

The Role of Gold Processing Plants in Artisanal and Small-Scale Mining

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Foreword



In the 1990s, according to the World Bank, artisanal and small-scale mining (ASM) accounted for just 4% of global gold production. The great preponderance of it took place in the informal sector which reflected the situation in most other rural occupations, such as fishing and farming. At that time the price of gold was around \$250 an ounce. ASM gold production now accounts for some 20% of the annual total and the current price exceeds \$3,000 an ounce. The volume and value of the sector has been transformed out of all recognition and approximately twenty million people's livelihoods depend upon it. But the lack of regulation that characterised the sector is no longer appropriate to an economy now worth over \$65 billion a year. The lack of environmental regulation is impacting on the Amazonian rainforest, and the widespread use of mercury is threatening to exhaust Ghana's supplies of potable water. In the Amazon, indigenous people are suffering at the hands of illegal miners and many communities across Africa are debauched through child labour, prostitution and gender-based violence. The profits to be realised from the sector, flowing from buoyant prices unencumbered by taxes or the costs associated with safety or environmental regulation, are highly attractive to organised crime and armed groups. These profits have come to fuel widespread corruption, money laundering and violence across the Andean countries, the Sahel and parts of South-East Asia.

Those of us who want to contribute to the sustainability of small-scale gold mining need to come up with some new thinking. That is why, in early March, the World Gold Council and our partners from the World Bank and Intergovernmental Forum on Mining launched a new process to address the challenges associated with the sector. Amongst other actors who have joined with us are the OECD, LBMA and the UN's Planet Gold programme. Working with governments, central banks and a range of gold value chain actors, we want to improve the position of those miners who want to professionalise and formalise on one side whilst confronting the criminal gangs and other

sources of exploitation in the sector. ASGM should be good for development, for governments and for communities.

One of the ways in which the World Gold Council is contributing to this work is through supporting research into the role that centralised, mercury-free processing plants, potentially augmented by new approaches to traceability, might play. As this research report from Levin Sources, based on a headline assessment of six countries, makes clear, in most countries such plants are not fulfilling a particularly positive role. There are some examples of innovation and excellence but in other cases the report identifies some common pitfalls. This is largely because they are reflecting the lack of standards and expectations in many markets. But, in principle, such plants can offer a means of significantly increasing gold recovery rates whilst replacing the role of mercury with its attendant health and environmental impacts. The increased gold yields could increase miners' incomes and community benefits and finance the costs of formalisation and enforcement. Moreover, such plants could act as centres for providing support and expertise in areas like safety and geology and create regulatory 'pinch points' through which governments can assert greater oversight of the sector and counter the role of malign actors.

What this report does do, is to help us to learn from success stories such as Dynacor in Peru and Mwamba Mining in Tanzania. Equally important, it highlights some common mistakes and shortcomings and points the way to how governments, investors and responsible actors in the ASGM value chain can work together to produce models that work. It would be naïve to take a Field of Dreams 'build it and they will come' approach to the creation of a network of processing plants. A lot of work needs to be done to create an enabling regulatory framework, to ensure that there is an ecosystem of user-friendly payment systems and timely means of assessing gold content, to make certain that cyanide is managed and tailings facilities are properly engineered and, above all to lay the foundations of trust that will encourage artisanal and small-scale miners to want to work with such processing plants. Although the idea around greater use of centralised processing plants is seductively simple, implementation is complex. Lots of things need to be lined up and this report improves our understanding of an under-studied link in the gold supply chain. It helps us to see what could be achieved through a strategy designed to transform ASGM more clearly into a blessing for governments, for communities, for miners and the gold market.

David Tait
Chief Executive Officer
World Gold Council



Glossary

AGC	Artisanal Gold Council
ASGM	Artisanal and Small-Scale Gold Mining
ASM	Artisanal and Small-scale Mining
BOT	Central Bank of Tanzania
CBE	Central Bank of Ecuador
CIL	Carbon-in-Leach
CIP	Carbon-in-Pulp
COEs	Centres of Excellence
DAO	Department of Environment and Natural Resources Administrative Order (Philippines)
DEIA	Detailed Environmental Impact Assessment (Mongolia)
DENR-MGB	Department of Environment and Natural Resources - Mines and Geosciences Bureau (Philippines)
DRC	The Democratic Republic of the Congo
ECAS	Environmental Quality Standards
EIAs	Environmental Impact Assessments
EITI	Extractives Industries Transparency Initiative
ESG	Environmental, Social, Governance
FIU	Financial Intelligence Unit
FPIC	Free, Prior and Informed Consent
FS	Feasibility Study
IRR	Implementing Rules and Regulations
KYC	Know Your Customer
LBMA	London Bullion Market Association
LGU	Local government unit (Philippines)
LMP	Maximum Permissible Limits (Peru)
LSM	Large Scale Mining
MFPS	Mercury-free processing plants
MIMR	Ministry of Industry and Mineral Resources (Ecuador)
MINEM	Ministry of Energy and Mines (Peru)
MinGem Houses	Mineral and Gemstone Houses (Tanzania)
MPL	Mineral Processing License
MRPAM	Minerals Resources and Petroleum Authority of Mongolia
PENCAS	Philippine Ecosystem and Natural Capital Accounting System
PEPs	Politically Exposed Persons
PML	Primary mining licence
RA	Republic Act (Philippines)
REINFO	Comprehensive Registry of Mining Formalisation
RMI	Responsible Minerals Initiative
SAM	Sustainable Artisanal Mining
SDC	Swiss Agency for Development and Cooperation
TSF	Tailings Storage Facility
WMA	Weights and Measures Agency



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1. Executive summary

This report is based on the hypothesis that processing plants can help bring more ASM gold into responsible supply chains and make an important contribution to formalised and responsible gold sectors as the basis for driving sustainable development in gold-producing regions. It finds that processing plants contribute to improved gold recovery rates which can increase miners' income and therefore also benefit communities and the government (through greater tax income). Miners can use this additional income for formalisation and enhanced technologies, better health and safety measures and improved environmental protection. Governments can use the additional funds to more effectively regulate and support the sector.

The report finds that processing plants can be key aggregation points in the upstream gold value chain and have the potential to support greater transparency and certain types of traceability. However, they are challenging to run in ways that are both commercially viable and responsible unless they hit a context-specific threshold of scale, which remains a challenge for the majority. Dictating that scale is the throughput of ore, which is a function of a variety of factors, including whether pre-existing relationships

(especially in relation to finance) may lock out new value chain actors; logistics; the quality of infrastructure for transporting material; the regulatory framework; and the willingness of miners to sell to the plant.

The report also finds that there are examples of where it is working well – such as Peru and Tanzania. Trust (or lack of) between value chain actors shapes the business model. Overall, it finds that whilst a responsibly managed plant can be transformational in the right circumstances, getting to a place of responsible plant management will be a process of continuous development that requires an enabling environment (notably the right kind of government involvement) as well as access to capital. In terms of the original hypothesis, our research and follow-up conversations suggest that there may be more flexibility in terms of scale than previously assumed. A commercially viable and responsibly run plant could run at 50 - 100t per day in some contexts. However, its ability to do so will depend on the average grade of ore being higher than the hypothesis of 2g/t.

Research was conducted in January and February 2025 in Ecuador, Mauritania, Mongolia, Peru, Philippines and Tanzania. Anonymised detail on the processing plants visited during the research can be found in the annex.





2. Introduction

This report explores the potential role of processing plants in driving the sustainable formalisation, legitimisation and professionalisation of artisanal and small-scale gold mining (ASGM) value chains. It looks into the different operating models for, and roles played by, gold processing plants and their impact on the gold value chain, with a focus on six country case studies and fourteen processing plants. Its purpose is to drive better understanding of the role that responsibly managed and commercially viable gold processing plants could play in improving environmental and social performance, incentivising formalisation and facilitating more effective due diligence as the basis for growing the inclusion of responsible ASGM into responsible value chains.

ASGM value chains remain largely informal.¹ Initiatives to encourage ASGM actors to legitimise, professionalise and eventually formalise are often hamstrung by complex regulation, poorly designed incentives or by additional costs that can be inherent in operating in the formal sector. Artisanal and Small-Scale Mining (ASM) miners' reliance on informal and often complex trading channels contribute to a persisting lack of transparency in gold supply chains and leave miners vulnerable to exploitation and informality, as well as trapped in a cycle of limited access to responsible finance and an inability to adopt more responsible practices. Consequently, downstream companies hesitate to source from ASGM because of the compliance and sustainability risks that are often perceived to be unmanageable.²

Hazardous chemicals are a major concern in the ASGM sector, with mercury use being particularly widespread, causing significant adverse environmental and health impacts and creating enduring environmental liabilities. Many artisanal and small-scale miners, especially those who rely on mercury, may only succeed in recovering 30-40% of the gold from the ore that they mine. Sometimes the waste material, which contains mercury and high residual levels of gold, is collected by traders and aggregators, who pay minimal amounts to the miners but take away the tailings for treatment with cyanide – a combination that causes severe air, water and soil pollution and, in turn, health impacts on people and biodiversity.

Despite these challenges and given that ASGM mining accounts for around 15-20% of global mined gold supply and that the sector is an important source of livelihood for millions of people worldwide, the WGC is one of several organisations that are leading efforts to better integrate ASGM miners into responsible global supply chains. For that to be achieved, ASM gold must be produced in line with international responsible business and ESG standards.³



The working hypothesis of this report is that responsibly-managed gold processing plants can play an important role in addressing many challenges in the ASGM sector by offering more efficient, mercury-free methods for gold recovery to artisanal and small-scale miners. By improving recovery rates (from around 40% to 90%), these plants can significantly increase miners' revenues, making formalisation a more viable option. The additional income can be reinvested into adopting safer mining practices and covering formal sector costs, such as licensing fees, taxation and compliance requirements. By reducing the reliance of the sector on mercury, responsibly-run processing plants can also contribute to a healthier environment for people and nature and so build more resilient and prosperous societies. More operations entering the formal sector also means more income for governments which can subsequently put those funds into law enforcement, environmental protection and ASM community beneficiation.

