program (UNEP) is supporting a process led by Tanzania's Vice-President's Office (VPO) to draft a National Action Plan to reduce the use of mercury, which is a legal requirement under the Minamata Convention.

4.4.3.2. Mercury use in northwest Tanzania

In spite of these initiatives and efforts, mercury use remains **omnipresent** in northwest Tanzania. If we exclude cyanide leaching plants (see below), 98% of all surveyed gold processing sites use mercury. Only on 4 tiny gold processing sites in Kigoma did IPIS surveyors not ascertain mercury use. Likely, the chem-

86 S. Bose-O'Reilly et al., 'Health assessment of artisanal gold miners in Tanzania', *Science of The Total Environment,* 2010, 408(4), pp. 796-805.
87 In October 2018, doctors raised the alarm about the increasing number of birth defects in mining communities in Mara and Geita (P. Rugonzibwa, 'Unsafe mining blamed for children abnormalities', *Daily News*, 30.10.2018, <https://dailynews.co.tz/news/2018-10-305bd7ee2287fbe.aspx>.
88 UNEP, *Global Mercury Assessment 2018* (UN Environment Programme, Nairobi, 2018).
89 United Republic of Tanzania, *Industrial and Consumer Chemicals (Management & Control) Act*, Supplement No. 3, 28.7.2003.
90 The official import of mercury (i.e. 1.2 ton in 2015), which is in fact mainly for non-extractive consumption, is much lower than the estimated ASM mercury consumption of 31.5-58.5 t/year, pointing to considerable illegal trade (COWI, *Mercury trade and use for artisanal and small-scale gold mining in sub-saharan Africa* (World Bank, 2016), pp. 26-33).

ical is not easily available in this remote region with limited gold mining activity. Moreover, all surveyed gold mining sites in Kigoma are alluvial, where mercury is less needed in processing, particularly if the gold is sufficiently coarse. As mentioned above, cyanide leaching plants are a next step in ASM gold production. They buy tailings from gold processing sites to recover the gold that was not captured by panning or mercury amalgamation. While leaching does not involve the use of mercury, 7 of the plants in our sample form part of a larger processing site where small-scale processors first treat the concentrate with mercury.

Our map of gold processing areas could therefore be considered as a risk map for toxic pollution. Mercury **contaminates the environment** in different ways. Firstly, its hazardous vapour is lost to the atmosphere in the burning process (see below) or due to improper storage. In principle, mercury should be stored in an airtight container, with a layer of water on its surface. This hardly ever happens in processing areas where mercury is typically sold and stored in used soda bottles.

Secondly, the mercury substance itself can be lost due to improper handling. Mercury is mixed with ore and water in the often-brute panning process. It is regularly rubbed into the ore concentrate by bare hand, as gloves are rarely available (see section 4.4.2.) and according to several processors less efficient in amalgamating gold with mercury. Processors subsequently squeeze the mixture in a piece of tissue to separate the parts that did not amalgamate with the gold. Throughout this process IPIS surveyors observed that small amounts of mercury easily get spilled on the ground or in the tailing water. There were some reports of miners purposefully discharging "exhausted" mercury because of a wrongful belief that it would have lost its capacity to amalgamate.

Processor amalgamating gold with mercury (Mara, 2018 – Photo: IPIS)

To avoid the contaminated tailing water from polluting the soil or water source, amalgamation ponds have been built on many gold processing sites. IPIS found that a great number of these are in bad condition, as they were poorly constructed or did not stand the test of time, and may therefore have leakages. Moreover, during the rainy season, these polluted basins regularly flood. Another concern is that contaminated waste material is periodically shovelled out of these ponds and added on top of other tailings. Mercury is not removed in this process, and gradually drains the soil or flows with rain water to lakes, rivers and streams.




Mercury-contaminated water flooding from amalgamation ponds (1), Gold processing on the shores of Lake Victoria and next to rice fields (2, 3), Cattle grazing on a gold processing site (4) (Mara/Geita, 2017/2018 – Photo: IPIS)

Given that gold processing requires a lot of water, such sites regularly arise on river banks and lake shores, with clear risks of contaminating fish and drinking water. These fertile areas moreover attract farmers. IPIS observed many cases of crops being grown on the verges, or even within, gold processing sites. Another widespread health risk are animals grazing around and drinking from processing ponds. Some miners reported herdsmen breaking into processing compounds at night to let their cattle graze and drink. Several incidents were reported whereby cows, goats or sheep got sick or died after drinking contaminated water.

Mercury is **traded** in different quantities. These range from 34.5 kg canisters to 1-2 kg flasks, soda bottles and soda bottle tops (called *koki* in Swahili*)*. The latter are often bought by individual processors and contain around 5 mm^3 (or 67.67 grams) of mercury. Prices diverge from TZS 15,000 to 40,000 (USD 6.5 - 17) per *koki*, depending on availability and location. The market price per kilogram of mercury in northwest Tanzania ranges from TZS 230,000 up to 400,000 (USD 100 - 174).