Most importantly, these processing plants can play a crucial role in integrating ASGM operations into formal supply chains. This benefits downstream buyers by ensuring greater transparency over the gold supply chain and circumstances of production, so aiding their risk assessment and mitigation efforts and increasing assurance levels. Furthermore, through improved access to formal market actors, ASM miners can achieve fairer compensation. Responsibly run

¹ The World Bank (2024)

² planetGOLD (2024)

³ idem



processing plants that operate in proximity to ASGM sites could further enhance their impact by reducing logistical barriers and the costs and security challenges often associated with gold aggregation in formal supply chains.

Lastly, as aggregators of gold from numerous mining provenances, processing plants act as a domestic pinch point through which regulators can assert greater control over the sector. Centralising processing also makes it easier to police gold supply chains, as a pathway to exposing smuggling routes and mechanisms and the involvement of criminal actors that are seeking to absorb gold or leverage its trade for reasons of profiteering, corruption, tax evasion and money laundering.

This report is based on desk and field research in six ASGM producing countries: Ecuador, Mauritania, Mongolia, Peru, the Philippines and Tanzania. For the field research, a number of processing plants were selected for site visits and an in-depth interview, asking questions around their legal status, their supply chain, operations, and business practices. The results of the desk and field research are presented in this report, through country overviews and processing plant profiles (in the Annex). The research findings largely support the initial hypothesis, but there may be nuances to consider in terms of scale and the trade-offs in terms of average grade of the ore and accessibility. Few existing processing plants would meet the World Gold Council's working assumption criteria though our research provides learnings that could support their evolution towards it. However, more detailed research is required to test the findings to a greater degree.

The starting assumptions for a commercially viable processing plant used to guide this research were:

- A minimum threshold for throughput is likely to be 200t of commercially viable ore per day, though a realistic starting point may be 100t, with 200t as an ultimate target.
- Material arriving at the plant would be unprocessed, meaning the plant will be the first point of processing for the ore in order to ensure ore has not been mixed and to allow chemical fingerprinting traceability methods to be applied at a later stage.
- The average distance from which the ore has been transported would be at a level to not undermine commerciality.
- The recovery rate would be above 90% (ideally already at or with the ability to reach 93-94%).

The report begins with a summary of learnings drawn from previous research on aggregators and processing plants carried out by the Responsible Minerals Initiative (RMI) and planetGOLD. It then presents the country case studies, focusing on the processing plant landscape, the political context, the institutional and regulatory framework, and barriers and opportunities for generating commercial viability and responsible operation of processing plants. The conclusion summarises the main findings from the country case studies which apply across borders and provides recommendations to different stakeholders in the gold sector on how to further promote responsible gold production and supply chains. The Annex provides anonymised detailed profiles of the processing plants visited in context of this research.





3. Previous research

Previous research on processing plants has been carried out by the [Responsible Minerals Initiative \(RMI\)](#) and [planetGOLD](#). This section summarises the main findings of these prior studies with regard to barriers to commercial viability and responsible business conduct of processing plants.

Processing plants are a type of aggregator, actors in the supply chain which aggregate gold-bearing material or do a first round of processing before the material is sent to fine-grade refiners that will typically refine to 99.5% minimum purity.

The RMI distinguishes between three types of aggregators:

- The miner aggregator uses gold from a mine controlled by itself and additionally receives gold from external artisanal and small-scale or large-scale mines.
- The processor aggregator sources material from independent mines (ASGM and Large-Scale Mining (LSM)). Both miner aggregators and processor aggregators “mill gold ore, process the milled material and produce gold doré.”⁴
- The trader aggregator receives doré bars or scrap gold from independent traders, might process gold concentrate or combine dorés into one tradeable product, and arranges gold exports.⁵ One aggregator may procure gold from another aggregator based on unique selling points in accordance with their available working capital, geographic location, and commercial relationships. In this study, we focus on processing plants in the first two categories.

Key barriers to commercially viable and responsible processing plants as identified by the two studies are:

- **Poor operating standards.** Many processing plants and their upstream suppliers do not comply with responsible business standards, causing negative environmental, social and governance impacts.⁶ (This reflects the reality that in many cases downstream users in the informal sector are not seeking assurance on this.)
- **The informality of many small-scale processing plants** increases the chances that they do not comply with laws and regulations, responsible business conduct expectations and tax and royalty payments and that they are involved in financial malpractice or smuggling.⁷
- **The remoteness of mine sites can be a challenge** for securing supply for processing plants if the plants are centralised and inaccessible to suppliers. This matters because ASM miners produce small quantities and

need to sell frequently but cannot make a long journey often. Furthermore, transport routes often pose security risks, particularly in regions where criminal or non-state armed groups target gold-transporting vehicles, such as in Ecuador. Miners therefore may end up selling to (informal) local traders for ease.⁸ Longer journeys to transport the product also increases costs.

- **Lack of access to finance for ASGM operators** is a result of miners’ struggle to achieve security of tenure, to have collateral through which they can secure loans, to even have access to personal identification documentation (e.g. birth certificates, identity cards, passports) in some jurisdiction, amongst other factors. This can lead to them relying on pre-financing agreements with informal traders or collectors. Over time a dependence develops which may lock them into informal financing relationships and deny them access to formal buyers such as processing plants.⁹
- **Distrust between miners and processing plants.** Miners sometimes fear being exploited or treated unfairly by other market actors, for example buyers/processing plants that offer low prices and/or that use unfair pricing mechanisms. This may motivate miners to process their gold themselves with the use of mercury in order to avoid these higher-risk business relationships.¹⁰
- **Women are often particularly disadvantaged in the ASGM sector.** Cultural norms and discrimination limit women’s access to formal markets. They may not be able to own a mine, can struggle to get permits or to have access to training and therefore technical knowledge. Women also sometimes receive lower prices, are excluded from the productive (higher paying) roles than men or are subject to other unfair trading conditions, which makes them less likely to engage with formal market players.¹¹

This study aims to build upon these findings and validate them through our research at country and processing plant-level.

⁴ RMI (2021), p. 8

⁵ RMI (2021)

⁶ idem

⁷ idem

⁸ planetGOLD (2024)

⁹ idem

¹⁰ idem

¹¹ idem



4. Case studies

4.1 ECUADOR

The processing plant landscape

It is estimated 100,000 people depend on ASGM in Ecuador, contributing 85% of the national gold production.^{12,13} There is widespread informality in the sector.¹⁴ Most of the gold processing plants in Ecuador are located in Zamora Chinchipe, Azuay, El Oro, Tungurahua, Cotopaxi and Guayas, with Azuay and El Oro – in particular Portovelo – being the most populated with plants. Portovelo is also considered the main mining location in Ecuador, with a high presence of high-tech processing plants.

There are two main operating models for processing plants in the country: some companies process material exclusively from their own concessions (exclusive processors), while others rent out their facilities for the processing of third-party minerals (toll processors). According to the Ministry of Energy and Mines (MINEM), there are 171 mills nationwide, of which at least 100 operate as toll processors.

There are also different scales and grades of processing plants. The large-scale processing plants process up to 2,000t of material per day, generating around USD 1.5-2.2 million revenue each month.¹⁵ Medium-sized processing plants work with around 100-200t of material per day, and small-scale processing plants with up to 50t per day.¹⁶ Processing plants achieve gold recovery rates of up to 90%, a 30% increase from recovery rates obtained through traditional amalgamation methods using mercury.¹⁷ Clandestine illegal processing plants have been discovered within buildings near mining hotspots, operating as part of a larger illegal gold network, confirming criminal gangs' participation in the sector and in this value chain tier specifically. They constitute competition for formal processing plants.

ASGM miners either sell untreated ore to processing plants which then produce doré bars or concentrate, or they process the gold themselves, with or without mercury, and sell doré, amalgam or concentrate locally to processing plants, traders or the Central Bank of Ecuador (CBE). Processing plants in turn either sell the gold to the Central Bank (in the form of doré bars) or export it internationally.¹⁸ Processing plants can acquire commercial licenses which give permission to export. Those processing plants who are exclusively renting out their facilities and do not purchase materials do not tend to have export licenses as they are not involved in the gold trade.

The Central Bank runs a buying programme for ASGM miners, with local processing plants acting as official

intermediaries. However, limited numbers of ASGM miners have the right paperwork in place to participate in the programme, with common barriers being a complex registration process, long payment processing times, security risks, difficulties accessing roads and therefore delivering material, and lack of understanding of the programme.¹⁹ The Central Bank pays between 92-94% of the international price. According to an internal World Gold Council study, access to the bank's regional offices has supported formalisation and the operational efficiency of the ASGM sector, ensuring access to fair pricing in the domestic market for miners. For the government, benefits of the scheme include decreased payback time, reduction of risk related gold price volatility and strengthening of Ecuador's international reserves. The programme's effectiveness was recognized with the Initiative of the Year at the 2023 Central Banking Awards.

Ecuadorian processing plants reportedly sell concentrates mainly to China, Peru, and the US.²⁰ China is the main export market for polymetallic concentrates. Chinese refineries beneficiate them to obtain free metals (gold, silver, copper and others) and then refine these metals in China to achieve higher purity. Identity preservation and segregation models of traceability are not possible because polymetallic concentrates from Ecuador are blended and processed with those from other countries.

Ecuador is currently experiencing a peak in gold production, coupled with high international prices, which are incentivising the industry's growth.²¹ In the traditional mining regions of El Oro and Zamora Chinchipe, artisanal mining operations are growing in number as well as size, with miners increasingly adopting advanced technologies to increase the scale of their extraction activities. This shift is pushing many to redefine themselves as small-scale miners instead of being considered artisanal. This mechanisation is having positive impacts on production levels, which is also, in some cases, benefitting the processing plants who are gaining larger volumes of material from their existing supplier base. Fewer but larger suppliers should, at least in theory, reduce the administrative and due diligence burden and allow for more trusting longer-term relationships to be established. However, unless there is enforcement of basic environmental standards and a clear pattern of replacing mercury-use, it is likely to be intensifying adverse environmental impacts in hotspot locations where mining and processing activities are concentrated.²²

The processing plants visited in the course of this research are all formalised and have the right permits in place. They operate according to the toll processing model. Despite not taking ownership of the ore and gold, they conduct Know Your Customer (KYC) checks on clients and check the formalisation status of miners. They however do not tend to do mine site

¹² PlanetGOLD (2021)

¹³ Ministerio del Ambiente y Agua (2020)

¹⁴ Mestanza-Ramón, D'Orio & Straface (2021)

¹⁵ La Hora (2019)

¹⁶ Connectas (2024)

¹⁷ Veiga et al (2022)

¹⁸ planetGOLD (2024)

¹⁹ idem

²⁰ idem

²¹ Connectas (2024)

²² The World Bank (2019)



visits or use methods to ensure actual traceability. The plants tend to have environmental expertise on site and follow environmental regulations and standards. They make use of a communal tailings dam to store their tailings more long-term.

Political context

The illegal gold trade is a deeply rooted problem in the country. International criminal groups with links to drug trafficking have increased their influence on mining areas, in particular in the provinces of Azuay, El Oro and Imbabura. The Government of Ecuador has tried to regain control over the affected mining areas, with mixed results. Furthermore, there are serious responsible business conduct risks, including homicides, violence, robberies, extortion, money laundering and financing of crime. Some say that Ecuador is becoming a platform for laundering money through gold. There are strong indications that mine sites and processing plants in the Camilo Ponce and Portovelo areas are being extorted by criminal groups. Corruption of some public officials, particularly at the local level, and insufficient government presence in mining areas contribute to an environment conducive to illegal gold mining. In recent years, hundreds of mining permits have reportedly been issued irregularly.²³

The illegal gold trade and involvement of drug trafficking organisations in the sector is not only a national issue. The drug trafficking organisations link into a complex network that operates across Latin America. Notably criminal organisations from Colombia reportedly control territories in Ecuador, especially close to Ecuador's northern border but also in the Amazon region which affects Indigenous People.²⁴

Institutional and regulatory framework

Ecuador's special regulations stipulate that, with an exception for alluvial miners, artisanal miners are not allowed to process their ore themselves and are required to use legal processing plants. The purpose of this requirement is to help authorities drive greater compliance with the Minamata Convention, as envisaged in the National Action Plan, and to control environmental impacts better, in particular those associated with mercury use.²⁵ It also creates a favourable environment for formal processing plants that offer processing facilities to miners that lack their own infrastructure.²⁶

Ecuador's 2009 Mining Law authorises two types of processing plants. Mills or 'chanchas' exclusively crush and grind and have a capacity of 10t per day. Beneficiation plants include crushing, grinding, flotation, and/or cyanidation and have a minimum capacity of 50t a day.

Following the 18th Ministerial Agreement (2015), processing plants must fulfil the following requirements to obtain authorisation: complete a mining permit application form; submit company records, banking information, information on legal representation; deliver a technical report that includes information on the maximum processing capacity of the plant, final disposal logistics, the type of processing method and technology (flotation or cyanidation), location, employee background, and machinery used. In terms of commercialisation, mining title holders have the right to freely sell their production inside the country or on the international market. They must share a semestral report on transactions upon request from regulatory agencies.

A challenge lies in the enforcement of the regulatory framework. Some ASM leaders have reported that mining authorities are often excessively bureaucratic and appear biased in deciding which formalisation requests to process, eroding trust among stakeholders and creating property rights-related conflicts. Some stakeholders claim that the excessive bureaucracy around formalisation processes creates a fertile ground for bribery and corruption in the granting of mining permits. There are also cases of bribery when government officials go to assess and audit operations, in order to ensure they report full compliance with legal safety and environmental standards. In 2024, local newspaper *Primicias* stated that many of the processing plants in the country are operating without an environmental license.²⁷

Barriers and opportunities

The informality of the ASM sector remains a major barrier to the responsible and commercially viable operation of processing plants. Public policies and programmes such as planetGOLD Ecuador have tried to improve formalisation rates, with mixed success. Formal processing plants (should) depend on legally mined ore, but much of Ecuador's ASM sector remains informal. In some cases, the miners cannot comply with traceability or due diligence requirements, which puts the processor's reputation and compliance at risk. Some plants are pushed to operate under agreements with informal miners to continue operating.²⁸ Another challenge for processing plants' acquisition of ore is that informal traders often provide prefinancing to miners and use their loan as a lever to ensure miners sell the gold to them. They thereby trap them in a cycle of dependence and contribute to enduring informality.²⁹ A major challenge for specific types of traceability lies with processing plants sourcing minerals from multiple suppliers, which makes identity preservation and segregation traceability models difficult to achieve.³⁰ Processing plants risk illegally mined ore infiltrating their operations.

²³ El Universo (2024)

²⁴ OAS (2021)

²⁵ NAP (2018)

²⁶ Veiga et al (2022)

²⁷ Tapia (2022)

²⁸ Monroy (2024)

²⁹ planetGOLD (2024)

³⁰ This does however not mean that mass balance traceability is unfeasible



Some miners decide not to sell to processing plants because they fear being cheated. Their distrust stems from their lack of knowledge about metallurgical valuation techniques; the existence of very few recognised independent metallurgical laboratories that could provide an alternative valuation in case of disputes; and the lack of commercial agreements that standardise the payment formula for miners. Miners often state that payment standardisation is necessary as plants tend to offer fair payment terms to experienced veteran miners while providing unfair agreements to those with less experience or lower levels of education.³¹

Another major barrier to the responsible operation of processing plants in Ecuador is that despite the use of mercury being illegal since 2015, many ASGM sites struggle to adopt mercury-free practices. Also processing plants that are meant to be mercury-free at times still use mercury clandestinely.³² The government-run National Programme for Chemical Management put in place a Mineral Selling Strategy to incentivise ASGM miners to sell untreated ore to processing plants for it to be treated mercury-free. The strategy involved capacity building and technology transfer at the processing plants Eyman Corporation, Nueva Union and El Pache as well as a communication campaign towards ASGM miners. The measures aimed at increasing miners' trust in the plants' ability to determine gold content for fair pricing and in their capacity for efficient gold processing. The programme had some success in terms of the processing plants buying a total of over 300t of ore during the project implementation phase. But the model proved challenging overall because there are not many ASM

organisations that operate formally.³³

Another barrier is the presence of criminal groups in mining areas and along trading and transport routes. Some miners are scared to go to processing plants because they are at risk of being extorted or robbed by criminal groups. Hence, they prefer to use processing options closer to the mine site, even if they are less efficient.

Key takeaways

- **Ecuador is experiencing rapid expansion of its small-scale gold mining sector, including increased mechanisation of artisanal into small-scale gold production.** This increases the potential for greater control and transparency of Ecuador's gold sector because production is growing faster than the number of new producer entities.
- **There are severe responsible business conduct risks, largely related to weak law enforcement, widespread informality and capture of the sector by criminal actors.** A perception of excessive bureaucracy prevents miners from fully formalising their activities, whilst creating an opportunity for corruption and bribery in the allocation of licenses.
- **The government is pursuing valuable initiatives to drive the sector's development and formalisation.** For example, the Central Bank's innovative buying scheme seems to have supported formalisation of the sector as well reducing domestic gold price volatility and strengthening international reserves. However, there remain some barriers preventing miners from participation.



³¹ See Monroy (2024)

³² planetGOLD (2024)

³³ idem



- **As a result, some processing plants continue to do business with informal operators in order to be commercially viable.** However, any trader that is incentivised to sell gold to a legal processing plant rather than to illegal traders contributes to increasing the country's formalisation rates and can be considered progress (even if the mining itself cannot be demonstrated to be entirely legal).

4.2. MAURITANIA

The processing plant landscape

ASGM started in Mauritania in the 2010s and has been growing since. The 2023 Extractives Industries Transparency Initiative (EITI) report speaks of an 'explosion' of ASGM in the previous years, while a BGR/GIZ report recorded a specific gold rush in 2016 in the Inchiri region.³⁴ According to recent estimates, there were around 52,000 ASGM producers in Mauritania in 2021.³⁵ Mauritanian ASGM produced 15t of gold that year.³⁶ The increase in ASGM has been accompanied by an increase in processing plants that treat artisanally mined gold, from one in 2020 to 25 as of September 2024.³⁷

The processing plants/units³⁸ are usually hosted in two government-controlled processing centres (run by government agency MAADEN), one in Chami and one in Zouérat, with a potential third centre being established in Agan, in the south of the country. The planned centre in Agan is meant to operate without mercury and solely with a gravity-based system. The centres in Chami and Zouérat were established in 2017, as part of the government's efforts to organise the sector. Small businesses operate the processing units, most of them owned by Mauritians and Sudanese nationals. In 2024, buying counters were opened in the centres to integrate informal actors better into the formal system.³⁹

The centre in Zouérat has been partially moved to a new centre in Sfayrate, to mitigate the adverse environmental impacts of the old centre on population centres. Around 70% of processing units have already moved, and the rest are likely to follow. The population around Zouérat had complained about the centre's poor maintenance. Similar warnings have been issued about the Chami centre's environmental impact, with relocation there being hindered by opposition of businesses who fear an increase in costs and a loss of opportunities.

MAADEN and its subsidiary offices are the only authorised actors to purchase and resell processed gold. Most of it is reportedly exported to Turkey and the UAE. A significant amount of material is also

reportedly smuggled to the UAE where it is exchanged for goods that are then imported to Mauritania. This illustrates how importers to Mauritania are using gold as a financial instrument to overcome a commercial challenge, due to foreign currency in Mauritania being limited.

From the interviews at processing units at the MAADEN-controlled processing centres in Chami and Zouérat, we learned that mercury use is pervasive. Tailings storage is also problematic from an environmental perspective. As the sale is only authorised through the government-controlled counters but private buyers coming to those counters pay low prices, there might be incentives for miners to sell gold through informal channels. Further, miners allegedly do not trust the assay methods. The poor wages for processing unit employees can be linked to issues of theft within the centres.