Controlling the use of mercury requires getting a grip on its supply chain. Little is known however about the trade of mercury in East Africa. A COWI report from 2016 identifies the Kenya connection, through the border town in Sirari, as the main illicit trading channel for Tanzania's northern goldfields.[91] Our research identifies two main commercial modus operandi within the focal area. On the one hand, mercury is supplied directly to mining and processing sites by gold traders or vendors who sell it to processors, or barter it for gold. On the other hand, there is a sizeable black market of jewellers and small shops where miners and processors stock up on mercury. The most important mercury trading hubs identified within this project's focal area are Mwanza, Geita, Kahama and Musoma, and to a lesser extent Nyaligongo, Katoro, Rwamgasa, Nyarugusu, Masumbwe, Kakola and Ushirombo.

91 The Southern goldfields are reportedly supplied from Zimbabwe through Zambia (Tunduma border post), whilst the port of Dar es Salaam feeds the remaining trade networks (COWI (2016), pp. 28-32).

4.4.3.3. Worst practices

The Minamata Convention prioritises the elimination of the largest and most dangerous uses of mercury. These so-called 'worst practices' are:

- Whole ore amalgamation;
- Open burning of amalgam or processed amalgam;
- Burning of amalgam in residential areas; and
- Cyanide leaching in sediment, ore or tailings to which mercury has been added without first removing the mercury;[92]

This section assesses how northwest Tanzania scores on each of these 4 worst practices.

First, **whole ore amalgamation** is the process whereby mercury is added to all milled material before concentration. This consumes large amounts of mercury, which can often not be recaptured or recycled and are therefore lost in tailings. Concentrate ore amalgamation, on the other hand, means that mercury is added after milling, sluicing and panning the ore. On average the former is estimated to consume 5 units of mercury for every unit of gold, while the latter typically consumes 1.3 units of mercury per unit of gold.[93] The highly pollutant whole ore amalgamation was not observed on any of the 187 gold processing areas. The practice is largely unknown in this region, as mercury is likely considered too expensive to waste in this process.

Second, **open burning of amalgam** constitutes a far bigger problem in northwest Tanzania. The use of retorts was only observed on a handful of processing sites, painfully highlighting how previous efforts to introduce these tools did not have the desired impact. On 63% of all sites where mercury is used (representing 83% of workers on such sites) surveyors witnessed open air burning of gold-mercury amalgam. The actual percentage is likely to be higher as, particularly on small sites, burning only takes place occasionally and may have been missed during surveyor visits. The health impact of this process is immense. This is all the more so because workers often gather around the stove to check the output and blow the fire to increase temperature, thereby directly inhaling the toxic vapour. The full amount of mercury in the amalgam is lost to the atmosphere if no retorts or other fume hoods are used, and can travel long distances.[94]

Charcoals stoves burning mercury in a residential area and in front of a gold shop in Nyamongo (Mara, 2017 – Photo: IPIS)

92 United Nations, *Minamata Convention on Mercury*, 2013, Annex C.
93 A. Persaud and K. Telmer, *Developing Baseline Estimates of Mercury Use in Artisanal and Small-Scale Gold Mining Communities: A Practical Guide (Version 1.0)*, (Artisanal Gold Council, Victoria, 2015), p. 11.
94 Retorts typically recover about 80% of the mercury vapour (Artisanal Gold Council and UNEP, *Estimating Mercury Use and Documenting Practices in Artisanal and Small-scale Gold Mining (ASGM): Methods and Tools*, (AGC, Victoria, 2017), p. 15).

Particularly worrisome is that 63% of processing areas where **open burning** was observed, and 71% of all sites using mercury, are **close to residential areas**. Worse still, these are especially the bigger sites, which consume and burn most mercury. When burning is done next to places where children live and play, women prepare food, and households do subsistence farming, the risk of mercury poisoning is severe. In order to hide from thieves, government services or rain, some processors even burn their amalgam inside tents, huts or houses, further increasing the chances of inhaling toxic mercury fumes.[95] IPIS moreover found that gold buyers', particularly in Mara, regularly burn amalgam in or around their shops, a practice that is not captured by our processing site-level statistics.