Political context

Mauritania is an Islamic republic with a presidential system, although strong family connections shape society due to the presence of several ethnic groups. Cultural barriers can jeopardise successful implementation of projects. The police and the army maintain strict control, which reduces the threat of terrorism and criminality. Caste and family connections play a significant role in Mauritanian society, meaning corruption can be an inherent challenge. Politically connected individuals are reportedly involved in the gold sector, including in the financing of processing units. There have been reports of conflict between ASGM miners and industrial mining companies, linked to artisanal miners encroaching on LSM concessions, with confrontations happening between small-scale miners and police and military forces.⁴⁰

Institutional and regulatory framework

The regulatory agency for the ASGM sector is MAADEN Mauritanie. MAADEN is a public industrial and commercial institution with legal personality and financial independence, based in Nouakchott and operating under the technical supervision of the Minister in charge of minerals. It was established with the start of ASGM activity after 2015, with the government opting for supervising and managing ASGM miners instead of discouraging them.⁴¹

To establish a processing unit, a complete application file must be prepared, including a checklist for eligibility, which consists of a formal request addressed to the Director General; a financial capacity certificate; and the company's statutory documents.

MAADEN also implements site monitoring and tax

³⁴ BGR/GIZ (2018)

³⁵ UNODC (2023)

³⁶ idem

³⁷ ITIE Mauritanie (2023)

³⁸ For the case of Mauritania, we are speaking of processing units instead of plants as they are not completely separate entities but hosted in larger government processing centres.

³⁹ ITIE Mauritanie (2023)

⁴⁰ BGR/GIZ (2018); Alestiklal (2024)

⁴¹ Stapper (2023)



collection from miners. Taxes are applied to ore bags, transport vehicles entering the processing centres and other mining-related activities. The agency further issues certificates of origin to certify that gold comes from legal origin. By centralising all financial flows from gold production, MAADEN further acts against money laundering.⁴²

MAADEN plays two roles which can be seen as contradictory which potentially raises a conflict of interest: it is supposed to regulate and at the same time engages in commercial activities. The agency is responsible for organising and regulating ASGM. However, some observers argue that there is a lack of capacity in effectively applying the measures on the ground. Some miners argue that the fact that MAADEN sets gold prices gives the agency excessive control over the sector.

Barriers and opportunities

The idea of designated processing centres to collect and process ore has not yet resulted in the government's desired outcomes of a more formalised and better organised sector, allowing it greater control, including through taxation. One of the issues lies with the technology used, notably mercury amalgamation, and another has to do with the fragmented nature of the activity, with units within one centre being owned by different businesspeople. MAADEN has limited control over mercury use in the centre. In recent years, the Ministry of Environment has attempted to reduce and track mercury imports, but seemingly with little success. Borax has recently been introduced in some places as a treatment product, instead of mercury because of its effectiveness for gold recovery. There is poor management of contaminated waste (in open pits) and inadequate environmental management in general. Recently, GIZ and BGR launched a call for a project focused on mercury-free extraction. Implementation of the project should start in the coming months and will be overseen by MAADEN.

MAADEN has worked with the international NGO Pact on developing mercury-free mineral processing options. As part of the project, Pact developed a mineral testing facility in Nouakchott, where Pact and partner Magma tested different processing options. They also offered capacity building to miners on formalisation, organisation, safer extraction techniques, and mercury-free processing methods.⁴³

MAADEN has not yet effectively implemented actions on formalisation, legitimisation, professionalisation or control of ASGM. They provide some first aid, water and electricity to miners, but according to miners, there is little other assistance. This also has to do with ASGM activity being a relatively new activity in the

country.⁴⁴ There is discontent about the fact that MAADEN collects taxes but does not provide services in return. This has allegedly pushed miners to fraudulent activity and to selling gold through channels other than the MAADEN desk. There are allegations of embezzlement and corruption linked to MAADEN.

One of the biggest barriers to processing plants is the insufficient supply of gold ore. Many processing units are currently inactive for that reason. This is symptomatic of too many small and weakly regulated plants, with a better option being the government only allowing processing plants of a certain size. Miners choose to sell gold through illicit channels to make more profit, given the low gold prices at the MAADEN-controlled centres. Production of gold remains lower than its potential as the government is slow with issuing licenses. Miners are pressured to exploit more remote sites which makes it time-consuming to return to the official processing centres.

Key takeaways

- **Mauritania's ASGM sector is relatively young, having started in the 2010s.** This should have provided an opportunity for the government to avoid some of the entrenched errors in the regulation of the ASGM sector observable in some other countries – but that opportunity is in danger of being lost. There has been a boom in the setting up of processing plants between 2020 and 2025, creating difficulties with oversight of an immature sector.
- **Processing units in the government-run centres struggle to attract enough gold-bearing material to be commercially viable.** This is related to the lower prices offered by MAADEN which makes illicit markets more attractive to miners, discontentment with the taxes miners should pay to MAADEN (with a feeling that they don't receive much assistance in return), and the fact that licensing for mine sites is a slow process.
- **The immaturity of the sector is reflected in poor quality of governance of the sector, with alleged high risks of cronyism and conflict of interest, weak enforcement of rules and regulations.** This allows the continued use of mercury, poor environmental safeguarding measures, and encourages criticism of the competence of authorities. As the sector matures, there is scope for greater institutional strengthening and evolution of Mauritania's sector governance.
- **Restrictive financial systems mean gold remains an important financial instrument for local importers, which skews incentives to operate in the legitimate sector.**

⁴² ITIE Mauritanie (2023)

⁴³ Stapper (2023)

⁴⁴ EPRM (2021)



4.3. MONGOLIA

The processing plant landscape

The ASGM sector counts around 40,000 to 60,000 people in Mongolia.⁴⁵ It was estimated that in 2017, around 45% of all gold was produced by ASM miners, however, these numbers are hard to determine as medium-scale mines also sell gold on behalf of ASM producers.⁴⁶

ASGM miners sell gold either to local traders or to local processing plants. According to an RMI report, 60% of ASGM miners sell gold directly to a processing plant and among those that are located within an eight-hour drive of a processing plant, 100% sell gold to the plant⁴⁷, which is evidence for the importance of geographical proximity. Processing plants typically provide the equipment, and the artisanal miners handle the crushing and grinding themselves. Most artisanal gold processing plants in Mongolia can process up to 15t of ore daily.

Processing plants sell processed gold directly to the Central Bank or do so via traders.⁴⁸ The Bank purchases gold from authorised traders after verifying its assay, origin, and required documentation, then directly transfers the payment to the trader's account via a secure online transfer. This streamlined process is meant to enhance transparency, ensure regulatory compliance, and strengthen trust and reliability in the gold trading market. According to a 2022 EITI report, individuals (representing ASM) make up 56% of all gold traded to the Bank of Mongolia.⁴⁹ Medium-scale mining companies have reportedly taken advantage of the lower ASM tax rate and also sell gold to the Bank of Mongolia, disguised as ASM gold.⁵⁰ The Central Bank has a monopoly on the gold trade and is the main legal buyer, storer and exporter of gold. It purchases around 20-24t of gold per year from domestic mines.⁵¹ However, according to an RMI report, a proportion of gold is regularly smuggled into China.⁵²

Since 1990, small-scale gold mining in Mongolia has relied on mercury. Over time, mining operations and processing mills evolved, with hammer, ball, and pan mills being introduced. In accordance with a decision to relocate these operations away from residential areas, designated zones were established for the mills. During this period, mercury remained in use. However, in 2008, the government began dismantling and confiscating mills that utilised mercury, prompting a shift to more covert methods. Some people reportedly began using mercury at home for gold extraction.

Awareness around the risks of mercury use has also led to efforts aimed at introducing alternative methods and more sustainable practices of gold extraction. One such effort was the 'Mercury-Free Life'

conference in the Bornuur sub-province of Tuv province which aimed to promote mercury-free gold extraction and to unite and support mills using mercury-free technology. The initiative led to the creation of a mercury-free processing facility in Bornuur, supported and funded by the Sustainable Artisanal Mining (SAM) project of the Swiss Agency for Development and Cooperation (SDC) and the government.

As part of the planetGOLD project, the Artisanal Gold Council (AGC) has installed two mercury-free processing plants (MFPS) in Mongolia to prevent mercury use, enhance capacity and recovery rate. Located in Mandal soum, Selenge province in one of Mongolia's most active artisanal gold mining regions, these MFPSs introduce new gold processing practices to the sector. MFPS-1 has the capacity to process 5t of ore per day and is equipped with a jaw crusher, roller crusher, dry vibrating mill, centrifugal concentrator, and shaking tables, featuring a waterless grinding mill. MFPS-2 can process 10t of ore per day and includes a jaw crusher, cone crusher, ball mill, centrifugal concentrator, and shaking tables. Both facilities are gravity-based gold processing plants equipped with handling conveyors, electric winch-hopper system, and slurry pumps to reduce intensive manual labour and save time. Since 2023, both projects have halted mining and processing activities reportedly due to the Ministry of Industry and Mineral Resources' (MIMR) cancellation of ASM land permits across Mongolia. With this moratorium the Ministry aims at restructuring the artisanal mining sector and promoting more responsible practices. Ore supply has therefore been disrupted. Since 25 December 2024, ASGM land requests have been approved again, which might solve the issue. The plants also have pending FS (Feasibility Study) and DEIA (Detailed Environmental Impact Assessment) approvals.

The technological team of the AGC/planetGOLD Mongolia project conducted comprehensive experiments and studies, which confirmed that only gravity-based gold beneficiation technology should be implemented. Laboratory tests revealed that gravity technology can recover up to 70% of the gold, whereas flotation only recovers about 30%. While a combination of gravity and cyanide methods has proven most effective for hard rock deposits, obtaining cyanide permits in Mongolia is highly challenging for large mining and it is not allowed in ASGM ore processing. Currently, only a few large-scale mines possess cyanide usage permits, granted by the State after rigorous research, analysis, and legal reviews, leaving ASM miners without access to cyanide. Many large-scale projects also face waiting times of over 5 years for cyanide permits. Due to these regulatory barriers, the project chose to focus on gravity technology throughout its duration, with the goal of fully utilising tailings by processing the remaining gold at a nearby large cyanide plant, benefiting both

⁴⁵ planetGOLD Mongolia

⁴⁶ UNIDO (2017a)

⁴⁷ RMI (2021)

⁴⁸ idem

⁴⁹ Mongolia EITI (2022)

⁵⁰ RMI (2021)

⁵¹ WGC (forthcoming)

⁵² RMI (2021)



parties. Cyanide plants are particularly interested in purchasing these tailings because they often contain high gold content, typically more than 5g/t, making them highly valuable.

Based on the two processing plants visited in the course of this research project, it seems that the high costs and the long timeframes to obtain the FS and the DEIA are the biggest challenges. Further, many processing plants are not operational because ASGM land permits have been stalled and therefore ore supply is an issue. In terms of the Central Bank purchasing model, a positive seems to be the fair price the bank pays, while challenges are that their test of gold purity can take a few days and they don't buy small quantities directly, as well as requiring more formalities than traders do.

Political context

There have been corruption allegations involving government officials illegally granting small-scale mining and rehabilitation agreements, issuing land permits, and approving environmental assessments. A particular governance challenge lies with the presence and role of officials at *soum* level (an administrative sub-division), the official intermediaries between artisanal and small-scale miners and the Minerals Resources and Petroleum Authority of Mongolia (MRPAM). *Soum* governors have been found to abuse their position to grant favours in the issuing of land access, and they have been found to request payments amounting to bribes from miners, which puts those miners who cannot afford paying these fees at a disadvantage.⁵³

Institutional and regulatory framework

At the end of 2010, the government adopted a small-scale mining regulation encouraging the activity and its formalisation. Mongolia established the Artisanal and Small-Scale Mining National Federation of Mongolia in May 2013. The federation works on improving the regulatory environment for ASM, empowering miners and developing a responsible ASM sector in the country.⁵⁴

Processing plants are primarily governed by the Processing Plant Regulation and the Commissioning Regulation. There are 13 critical permits and over 19 additional minor documents or permissions that the plants need to secure, which leads to a lengthy permitting process and substantial financial costs. Most of the country's regulation is targeted at larger processing plants operating as part of LSM concessions. Smaller, independent processing plants in the ASM sector therefore are not operating in a straightforward and streamlined legal and regulatory environment. This creates instability for the plants' operations, with them still being subject to local government inspections and potential closures or stop

work orders. Of the 23 plants processing ASGM gold in Mongolia, reportedly only two possess all the requisite permits. Among these permits, the most difficult to obtain are the FS and the DEIA, which come at a considerable cost because they require the involvement of certified professional firms. A DEIA can cost around USD 75,000 per plant.

In 2019, the government of Mongolia decided to create separate regulation for independent processing plants that mainly serve ASGM miners. However these regulations seemingly have some shortcomings and make certain assumptions that are not always applicable to small-scale processing plants. The requirements around advanced infrastructure (e.g. railways and paved roads) go beyond the financial capacity of small-scale plants. The regulations further demand that processing plants develop mine plans in order to achieve plant authorisation. As the processing plants are independent entities and separate from the extraction operations, this requirement cannot be met by the plants. Processing plants are also required to source gold of formal and transparent origin. However, the amount of formalised ASGM in Mongolia is limited and few ASM organisations provide certificates of origin. The regulation also does not clarify how the origin of the ore should be confirmed.

This context of regulations being perceived to being overly ambitious and unrealistic creates fertile ground for corruption, when processing plants seek ways to continue operating when faced with bureaucratic hurdles. Inspection authorities can shut down plants for not complying with the regulations.

Barriers and opportunities

Mongolia has demonstrated a commitment to formalisation and more responsible ASM practices, including through its long-standing partnership with the SDC. Nonetheless, the persisting informality of the ASM sector in Mongolia is a barrier to the operation of commercially viable and responsible processing plants. It is estimated that merely 16% of the sector is formalised, despite efforts to promote formalisation and improve technology.⁵⁵ As the planetGOLD experience shows, a major issue for processing plants has been the lack of ore supply due to the government's moratorium on ASM land permits. Also outside of the moratorium, the process to obtain such a permit involves multiple steps and requires considerable time. The secured ASGM area is, however, a key factor for processing plants' FS. Only once the FS is approved by the MIMR, the DEIA can be discussed and approved. A lack of formally designated ASM land means most of the ore that processing plants work with is illegal. While many plants operate without official permits, they continue functioning covertly. Local authorities regularly conduct inspections that can lead to the suspension of the plants' activities.

⁵³ UNIDO (2017a)

⁵⁴ Mongolia EITI (2022)

⁵⁵ planetGOLD Mongolia



A major issue is that processing plants often struggle to obtain the required operational permits. They must meet the same permit standards as large mining companies, regardless of whether they process 1t or 10,000t of ore daily. Permits like the DEIA and other key approvals require third-party execution and must be reviewed and approved by relevant government agencies. This lengthy, costly process places a significant burden on small-scale actors. The permits must be renewed every five years, which is a further challenge. Building and running a processing plant in Mongolia is generally very costly, in addition to the high cost of complying with legislation. Mongolia has harsh and long winters, meaning the plant needs a building and heating to enable winter operations.

Many miners reportedly distrust processing plants and prefer to work independently. One contributing factor is the role some processing plants play in gold trading, either purchasing gold directly or hosting independent traders. According to some advocates for small-scale miners, plants and traders don't always offer miners a fair price and use of the water density method to assay gold often results in inaccurate weight and pricing.

Plants typically charge MNT 200,000-250,000/t (USD 58-73) for ore processing. Recovery rates vary, with plants reporting 60-70%, but miners estimate it to be closer to 30-40%. Most plants use simple equipment, leading to lower gold recovery. Disputes can arise if recovery is low. As small-scale processing plants do not have cyanide permits, they sell tailings on to larger plants for cyanidation. The profits from the resale of gold-containing tailings are usually kept by the plants, with little or no profit-sharing with miners. The lack of profit-sharing from the sales of tailings reduces incentives for plants to improve recovery rates and discourages miners from using processing plants and instead makes them resort to harmful practices like mercury amalgamation. The main factor that enables a plant to attract more clients is to provide loans to the miners. Some miners come to the plant to borrow funds for operational costs for mining, such as gas, food, a ger (yurt), fuel, etc.

Key takeaways

- **The AGC/planetGOLD work in Mongolia has tested technical concepts and given insight into the processing plant sector and progress has been made in reducing mercury use.** However there are wider geographical and structural issues in the ASM sector making the establishment of larger and commercially viable plants more difficult.
- **Processing plants struggle to source only from formal ASM sites because of the government's moratorium on ASM land permits.** Obtaining permits is further a lengthy process for miners. Miners are often disincentivised to use formal processing plants,

which are reportedly perceived to offer unfair prices and do not share profits from the resale of tailings with the miners.

- **A major barrier for small-scale processing plants is the high cost to build the required infrastructure and to obtain all necessary permits.** The system is designed with large-scale organisations in mind and is not always well-adapted to smaller players.
- **A plant seems to attract more clients when it provides loans to the miners, allowing miners to come to the plant to borrow funds for operational costs for mining.**
- **Providing processing plants with a percentage of the production would incentivise them to tune equipment in ways that would improve yields, and which is fairer to the miners.**
- **The Mongolian government has taken strong measures against mercury use in the ASGM sector. It has also imposed tight controls on cyanide, with cyanide use not being permitted in the ASGM sector.** Processing plants working with ASGM ore therefore rely on gravity or flotation methods, which would be environmentally more sustainable if more miners were willing and able to use them rather than amalgamating with mercury clandestinely.

4.4. PERU

The processing plant landscape

Peru is shaped into three regions: the western coastal

foothills, the central Andean mountains and the Amazon rainforest to the east. The geography influences trading interactions and limits the potential movement of goods between regions. Gold is mined and processed in all regions, but the level of formality, scale and extent of responsible business conduct varies.

ASM gold mining in Peru comprises more than 300,000 mining operators.⁵⁶ ASGM miners contribute approximately 25% of the country's gold exports.⁵⁷ Chala, located in the province of Caravelí, Arequipa region, has established itself as an important gold hub in Peru due to its proximity to prominent artisanal mining centres such as Huanca, Mollehuaca, Relave, Chaparra, Santa Filomena, and others, as well as easy access to the Pan-American Highway. This growth has led to the establishment of various mineral processing plants in the area. According to the RMI, in Peru, mines commonly have their own processing plants on site or have a direct relationship with one. Processing plants act as the main aggregators, with there being fewer traders compared to other countries with strong ASM sectors.⁵⁸

⁵⁶ INGEMMET (2023)

⁵⁷ planetGOLD Peru

⁵⁸ RMI (2021)



An early processing plants to be established was Chala One, operated by the Canadian company Inca One Gold Corp. This plant began operations around 2012, focusing on the collection and processing of gold-bearing ore for subsequent export. It had a capacity of 150t per day. Inca One had a partnership with planetGOLD Peru and therefore incorporated the planetGOLD Criteria. There were plans to establish a credit system for ASGM miners through a collaboration between the processing plant and banks that would rely upon purchase records as a guarantee for credits for miners. In 2024, Inca One was liquidated after receiving a notice of default from OCIM Precious Metals for a missed gold loan payment.⁵⁹

A notable facility is the Veta Dorada plant, owned by Canadian-listed Dynacor Group Inc., which was founded in 1996. This plant has undergone several expansions, reaching a processing capacity of 500t per day by 2022, making it the ninth-largest gold exporter in Peru. Its sales are guaranteed to Swiss refiner PX Precinox. Dynacor has worked closely with artisanal and small-scale miners over a sustained period of time, providing technical support and a stable market for their production, ensuring transparency and sustainable practices.⁶⁰ Dynacor is believed to be the only free-standing processing plant to be certified

under the International Cyanide Management Code – having achieved that status in 2024. Dynacor draws ore supplies from around 750 small-scale mines. The company links its due diligence to the possession of permits and the tax status of its suppliers. We understand that the company provides ongoing technical support to its supplying mines in areas like geology and safety.

Apart from larger formal processing plants, there has been an increase in the number of informal processing plants in Chala, raising environmental and health concerns.⁶¹

Peru produces both separate metals (gold and silver) and polymetallic concentrates. Switzerland and the US are the main export markets for gold and silver, while China and South Korea are the main export markets for polymetallic concentrates. Buyers from India and the United Arab Emirates are also important players in the Peruvian mineral market.

From the plants visited for this research, we conclude that several Peruvian processing plants have large processing capacities of around 350t per day. They tend to work mainly with regular suppliers and conduct due diligence on mine origin. Processing plants seem to work with collectors who visit mine



⁵⁹ Inca One (2024)

⁶⁰ Tecnología Minera (2024)

⁶¹ Diario EP (2024)



sites, and sometimes also provide technical assistance for example for geological studies. The plants also have environmental and occupational health and safety expertise and measures in place.