A fourth and final worst practice is **cyanide leaching of mercury-contaminated tailings**. As set out in Chapter 3, cyanide leaching is widespread in northwest Tanzania. Contrary to mercury, cyanide is a non-persistent compound that can be degraded. When used correctly cyanide leaching poses no risk to human and environmental health, and its efficiency in capturing gold is likely to have even reduced the consumption of mercury in the region. However, this is on the condition that the chemical is used correctly and that that any mercury contained in tailings is removed before cyanidation. All surveyed leaching plants reported to supply tailings directly from artisanal and small-scale processing areas. As mentioned above, there is a very high risk that these are mercury-contaminated. No efforts were identified of removing mercury from the tailings before mixing them with cyanide. In the leaching process, mercury forms a highly mobile and water-soluble complex with cyanide. It renders mercury even more toxic and accelerates its evasion to water, soil and air. This a big health and environmental concern, all the more so given that leaching plants are hardly ever covered and often too shallow, leading to regular overflows in the rainy season.

A leaching tank spilling cyanide-contaminated water (Shinyanga, 2017 – Photo: IPIS)

4.4.4. Other environmental concerns

In addition to the above hygiene challenges, dust, noise pollution, and mercury and cyanide contamination, ASM raises a number of other environmental concerns.

In the first place, waste material and fuel spills and exhausts pollute soil, air and water in and around mining and processing sites. **Water pollution** is a particular concern, with disposals of tailings and waste-rock sometimes even congesting streams and rivers. Many villagers complain that river water is making them and their animals sick. Most of these flows discharge their waters in Lake Victoria, which is Africa's most important source of inland fishery production, feeding over 40 million people in Tanzania, Uganda, Kenya and beyond.[96] The Mara river, which runs from Kenya through Tanzania to Lake Victoria, is under particular threat. There are serious concerns that large and small-scale gold mining on the river banks are polluting the water, and thereby putting the Serengeti and Masai Mara ecosystems, of which it forms part, under threat.[97]

A second major concern is **deforestation**. In the ASM sector, gold is because of its scale the biggest consumer of wood in northwest Tanzania. It is mainly used for shaft support and winches. Limestone and salt

95 The vapour can moreover be absorbed by ceilings and walls, causing long-term exposure to those living and sleeping in those places (ibid).

96 M. Njiru et al., 'An overview of the current status of Lake Victoria fishery: Opportunities, challenges and management strategies', *Lakes & Reservoirs: Research and Management*, 2008, 13, pp. 1-12.

97 G. Koech, 'Mara River threatened by mining, pollution and forest destruction', *The Star*, 22.06.2018, <https://www.the-star.co.ke/news/2018/06/22/mara-river-threatened-by-mining-pollution-and-forest-destruction_c1775822>.

mining also play their part because of the huge amounts of firewood consumed in burning and evaporation processes. To halt deforestation, district authorities are passing by-laws to limit or prohibit the cutting of trees, causing considerable surges in timber prices. In the absence of alternatives, this perversely leads to savings on shaft support in gold mining. Notably, some gold mining site managements in Geita and Shinyanga have started forestation projects, both to compensate for their ecological footprint and meet their own wood demand.

Thirdly, ASM **degrades land** across northwest Tanzania. Insufficient geological knowledge, shaft support, ventilation and dewatering cause poor mineral recovery and lead miners to start and abandon pits at an overtly rapid rate. Hardly ever do production sharing arrangements consider the costs of waste management and rehabilitation. Consequently, old and new tailings and waste products are dispersed across the region. Only in some limestone mining areas are tailings not just accumulating, as farmers can collect them without charge to use as fertilizer. Furthermore, mined-out pits are hardly ever properly closed and are hazardously scattered across mining areas. Not only is this extremely dangerous for people and animals, it also destroys landscapes and makes them unsuitable for rehabilitation. Alluvial diamond mining is particularly invasive as miners typically dig only a few feet deep to reach the gravel, wash it, sort it and then repeat this on a next spot. A diamond mining rush therefore rapidly degrades huge areas with shallow pits and small mounds.

Landscape degradation by alluvial diamond mining on the border between Shinyanga and Mwanza regions (2018 – Photo: IPIS)

Seen how environmentally destructive some operations are, it is worrying that a few of them are taking place within **protected areas**. These include forest reserves such as Biharamulo in Geita and Makere in Kigoma. It is not against the law to mine in such reserves, but discouraged through high compensation charges. The Forest Act imposes a mining fee of ca. USD 650 (TZS 1,505,000) per hectare per year, and an establishment fee of a mineral extraction plant of ca. USD 5,130 (TZS 11,800,000) per hectare per year.

4.5. Worker and community relations

As noted above, there are important wealth spill-overs of ASM to neighbouring communities. However, the above challenges of gender discrimination, child labour, poor health, hygiene and safety standards, pollution and environmental degradation, combined with the proximity to and even embeddedness in human settlements, can put serious **pressure on the social fabric**.[98]

98 A. Kitula, (2006) 'The Environmental and Socio-economic Impacts of Mining on Local Livelihoods in Tanzania: A Case Study of Geita District', *Journal of Cleaner Production*, 2006, 14(3–4), pp. 405–414.

First of all, local authorities are often ill-equipped to deal with (sudden) rises in population that risk to overstretch already scarce social welfare and policing services. The influx of cash and consumers regularly leads to soaring prices, and not seldom brings along increased alcohol abuse, prostitution, violence and crime.

That mining attracts crime is clear from the fact that 42% of miners and processors work on a site that was struck by theft in the past year. Thieves mainly target minerals, equipment, cash and mobile money businesses, and do not shy away from violence. Some of them were reportedly armed with machetes or even guns, and casualties are not uncommon. In two separate incidents in Mara and Kigoma, several miners were killed during a raid, leading to the temporary closure of these mines. Thieves are rarely caught and most cases are closed due to lack of evidence.

Relations among miners are sometimes tense and occasionally violent. While most frictions are latent, 14% of workers operate on a site that is affected by outspoken internal conflict. Key sources of tension are competing claims over licenses and pits. Several reported incidents related to pits meeting underground or site owners and cooperatives contesting each other's mining titles. Distribution of income and production sharing are other causes of trouble (see section 4.1.).

Sometimes tensions run out of hand and lead to outright violence, with miners using stones, knifes or machetes.[99] IPIS registered reports of 18 miners who got wounded due to fights with other miners and 2 who got killed in the year preceding site visits. In one flagrant incident in Shinyanga a miner was allegedly beaten to death by the site's management after he entered a pit in which he had no claim. In reaction his fellow miners set fire to the management's office.

Outspoken **conflict with communities** living around mining and processing sites is less common. Only 2% of workers operate on a site where outright conflict with neighbouring villages was reported. Most differences arise over land, but the majority of cases is settled amicably. The process of granting mining rights is indeed not always aligned with existing surface rights, and even less with informal land use or customary titles.[100] This regularly results in competing land use claims, with mining titles assigned on farmland or even in people's residences. As court-settled compensations for land owners tend to be low and slow, most land issues are sorted out privately, often with facilitation by local authorities, resident mines offices or small-scale miners' associations.

The absence of land development plans, demarcating areas for mining, living, crop cultivation and livestock keeping, leads to further frustrations over water, soil, noise and air pollution, as set out above. This particularly affects miner-farmer relations, with recurring complaints of animals suffering or dying from water or soil contamination, or by falling in abandoned pits. In some areas, vibrations from blasting and drilling are disturbing villagers and sporadically lead to cracks in houses and land.

Finally, 5% of the workforce is active on a site that states to be in **conflict with a medium or large-scale mining** operation in their proximity. Many of these conflicts again concern land and title issues. Over the years, these industrial miners have obtained large concessions that span across areas where artisanal miners have long been active. Hopes of compensation or support from these large-scale operations have often been in vain, leading to considerable anger and envy.

99 In October 2018, the Tarime District Commissioner closed a site following a title conflict between small-scale miners that got seriously out of hand ('Tarime suspends small scale mining in Kibaga', *The Guardian,* 5.10.2018, <*https://www.ippmedia.com/en/news/tarime-suspends-small-scale-mining-kibaga-%C2%A0%C2%A0%C2%A0*>).

100 IHRB, *Human Rights in Tanzania's Extractive Sector: Exploring the Terrain* (Institute for Human Rights and Business, London, 2016) pp. 49-50.

5. STATE OVERSIGHT

The numerous socio-economic and human rights challenges set out above, highlight the considerable work that remains to be done on enforcing the relevant regulations on licensing, working conditions, health and safety, child labour, environmental impact, etc. This chapter elaborates on the different functions of visits by state services and draw lessons on where and why oversight remains incomplete.

5.1. Functions of visits by state institutions

At least 10 different state institutions are involved in ASM oversight. 62% of sites in our sample are visited by the Resident Mines Office (RMO), 55% by representatives from the village authorities, 19 % by the National Environment Management Council (NEMC), 18% by district authorities, 14% by the Tanzania Revenue Authority (TRA), 7% by the Occupational Safety and Health Authority (OSHA), and 6% by various other services including the police, Tanzania Food and Drug Authority (TFDA), Tanzania Forest Service (TFS) and Immigration. Together, these state service have a relatively wide coverage. 52% of workers operate on a site that is visited, occasionally or periodically, by three or more state actors, 11% by 2 and 28% by 1. However, 9% of workers never receives a government institution on their site. It is moreover striking that state services do not appear to distinguish between licensed and unlicensed sites, as there are no pronounced differences in the number and kind of actors visiting.