Political context

Informality is a big issue in the Peruvian ASM sector. It has recently been exacerbated by the expansion of illegal gold extraction networks which operate outside the regulatory framework and are alleged to use processing plants to launder illicit gold. These networks are linked to transnational organised crime⁶² and the drug mafia.⁶³ This growing influence of criminal groups on gold extraction has led to a deteriorated security situation in mining regions. In the province of La Libertad, for example, there have been attacks on processing plants and mining operations.⁶⁴ Peru's latest EITI report links informal and illegal mining to crimes such as human trafficking, drug trafficking and money laundering.⁶⁵

Institutional and regulatory framework

ASM is subject to Law 27651 about the formalisation and promotion of ASM. In November 2022, the MINEM further approved a multi-sectorial national ASM policy to more clearly define the responsibilities of different public institutions for ASM formalisation. A particular challenge lies in distinguishing between informal and illegal mining.⁶⁶

The increase in the gold price in the 2000s spurred the arrival of so-called "swallow miners" to traditional mining communities. These miners, lacking roots or a sense of belonging, often brought disorder, chaos, crime, and pollution to these areas. In response, the government started to issue a series of decrees and regulations on mining formalisation, starting with Legislative Decrees 1100 and 1105. The regulatory packages issued between 2012 and 2013 were widely criticised for having been enacted without the prior conduct of a mining census and therefore without even an approximate understanding of the number of ASM miners in the country. The regions, lacking human, economic, and technical resources, were overwhelmed by the number of miners who were required to begin the formalisation process. As part of the formalisation process, miners have to submit a declaration of commitments related to a series of environmental, labour, and safety regulations.

Later, legislative Decree 1336 created the Comprehensive Registry of Mining Formalisation (REINFO). It was created as an official registry for miners in the formalisation process and became a central tool for identifying and controlling miners. To date, REINFO is a live registry updated daily, identifying miners in the process of formalisation from all regions of Peru. The registry can be filtered by districts, provinces, regions, whether the miners in the formalisation process are individuals or legal entities,

⁶² Revista Quehacer (2023); Solidaritas Perú (2023)

⁶³ OAS (2021)

⁶⁴ InSight Crime (2023)

⁶⁵ EITI Peru (2024)

⁶⁶ idem



whether they hold exploitation or beneficiation concessions, and whether their listing status is active or suspended. The success of Peru's processing plant model lies in the ability to legally purchase raw ore from ASM miners who are 'in the process of formalisation' through their registration in REINFO. Processing plants must check REINFO to verify the status of miners they source from, as well as the location of their concession.

Legislative Decree 1336 also simplified the formalisation process by simply demanding four steps to be completed before the authorisation for exploitation and/or beneficiation of minerals is granted: approval of environmental management instruments; proof of ownership or authorisation for surface land use; proof of title, assignment contract or exploitation contract for the mining concession; and submission of a sworn statement regarding the absence of archaeological remains. This has led to more processing plants attaining formalisation, many with capacities exceeding 150, 200 and 300t per day.⁶⁷ To be considered a Small Mining Producer, processing plants must remain within the limit of a maximum processing capacity of 350t per day.

Formalised processing plants are required to put in place environmental management plans. Government authorities conduct unannounced visits to the plants to verify strict compliance with the plans. These checks focus on the implementation of prevention and mitigation measures, monitoring of pollutant emissions into the air, water, and soil, compliance with Environmental Quality Standards (ECAS) and Maximum Permissible Limits (LMP), and the proper management of tailings and waste.

Despite these efforts, the results of regulatory efforts towards formalisation have reportedly been limited.⁶⁸ Despite the country having a relatively sophisticated network of processing plants, the number of processing plants operating in the country is unknown and many are not registered or operate under conditions that do not comply with the legal and regulatory framework.⁶⁹

Barriers and opportunities

One of the main challenges in Peru is widespread informality in the ASM sector. Illegal and informal mining represents between 22 and 28% of all of Peru's gold production.⁷⁰ The artisanal mining sector formalisation process has been slow and not very effective.⁷¹ According to the MINEM, between 2012 and 2022, 10,692 miners have been formalised. This is around 20% of the currently active listings in REINFO. This is partially due to a significant number of individuals registered in REINFO not even being artisanal miners but instead 'invoicers' who use the REINFO listing to be allowed to commercialise and sell their products to processing plants. Illegal miners can

operate under the umbrella of an 'invoicer' who rents out their REINFO status, hence enabling illegal groups to legally commercialise their products. The expedited formalisation process, while enabling the legal sale of minerals, has also triggered a deep crisis of trust, fostering negative public perception towards processing plants. This is largely due to the high risk of infiltration by illegal miners who do not fully comply with the formalisation requirements established in the Mining Law.

Various experts and organisations have expressed concerns about the REINFO registry, arguing that it has been used as a cover for illegal mining activities. Critics highlight that the constant extensions of the deadline for formalisation have allowed illegal mining activities to continue operating under the guise of being in the process of formalisation. Artisanal mining associations have repeatedly requested such extensions. In response to protests and road blockades, the Peruvian Congress approved a six-month extension for the mining formalisation process and therefore the validity of REINFO, which was originally set to expire on December 31st, 2024. Despite this, the government expressed reluctance to extend the programme further, due to its misuse and questions about its integrity.

The lack of responsible social and environmental practices leads to negative impacts on surrounding communities and therefore conflicts. Some processing plants are perceived to have contributed to these adverse impacts as they frequently engage in commercial relationships with informal suppliers without assuming any responsibility for their practices. Legally, however, these suppliers are considered 'independent' third parties which limits processing plants' accountability.

There is no overall traceability system or reliable approach for processing plants to certify the origin of raw material (note: Dynacor operates a paper-based traceability scheme that provides some transparency from mine to plant). This problem is exacerbated by the presence of various intermediaries in the supply chain. Further, many artisanal operations combine different deposits before sale.⁷² However, an opportunity for more transparent gold supply chains is the mobile app Qori, established by planetGOLD Peru in collaboration with the MINEM. It was in testing phase in 2023. The traceability tool can be used to register purchases and sales of gold as well as chemicals and equipment used.⁷³

A challenge for smaller plants processing ASM gold is the lack of access to credit and therefore opportunities to invest in better technologies. Larger plants that are part of the national processing plant association ANPLABEN have sufficient resources to finance expansions or technological implementations.

⁶⁷ EITI Peru (2024)

⁶⁸ idem

⁶⁹ RPP Noticias (2024)

⁷⁰ EITI Peru (2024)

⁷¹ planetGOLD (2024)

⁷² Beck & Kiener (2022)

⁷³ planetGOLD (2024)



Many of the formal plants operating in Chala offer certain benefits to artisanal miners who supply them with minerals from their mining operations. Some miners receive loans or advances, which helps 'bind' them to these plants. Others even provide accommodation and meals to miners who come from afar and await their sales settlements based on the assay results of their products (as in the case of Inca One). It is worth noting that miners often prefer quick payment for their minerals over fair payment (settlements based on the actual grade of their ore, with fewer deductions).

On the other hand, some plants take advantage of the lack of credit options for miners and allegedly 'trap' them with loans or advances, only to impose significant deductions at the time of payment. A report identified the mistrust of miners in processing plants as a barrier to a responsible and viable ASM sector. Some miners perceive that processing plants recover less gold and that miners therefore lose revenue. Some miners also perceive the payments from processing plants to be unfair. This is one of the reasons for the majority of gold being crushed and mixed with mercury by the miners and then being sold to local traders who export it. The tailings from the amalgamations are then sent to processing plants to extract the remaining gold which creates severely adverse environmental impacts.⁷⁴

Key takeaways:

- **Peru has a large number and high diversity of processing plants, including several that process much larger volumes compared to other countries studied and which have been operating for a decade or more.** It holds several high profile, successful businesses as well as a range of informal processors. There are strong examples from which to draw lessons for elsewhere including of efforts stimulated by the London Bullion Market Association (LBMA) to facilitate access for responsible ASGM to its Good Delivery Network of refiners.
- **As in Ecuador, capture of parts of the sector by criminal groups presents an enormous challenge, with severe human rights, environmental and business integrity issues pervading the sector.** Processing plants have been subjected to attacks, and some are connected to criminals and are used as vehicles for laundering both money and illegally mined gold.
- **A simplification of the formalisation process has led to more processing plants obtaining formal status.** The expedited process has however also created trust issues, as it is allegedly not preventing illegal miners from infiltrating the formal system.
- **Informality remains an issue, both for extraction and processing operations, despite many**

government-led efforts to formalise the sector. The REINFO registry is being abused by illegal actors, providing a cover for their illegal activities.

- **Peru has established several promising initiatives and partnerships, such as the planetGOLD and MINEM-initiated traceability app Qori.** Their impacts are yet to be assessed.
- **A success factor in Peru is the fact that processing plants are allowed to source from miners that are in process of formalisation, as opposed to only miners who have already achieved formalisation.** This model encourages progressive improvement, but it would be more encouraging if a higher proportion of miners who make applications for formalisation were able to complete the process.
- **Formal processing plants manage to secure ore supply by providing loans and advances to miners or offering them accommodation and meals while they wait for the sales process to conclude.** Some plants, however, allegedly use this system to trap miners in relationships of dependence, which can lead to exploitative practices.
- **Mistrust in processing plants' capacity to recover high amounts of gold and perception of unfair payments lead to many miners reverting to amalgamation with mercury and selling to local traders instead.**

4.5. THE PHILIPPINES

The processing plant landscape

There are an estimated 500,000 ASGM producers in the Philippines and they produce around 70% of all gold in the country.⁷⁵ The majority of miners operate informally, and the gold as well as financial flows linked to it largely go through informal or illicit channels.⁷⁶

Smaller processing plants are more accessible because they are usually located within the declared artisanal mining area whereas larger processing plants have a higher gold recovery rate but require travel. The smaller plants primarily use gravity concentration methods such as ball milling and panning, while larger processing plants utilise leaching for gold recovery.