The frequency of visits is irregular. In the large majority of cases they occur between 2 and 6 times per year. Miners indicated that they receive government visitors mainly in times of high production, when an accident occurs or if there is a specific request or complaint. The village authorities have the highest frequency: for 60% of sites they visit this is at least monthly. The RMOs obtain that frequency on only 14% of all sites they visit. The Small-Scale Mines Inspection Manual of the Ministry for Minerals explicitly states that except for specific indications of violations or complaints, only mines that have not been inspected for more than two years should be prioritised. [101]

There are different reasons why state institutions visit mining and processing sites. Given that most sites are not visited frequently, it is not uncommon that one visit serves multiple purposes, which are not always explicit. The three most common functions are inspections (5.1.1.), revenue collection (5.1.2.) and training and assistance (5.1.3.). A number of other, less frequent, functions are data collection, policing and law enforcement, and conflict resolution (5.1.4.).

5.1.1. Inspections

61% of sites, representing 75% of workers, receive inspection visits. With over 30% of all sites inspected during the past year, the RMOs are the main inspector. The Mining Act explicitly authorises them to "at any time enter any area over which a mineral right has been granted or any premise or working place except dwelling houses", for the purposes of inspecting prospecting, mining or processing operations, ensuring compliance with the Mining Code, detecting nuisances, taking samples, examining accounts or obtaining any other information.[102] Other key actors are – in order of importance – village authorities (21% of sites inspected), NEMC (14%), OSHA (7%) and district authorities (6%).

Inspections serve various purposes, depending on the state actor and context. The majority of inspections are about safety issues. This is followed by environmental impact, health and hygiene, and several other issues such as child labour, licenses and records.

Inspections of mining techniques and **safety** conditions mainly look at construction of pits and shafts, proper closure of abandoned pits, use and availability of PPEs, use and storage of explosives, and avail-

101 Ministry of Energy and Minerals of the United Republic of Tanzania, *Inspection Manual for Small-Scale Mines* (Centre for Science and Environment, New Delhi, 2017), p. 10.

102 2010 Mining Act, Article 110.

ability of fire extinguishers. While NEMC and OSHA frequently sanction infringements, RMOs often stick to reprimands. Only in case of accidents do the RMOs regularly decide to close mines until safety conditions are in order, as per instructions from the Ministry. After a serious and widely reported mining accident in Nyarugusu in January 2017, the Commissioner for Minerals called for a nation-wide inspection of all licensed small-scale mines, but simultaneously indicated that this could hardly be done with the mere 60 mining engineers he had in service.[103]

NEMC holds the main authority over inspecting and sanctioning infringements of mining and processing operations against **environmental** regulations. RMOs, OSHA, village and district authorities also cover environmental issues. Environmental inspections cover the use of chemicals, tailings storage, deforestation, waste management, and water and soil pollution. Miners reported sanctions that range from fines, over in-kind penalties to prison sentences.[104] IPIS noted a recurring criticism that authorities impose sanctions, but do not assist in finding alternatives, for instance on the need for timber to support shafts. Many miners moreover indicated that they prefer to pay the fines, such as those for abandoned pits that are not properly closed, than to change their practices.

The generally poor compliance with environmental regulations is not helped by the long-standing confusion over the applicable legal framework. The 2004 Environmental Management Act requires registering PMLs with NEMC, who determines whether or not the risks and footprint are so high that a full Environmental Impact Assessment (EIA) would be required.[105] The 2010 Mining Regulations, which has *de jure* precedence, necessitated PML holders to submit an Environmental Protection Plan (EPP) to the mining authorities. This requirement is however hardly enforced as few license holders are aware of it. According to a recent study, less than 10% of PMLs submitted an EPP.[106] This confusion has been addressed in the 2017 amendments to the Mining regulations which give precedence to the Environmental Management Act. However, much remains to be done to clarify and enforce these requirements in practice.

OSHA is mandated by the Organisational **Health and Safety** Act to inspect, forewarn or fine infringements. Again, also NEMC, RMO, village and district authorities inspect health and hygiene on sites. On the surveyed sites, these inspections span issues such as the condition of sanitary facilities, food inspections, and health precautions of using of chemicals like mercury and cyanide.

5.1.2. Revenue collection

Revenue collection is a second important function of state visits, reaching 55% of all sites (representing 51% of workers). Even if many taxes are not paid on-site but rather in the office or directly to the account of the respective taxing authority, a variety of state actors frequents sites to check on or collect a diverse range of formal and informal taxes.

Most tax collection visits, both in number of sites and frequency, are undertaken by **village authorities**. They collect taxes on 1 in 3 sites. Many villages collect a 'development levy' to contribute to village expenses and investments. As there is no legal basis for this levy, it is charged on an ad hoc basis and takes various shapes and sizes. Some villages levy a production tax (e.g. TZS 100-500 per 25kg bag of limestone), a sales tax (e.g. 2-10% on the sale of tailings), or a transport fee (e.g. TZS 2000 per 25kg bag of gold ore that is brought to the village for processing). Others claim part of the production (e.g. every 1 in 10 bags is for the village), or all production during a set timeframe (e.g. one shift of 8 hours). Yet others charge a site entrance fee or a periodical flat rate. In many cases, miners pay this tax without any problem as they directly see the benefits of their contribution to village investments. However, where these levies become excessive or do not consider the challenges of periods with low production and high investments, discontent rises.

103 'Plans to Inspect Over 35,000 Small-Scale Mines Underway', *Daily News,* 6.2.2017, <https://www.dailynews.co.tz/news/plans-to-inspect-over-35-000-small-scale-mines-underway.aspx>.
104 'Geita court remands 4 Nyarugusu mine workers', *The Guardian*, 28.2.2018, <https://www.ippmedia.com/en/business/geita-court-remands-4-nyarugusu-mine-workers>.
105 United Republic of Tanzania, *Environmental Management Act*, Supplement No. 20, 2004.
106 Mutagwaba et al. (2018), p. 73.

District authorities have a formal mandate to collect a 0.3% service levy on the annual turnover generated by any corporate entity, including mining and processing sites. Due to substandard record keeping, suspicions of underreporting and regular payment arrears, district authorities occasionally frequent sites for auditing and collection. Regularly, district authorities levy additional taxes through by-laws or informally. Many of these district levies are flat-rate equipment (e.g. TZS 12.000-400.000 per ball mill per year) or site-level (e.g. TZS 7 million per leaching plant per year) taxes. Because it is unclear to many miners what the basis is for these taxes and where the money goes, they have been nicknamed "the tax with no reason".

Resident Mines Offices are responsible for the collection of royalties (6% of the gross value of minerals or gemstones produced), as well as PML fees and inspection fees on the value of exports. In practice, RMOs only manage to capture part of ASM production. Small-scale license holders mainly self-report production when they go and pay their dues at the RMO office. On big unlicensed sites, RMO staff will try to be present on 'distribution day'. This is the last day of a weeks or months-long shift when miners distribute the bags of ore. On such occasions, RMOs typically collect royalties in terms of bags of ore and auctions them on-site. Production monitoring is much more straightforward on the level of gold elution plants, which are sealed by mining authorities. They are summoned when processing will take place, together with other taxing authorities, including TRA and local government authorities. It is hard to estimate which share of ASM production RMOs capture, as production or ASM royalty statistics are not systematically recorded. For gold, for instance, ASM production estimates in Tanzania range from 5 to nearly 14 tons per year.[107]

Another important tax layer is the 5% withholding tax[108] payable to the **Tanzania Revenue Authority**. Their visits were reported on 14% of sites. In other cases, this tax is collected by the RMO, paid directly by the miners to TRA, or neglected. As revenue collection is their only purpose, IPIS surveyors noted more discontent about TRA visits, because miners feel they get nothing in return.

Markedly, many miners are confused about who these different services are, what taxes they collect and which purpose these serve. IPIS surveyors noted numerous complaints that this cumulation of formal and informal taxes form an excessive burden that stifles sector development.[109]

5.1.3. Training and assistance

42% of sites, representing 37% of workers, receive some form of training and assistance from state services. The central actor here is the RMO who provides training and assistance on one third of all sites, or roughly half of the sites that it visits. NEMC is second with 10% site coverage on training and assistance. Other state actors play a minor role. Training and assistance are either a stand-alone activity, or combined with inspections to advise on improvements to irresponsible or ineffective mining and processing practices.

The focus of support diverges. The most important topic is safety techniques and equipment, which particularly aims to reduce the high prevalence of accidents. Second is the use of mercury, including awareness-raising on the devastating health effects, and trainings on its safe and efficient use. Already in 2006, the government partnered with UNIDO (the United Nations Industrial Development Organization) to design and implement a training program on mercury reduction. The widespread and irresponsible use of mercury set out in Chapter 4, highlights that a lot more remains to be done to ensure proper uptake of such training campaigns.

Two other recurring topics are environmental impact reduction, covering issues such as proper water drainage and control of deforestation, and record-keeping, administration and business skills. On a more ad hoc basis, state services advice and assist on issues such as procedures and requirements to apply and maintain licenses, health and hygiene, child labour, mining code and taxation.

107 UNEP, *Analysis of formalization approaches in the artisanal and small-scale gold mining sector based on experiences in Ecuador, Mongolia, Peru, Tanzania and Uganda: Tanzania Case Study* (UN Environmental Program, Nairobi, 2012), p.9; Mutagwaba et al. (2018), p. 25.

108 This is an income tax charged on the payer, rather than the recipient, of income

109 18% value added tax (VAT) is moreover due on sellers of mineral goods with an annual turnover exceeding TZS 100 million (USD 43,300).