In 1977, the Philippines Central Bank received Good Delivery refinery accreditation from the LBMA, permitting its gold bars to be sold on the international market. The bank is the only Central Bank on the LBMA's Good Delivery List. The bank's ASM gold buying programme was very successful between the late 1990s and 2011. In 2012, a 2% excise tax and 5% creditable withholding tax meant that ASGM sales to the bank dropped as miners looked for different

⁷⁴ idem

⁷⁵ planetGOLD Philippines

⁷⁶ UNIDO (2017b)



markets. In recent years the Bank's purchasing programme has largely recovered.

A more recent pilot initiative under the planetGOLD Philippines project has established a supplier agreement between the Central Bank and the small-scale mining association. Through the agreement, the Central Bank will assist the mining association in securing loans from banks and financial institutions, enabling small-scale miners to fund their own processing plants. Small-scale miners and their partner processing plants which register as gold traders with the Central Bank will reportedly further benefit from tax exemptions on their gold sales. The initiative ensures a stable supply and demand for the processing plants, supporting their commercial viability.

Two processing plants that planetGOLD has identified for the project are Paracale and Sagada. In Sagada, many ASGM operators are part of a local indigenous group for whom environmental protection is a high priority and therefore mercury use is scarce. Smaller processing plants in Paracale are typically located close to mining tunnels and primarily use gravity concentration methods such as ball milling and panning. planetGOLD estimate that once the Paracale plant is operational, it will produce an estimated 55kg of mercury-free gold per year.⁷⁷

Political context

Some miners have reported experiencing corruption and extortion by government officials and law enforcement personnel, which undermines their livelihoods and further perpetuates the sector's informality.⁷⁸ Local governors are responsible for regulating the ASGM sector but some have been found to abuse their position to enrich themselves from the sector. For example, they are alleged to solicit bribes from actors in the ASGM sector, finance illicit mines or get involved in the gold trade.⁷⁹ In Mindanao, extensive transnational smuggling of gold allegedly thrives due to the complicity of corrupt government officials that exploit the gold trade to finance counter-insurgency campaigns and election bids.⁸⁰

Institutional and regulatory framework

Processing plants are governed by Republic Act (RA) No. 7076, the "People's Small-Scale Mining Act of 1991", implemented by the Department of Environment and Natural Resources - Mines and Geosciences Bureau (DENR-MGB). Section 18 of the Act stipulates that the establishment and operation of safe and efficient customs mills for mineral or ore processing will only be allowed within mineral processing zones designated by the local government unit (LGU), following recommendations from the Board. DENR Administrative Order (DAO) No. 2022-03 or the revised Implementing Rules and Regulations



(IRR) of RA 7076, outlines the procedure for the establishment of mineral processing zones and documentary requirements for the application for a Mineral Processing License (MPL). RA 7076 stipulates that in areas where the private sector is unable to establish mills, the government should construct such mills. No foreign investment is allowed in ASM extraction or processing.

The legal framework prioritises registration and licensing. The enforcement of mining regulations however reportedly remains inconsistent due to a lack of resources and capacity within LGUs and other relevant agencies. This means that mining regulations are implemented inconsistently and sometimes with lenience towards non-compliance, for example allowing small-scale miners to operate in areas before they are approved for the activity, or all requirements have been met.

The Philippines has seen periods of moratoriums on mining projects and the imposition of stricter regulation due to concerns about environmental and social impacts of the sector. Economic needs during the Covid-19 pandemic led to the government lifting the nine-year moratorium on granting new mining permits and the four-year ban on open-pit mining. Also, local governments at times restricted mining activity by imposing bans, based on environmental concerns and negative impacts on local communities. This restriction of mining activity impacts processing plants which rely on the supply from those mines.

⁷⁷ planetGOLD (2024)

⁷⁸ Pascual et al (2020) ; ILO (2020)

⁷⁹ UNIDO (2017b)

⁸⁰ Global Organized Crime Index (2021)



LGUs often have significant power to grant or deny permits for processing plants and mines.

Barriers and opportunities

Processing plants encounter issues around varying practices and evolving legislation. Regulations are complex and there are bureaucratic hurdles, with little technical assistance being provided by the government. Businesses hence struggle to understand regulatory requirements, which can lead to delays and rejections of permit applications. Inefficient government services in the form of long processing times and unclear communication are another obstacle to the establishment and successful operation of processing plants. There is also a lack of technical support which makes it difficult in particular for small companies to comply with environmental and safety regulations.

The planetGOLD project has also encountered challenges with the approval for establishing a mineral processing zone.⁸¹ It can take several years to secure a Mineral Processor's License and there is a requirement for a Mineral Processing Zone being in place. If the site is on ancestral land, the plant must obtain Free, Prior and Informed Consent (FPIC) which is positive from an indigenous rights perspective but can add months or years to the approval process. The government increasingly has pushed for stricter environmental standards and community consultations. A mining forum held in June 2024 called for the promotion of biodiversity, low carbon development, and the implementation of the Philippine Ecosystem and Natural Capital Accounting System (PENCAS). This requires ore processing plants to invest in cleaner technologies and engage with local communities, which can increase operational costs. In particular smaller processing plants lack the knowledge and capacity to comply with environmental and safety regulations.

Another barrier to commercial viability is the limited processing capacity. According to the planetGOLD report, in Paracale the average processing plant production is 4 grams a day.⁸²

Key takeaways

- **Given that most gold extraction and trade is informal, Central Bank buying practices are not seemingly sufficiently incentivizing the miners to participate, and the legal framework can be complicated and inconsistently applied, the Philippines' gold processing sector is challenging to operate in.**
- **The sector's informality is reportedly perpetuated by corrupt practices by government officials and local governors, some of whom use gold extraction and trade for their own benefit.**

- **Central Bank buying programmes can support the responsible and formal extraction and processing of gold.** They, however, need to be financially attractive to incentivise miners to participate. The Philippines Central Bank's control over an LBMA accredited refinery creates a unique opportunity in the sector to export licit gold supplies.
- **The legal framework is not implemented consistently, which means irresponsible practices can continue.** Further, the legal framework for processing plants can be confusing and difficult to comply with, in particular in light of the absence of technical support.
- **A barrier for processing plants is the insecure supply of material due to the government regularly restricting or stopping mining activity based on social and environmental concerns.**
- **The government has made efforts to put in place stricter social and environmental protections, which has made getting permits more complicated, lengthy and costly for processing plants.**

4.6. TANZANIA

The processing plant landscape

Tanzania is Africa's fourth largest gold producer, with gold constituting around 50% of the country's exports and gold production contributing around 7% of Tanzania's GDP. The gold sector is dominated by large-scale multinational mining companies, accounting for 70-80% of production. 20-30% of gold production (5.3-9.8t a year) comes from over 1.2 million ASM miners, with ASM production increasing.⁸³ The sector is characterised by widespread informality,⁸⁴ unsafe working conditions and child labour, as well as adverse environmental impacts. There is also widespread use of hazardous chemicals, in particular mercury. Further, an estimated 15-20% of Tanzania's gold exports are informal.

In Tanzania, the establishment of processing plants for ASGM has been a significant development aimed at improving gold production management. These plants have been operational since the early 2000s, with notable initiatives supported by organisations like the World Bank, which established several Centres of Excellence (COEs) specifically for the ASM sector. These COEs focus on providing technical assistance, training, and access to efficient processing technologies.⁸⁵

Tanzanian processing plants mostly are vat leaching plants that process tailings from mercury-based recovery methods. Vat leaching plants mix gold containing material with leaching solutions in large vats or tanks. Cyanidation is one such vat leaching process.

⁸¹ planetGOLD (2024)

⁸² idem

⁸³ Tanzania EITI (2024); United Republic of Tanzania Vice President's Office (2020)

⁸⁴ Delve (nd); Mutagwaba et al (2018)

⁸⁵ Kinyondo et al (2020)



Reportedly, the only integrated extraction-processing operation is the one recently established in Geita between Mwamba Mining and ASGM primary mining licence (PML) holders. In 2023, Mwamba's processing plant Buziba was established in Geita District. Mwamba's goal is to provide mercury-free processing services for ASGM miners in Tanzania. It started operating very recently, in November 2024. Its current processing capacity is 500t a day, with plans to expand to 1000t per day by the end of 2025. Mwamba sources ore through partnerships with mine site license holders or through purchases from verified ASGM miners. They plan to purchase tailings from local gravity or vat leaching processing plants to help clean up the local environment.

The doré is sold to a part-government owned company. Mwamba is currently developing a sales channel to an LBMA refiner. Mwamba states that it implements strict ESG and due diligence practices. Before doing a transaction with miners, Mwamba evaluates the suppliers' mining practices, legality, validity of permits, and environmental and safety conditions. Mwamba is revamping its sourcing procedures to align with LBMA.

Political context

Organised crime associated with illegal mining practices undermines legitimate processing operations.⁸⁶ One of the most pressing issues is the demand for illegal payments and extortion. Criminal

groups often impose so-called protection fees on processing plants, which undermines legitimate business practices and is a financial burden that prevents processing plants from investing in more efficient technologies or other improvements.⁸⁷ The involvement of organised crime groups in artisanal gold extraction also means that processing plants struggle to source from legitimate suppliers.⁸⁸ The presence of organised crime in the gold sector can disrupt production and creates an atmosphere of insecurity and fear.⁸⁹

Another potential barrier for local processing plants is that pre-financing arrangements for miners, involving Chinese, Indian, Emirati, and even some Turkish actors, have become common. Chinese 'investors' often form partnerships with local PML holders or independently establish mining, milling, and processing operations, even though foreigners are not allowed to hold ASM licenses. Recent field visits to the ASGM areas of Songwe and Chunya have highlighted numerous such partnerships, particularly between local PML holders and Chinese and Indian investors. The flow of gold via foreign investors makes it more difficult for the Central Bank to reach its target of buying 6t of gold a year.

Political involvement in the sector and allegations of corruption further complicate the landscape, with politically exposed persons (PEPs) potentially engaging in illicit activities that distort the regulatory environment and favour certain entities over others.⁹⁰



⁸⁶ Hilson (2017)

⁸⁷ Kehbila et al (2021)

⁸⁸ Sullivan et al (2020)

⁸⁹ Mthembu-Salter (2019)

⁹⁰ IPIS (2019)



Traditional leaders play a crucial role in local governance. Their alignment with specific investors can allegedly marginalise local miners and create tensions within communities.⁹¹ Investors or processing plant owners can create buy-in with local communities by getting traditional leaders on their side, for example by putting them on the plant's or investor's payroll.