Trainings and assistance are mainly impromptu as manuals or other training materials do often not exist, or are not widely used. Rather, the respective state representatives share their own experience and expertise with miners in a contextual manner. Miners are highly appreciative of this support. As the owner of processing unit in Katente, Geita, explained "their services are good for us because they tell us things we did not know, or remind us of precautions we had forgotten about". Several license holders pointed to the important support of RMOs in obtaining their PML. IPIS surveyors noted numerous requests for additional assistance on safety, mining techniques, license applications, entrepreneurship, mercury use, hygiene and particularly prospecting and geology, which is hardly covered to date. An often-heard complaint was that state services mainly target site managers and fail to reach pit owners and miners with their assistance programs.

5.1.4. Other secondary functions

Whilst not systematic, state visits serve a number of other, secondary, functions. A first is **data collection**, undertaken on 7% of all sites (representing 5% of workers). This is mainly done by RMO and TRA who collect production and worker numbers as a check against due tax amounts. As noted above, such data is not systematically stored in a centralised database.

If there are reports of serious infringements, incidents or security risks, state services visit mining and processing sites for **law enforcement**, patrolling or to make arrests. This is the case for 6% of all sites, mainly big ones that represent 19% of workers. The Tanzanian police force is evidently the central actor in this regard, and has even established permanent posts on a number of big ASM sites. Village and district authorities equally play their part in maintaining law and order in their jurisdiction. The Tanzanian Forest Service steps in where miners operate in forest reserves. This is often a source of considerable tension, particularly where the enforcement of mining and forest regulations is not aligned. In Makere forest reserve in Kigoma there are reports of rising frictions. IPIS received several reports of destructions of properties and equipment as well as excessive use of force by forest services against miners and their families.

A final function of state service visits is **conflict mediation**. As set out in Chapter 4, most conflicts are about land and title issues. The Mining Act assigns a central role to the Mining Commission (previously the Commissioner for Minerals) in dispute settlement on mineral rights, related water uses and issues of compensation. In practice, the RMOs take on this role for many small disputes, often with the involvement of village or district authorities. IPIS moreover registered several cases in which RMOs had to intervene in disputes between miners and local authorities on excessive informal taxation.

5.2. Incomplete oversight

It is clear from the above that many state services are making efforts to improve the regulation and professionalisation of the sector. This oversight remains however incomplete, as some sites are never visited, many only occasionally, and often for only one or few of the various functions. There are two main reasons why oversight is incomplete, and often sporadic.

A first explanation is the inadequacy of resources and capacity for site visits. Government institutions like the Ministry for Minerals, NEMC and OSHA remain heavily centralised, with limited resources for regional or local representations. This leads to a cost-benefit approach, whereby the expenses of site visits are weighed against immediate returns in terms of fees, royalties and taxes. Remote and small sites thereby risk to be overlooked. Site visits are less of a burden on village and district authorities, but the latter tend to lack know-how and expertise on mining and the applicable regulations. RMOs evidently have the clearest ASM enforcement mandate. Yet, with 5 offices in the 4 regions they are often overstretched. Most of their staff moreover consists of engineers and geologists, implying that issues such as labour rights, health or environment are not their main areas of specialisation.

Through coordination and information sharing state services could improve the geographic and the-

matic coverage of oversight visits. Yet, this constitutes precisely a second stumbling block. The reasons are both structural and motivational. While there is considerable ad hoc coordination locally, there exists no structured system for data sharing or cooperation on monitoring and enforcement. Visits are not centrally coordinated, nor is there a geographic or thematic division of tasks. Furthermore, the Ministry for Minerals, contrary to state services on forestry, environment and land, has no representation within local government authorities at regional, district or village level. This not only complicates information and knowledge sharing, it also means that mining areas – particularly where production is low – are often a limited priority for local authorities. Land issues particularly suffer from this disconnect, as land use changes are not systematically aligned with new mining titles and vice versa.

Another reason for the limited coordination is the mismatch in objectives, motivations and incentives between state actors. The RMOs, for one thing, get their key targets in terms of licenses issued and revenue generated.[110] It is therefore in their interest to prioritise ASM sector development above mitigating societal impacts, sanctioning infringements or signalling them to actors like NEMC, OSHA or TFS. Most of the RMO's staff are moreover technical experts that perceive their role as advisory rather than regulatory. Village authorities, on the other hand, have more room to impose informal taxes on sites that are unlicensed, and have therefore no interest in assisting or instructing miners to submit license applications.

The consequence of this incomplete oversight is that the awareness of where the best and worst practices lie is dispersed, which, in turn, complicates efficient oversight. Monitoring remains moreover too ad hoc to ensure a proper follow-up of inspections, revenue collection and assistance.

110 Schoneveld et al. (2018), pp. 53-55.

6. CONCLUSIONS

In the past decade, Tanzania has been scaling up efforts to formalise and professionalise artisanal and small-scale mining. Yet, the dynamic and heterogenous nature of the sector makes it hard for top-down legislative and policy interventions to have an effective and sustainable impact. It equally complicates the collection of precise and structured data, which is essential to inform such interventions and monitor their effect. This report and the accompanying web map and open database seek to contribute to filling data gaps on ASM in Tanzania.

IPIS surveyed the ASM sector in 4 regions of northwest Tanzania, namely Geita, Shinyanga, Mara and Kigoma, mapping 447 mining and processing sites. The predominant mineral in this part of Tanzania is gold, which represents 75% of surveyed sites and 98% of their mining and processing workforce. The other main minerals covered by the survey are diamonds in Shinyanga region and limestone and salt in Kigoma. IPIS collected quantitative and qualitative data on the nature and scope of operations, organisation of work, health and safety, environmental impact, working conditions, community relations and state oversight. In this manner, we aim to present a balanced picture of the socio-economic and human rights impact of ASM in northwest Tanzania.

While the focus is often on mitigating the sector's harms, ASM presents a number of important opportunities and contributions. For one thing, ASM constitutes a **key livelihood and business opportunity** in northwest Tanzania. We estimate that, in the 4 focal regions, up to 121,000 people are directly engaged in mining and processing in times of high production. When auxiliary services are added, this estimate rises to over 485,000 jobs. In these poor rural areas, ASM is moreover a relatively rewarding source of employment. The average monthly income of gold miners and processors lies between USD 82 and 110, which is more than double the common wage for agricultural labour in Tanzania.

In addition to important indirect **wealth spill-overs**, over half of all mining and processing sites make direct corporate social responsibility (CSR) contributions to neighbouring communities. Similar to the well-known CSR by large-scale mining, such contributions mainly support health, education, road and village infrastructure. Furthermore, contrary to the persistent prejudice of ASM as a disorganised patchwork of rent-seekers, it is governed by **complex organisational models** and representation through cooperatives and regional associations. Despite considerable organisational and financial challenges, these provide an essential channel to facilitate outreach, support, sensitisation and oversight. The above features of ASM also explain why, despite evident nuisances and occasional frictions, ASM-community relations are generally good. Only 2% of workers operate on a site that has an outspoken conflict with a neighbouring community.

This positive record is however persistently tarnished by a number of significant challenges and concerns. One of the most infamous harms is ASM's problematic **safety standard**. Nearly 1 in 5 sites were struck by at least one accident in the year preceding IPIS visits. These accidents injured 175 and killed 90 workers, with many more casualties likely remaining unreported. This high accident rate results from a combination of low safety awareness, with scant use of personal protective equipment and poor digging techniques, diffused responsibilities and limited access to finance. The latter moreover pushes miners to informal financing arrangements, which makes them vulnerable to abuse and complicates oversight.

Health is another major concern. One third of workers has no access to sanitary facilities on-site, and for many others these are in poor condition or insufficient in number. Combined with inadequate waste management systems, this poses serious health risks for workers and neighbouring communities. Another key threat is posed by the widespread use of **mercury** in gold mining. 98% of gold processing sites in northwest Tanzania use mercury to extract gold from its ore, mostly irresponsibly. Three of the four worst practices, set out in the 2017 Minamata Convention, are widespread in the region: open burning of gold-mercury amalgam, burning of amalgam in residential areas, and cyanide leaching of tailings without first removing mercury. Other pervasive human and environmental health concerns caused by ASM in northwest Tanzania are water pollution, deforestation and land degradation.

While there are indications that **child labour** in these risky and unhealthy environments is gradually declining, IPIS still identified children below the age of 15 directly engaged in ASM, and particularly in processing, on over 1 in 10 sites. Furthermore, ASM remains a particularly patriarchal sector where **women** benefit considerably less from the mineral wealth than men. They make up only 20% of the total workforce and generally remain stuck in lower-level and less rewarding positions. On over 3 in 4 sites where women are engaged in operational activities, their work is limited to crushing and panning, which earn one third of what the average miner gets and offers little job security.

Tanzania has laws and regulations in place regulating all the above harms, but these are not well enforced. One important reason is the poor licensing of ASM. Over 75% of workers in northwest Tanzania operate informally on an unlicensed site. Yet, also most licensed sites fall short on compliance with most aspects of the legal framework. At least 10 different **government** institutions are making efforts to improve the **oversight** and regulation of the sector. Together they visit 94% of mining and processing sites for inspection, revenue collection, assistance, data collection, law enforcement and conflict mediation. This oversight is however not systemised, and remains often partial or occasional. Through structured coordination, information exchange and a clear division of responsibilities considerable progress can be made in minimising the harms and maximising the benefits of ASM in Tanzania.

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