Last but not least, the gold sector in Tanzania is impacted by it being a destination for ASM gold smuggled out of the Democratic Republic of the Congo (DRC). Without adequate due diligence and traceability efforts, Tanzanian processing plants and their downstream buyers risk such gold entering their supply chains.⁹²

Institutional and regulatory framework

The Mining Act of 2010, alongside its amendments, serves as the primary legislative framework governing mining operations, including processing plants.⁹³ This Act outlines licensing procedures and environmental management requirements.⁹⁴ The Mining Act and the Mineral Policy from 2009 establish a definition of a small-scale miner as “the holder of a PML, which is a licence for mining operations characterised by minimal machinery or technology and initial capital for investment that does not exceed USD 5 million or its equivalent in Tanzania Shillings”.⁹⁵ The Mineral Commission, established under the Ministry of

Minerals, is the key government agency responsible for overseeing mineral exploration and extraction activities, as well as processing plants.⁹⁶ The Environmental Management Act of 2004 also plays a crucial role, mandating environmental impact assessments (EIAs) for mining projects and processing operations.⁹⁷

The government has implemented policies aimed at formalising the ASM sector.⁹⁸ The Mining Act provides guidelines for registration and licensing. It aims at promoting responsible practices, enhancing productivity and safety of artisanal miners while ensuring environmental protection.⁹⁹ However, the legal framework has received criticism for being unhelpful in practice. A significant weakness is the complexity and ambiguity of the laws, which can hinder effective implementation. Many small-scale miners lack the technical knowledge to navigate the legal requirements.¹⁰⁰ Reports indicate that regulatory bodies often lack the resources and capacity to enforce the legal provisions effectively.¹⁰¹ The ambiguity and complexity of the legal framework can also generate a higher risk of corruption. Miners, facing bureaucratic hurdles, may resort to bribery to expedite processes or obtain licenses.¹⁰² This not only undermines the integrity of the legal system but also perpetuates a cycle of informality and exploitation.

In order to tackle illegal gold exports, in 2019 the government asked all mineral producing regions to establish government-controlled trading centres, of which there are now 28, with the largest being in Geita. These centres, Mineral and Gemstone Houses (MinGem Houses), facilitate the sale of gold and ore from ASGM but are mostly known to have lax due diligence practices.¹⁰³ Those can lead to mixing of legal and illegal gold, which undermines the integrity of the trading system and complicates regulatory efforts. The MinGem Houses do, however, act as a pinch point and an opportunity for developing more robust due diligence systems. In October 2024, the Central Bank of Tanzania (BOT) launched its Domestic Gold Purchase Program, allowing gold sellers to sell to the Bank at competitive market prices. The programme offers a reduced royalty fee, no inspection fee and no VAT, and allows registered entities to sell any amount to the Bank.

Barriers and opportunities

Bureaucratic inefficiencies and corruption can prevent the very establishment of processing plants, as plants may face difficulties in obtaining the necessary permits.¹⁰⁴ Additionally, the lack of financial support often limits the operational capacity of processing plants, leading to lower productivity.¹⁰⁵ The high initial capital investment required for modern processing technology can deter potential entrepreneurs.¹⁰⁶ Inadequate infrastructure also poses a significant challenge, as many processing plants are located in

⁹¹ Mtembu (2020)

⁹² Lederer (2020)

⁹³ United Republic of Tanzania (2010)

⁹⁴ United Republic of Tanzania (2019)

⁹⁵ Tanzania EITI (2024), p. 12

⁹⁶ United Republic of Tanzania (2019)

⁹⁷ United Republic of Tanzania (2004)

⁹⁸ The World Bank (2020)

⁹⁹ United Republic of Tanzania Vice

President's Office (2020)

¹⁰⁰ Mäkelä (2020)

¹⁰¹ Gordon (2021)

¹⁰² Mäkelä (2020)

¹⁰³ RMI (2021)

¹⁰⁴ Hinton et al (2018)

¹⁰⁵ Bain & Company (2021)

¹⁰⁶ Kibaya & Mvungi (2022)



remote areas with limited access to transportation and utilities.¹⁰⁷ This hinders the efficient movement of raw materials and processed gold, increasing operational costs.

Furthermore, regulatory challenges, including perceived inconsistent policies and licensing issues, create an uncertain environment for investors.¹⁰⁸ The ASM sector still largely lacks formal recognition, making it difficult for processing plants to establish sustainable partnerships. Environmental concerns and the need for compliance with regulations regarding mercury usage further complicate operations. Many processing plants struggle with integrating environmentally friendly practices while remaining economically viable.¹⁰⁹

It was notably difficult to obtain information from individual processing plants in Tanzania. Their reluctance to disclose administrative, financial, and governance information about their Carbon-in-Pulp (CIP) operations can be attributed to a complex interplay of factors. One significant aspect is the regulatory environment and compliance concerns that these operators seemingly face. Historically, many operators have encountered negative interactions with regulatory bodies, leading to a pervasive distrust of governmental oversight. Instances of penalties or abrupt changes in regulations can create an atmosphere of apprehension, making operators hesitant to share information that could potentially expose them to scrutiny or legal repercussions. The mining sector in Tanzania is characterised by intricate regulations, and operators may fear that disclosing sensitive information could lead to unintended compliance issues.

Economic vulnerabilities also play a crucial role in shaping the attitudes of these operators. Small- and medium-scale enterprises often operate with slim profit margins, which makes them particularly sensitive to any factors that could jeopardise their financial stability. The fear of revealing financial information may stem from concerns about exposing their operational efficiencies or weaknesses to competitors, which could undermine their market position. Operators may further worry that their data will be used in ways that portray them negatively, potentially harming their business operations or community relations. This concern is particularly salient in regions where mining has historically been associated with exploitation and negative externalities.

In many communities, mining operations are deeply intertwined with local identities and social structures. Operators may feel that disclosing sensitive information could compromise their standing within the community or lead to questions about their legitimacy. Furthermore, cultural norms surrounding privacy can create an environment where financial and

operational matters are viewed as private affairs, leading to a general reluctance to share such information with outsiders. Moreover, although Tanzania is amongst the countries who are generally regarded as leaders in seeking to formalise and professionalise their ASGM sector, the long-term penetration of the sector by external actors, such as Chinese, Indian and Emirati traders, and how they operate in the political and legal context, seemingly obstructs progress towards greater transparency and improved regulation of the sector.

Key takeaways

- **The ASGM sector in Tanzania is characterised by informality and poor social and environmental practices, including the widespread use of mercury.** The increasing presence of foreign investors in the ASGM sector, notably from China, has led to less material being available to local processing plants. But there are opportunities to capitalise on regulatory and system reforms and to strengthen the role of processing plants, if there was more consistency and better enforcement.
- **In spite of formalisation efforts, ASGM stakeholders struggle to comply with regulatory requirements because of their complexity and ambiguity and a lack of technical knowledge.** This hampers the establishment of processing plants.
- **Enforcement of the rules is weak.** This creates an environment conducive to corrupt practices, which in turn perpetuates informality and exploitation.
- **Criminal groups are active in the ASGM sector.** They reportedly extort processing plants and their control over gold extraction means there are fewer legitimate suppliers for processing plants to source from.
- **Foreign investors are increasingly forming partnerships with PML holders and therefore capturing parts of the production, often exporting it directly through their own channels, circumventing official processes.**
- **The MinGem Houses, while currently not implementing strong enough due diligence practices, are an opportunity for more responsible and transparent ASGM supply chains.**
- **Establishing and operating processing plants is costly, with there being a lack of financial support.**
- **There is a sense of distrust in the government among processing plants, which has to do with the imposition of penalties and abrupt regulatory changes and perceptions of corruption within the system.**

¹⁰⁷ Basu & Dube (2021)

¹⁰⁸ Mwanga (2020)

¹⁰⁹ Mungai et al (2021)



5. Conclusion and recommendations

This report is based on the hypothesis that processing plants can help bring more ASM gold into responsible supply chains and make an important contribution to formalised, professionalised and responsible gold sectors as the basis for driving sustainable development in gold-producing regions. Our research findings are in line with those of PlanetGOLD and RMI set out in Chapter 3, though they expand on the opportunities to support a more commercially viable ASM gold supply chain through greater formalisation, legalisation and professionalisation of the plants. In particular, we found that processing plants contribute to improved gold recovery rates which can increase miners' income and therefore also benefit communities and the government (through tax income). Miners can use this additional income for formalisation and enhanced technologies, better health and safety measures and improved environmental protection. Governments can use the additional funds to more effectively regulate and support the sector. We recognise that these outcomes are more easily stated than realised.

The report finds that processing plants can be key aggregation points in the upstream gold value chain and have the potential to support greater transparency and certain types of traceability. However, they are challenging to run in ways that are both commercially viable and responsible unless they hit a context-specific threshold of scale, which remains a challenge for the majority. But there are examples of where it is working well – such as at some operations in Peru and Tanzania. Trust (or lack of) between value chain actors shapes the business model. And overall, that whilst a responsibly managed plant can be transformational in the right circumstances, getting to a place of responsible plant management will be a process of continuous development that requires an enabling environment (notably the right kind of government involvement) as well as access to capital. In terms of the original hypothesis, our research and follow-up conversations suggest that there may be more flexibility in terms of scale than previously assumed. A commercially viable and responsibly run plant could run at 50 - 100t per day in some contexts. However, its ability to do so will depend on the average grade of ore being higher than the initial hypothesis of 2g/t.

There are many different models of processing plants across and within the six countries, with some succeeding with commercial viability, responsible business practices, or both. For this, however, the right political, regulatory and physical conditions must be in place. In this conclusion, we recognise that

country-specific factors may hamper the replicability of successful models. But we have been able to identify common key barriers to artisanal and small-scale miners and processing plants achieving commercial viability and practising business responsibly at the same time. Below, we outline factors which make commercially viable and responsibly run processing plants more likely, which could form the basis for guiding processing plants' owners, operators, investors, regulators and business partners on how to develop these important aggregators for more sustainable gold sectors.

Success factors for commercially viable and responsible processing plants:

Policy & regulatory context

- **Adoption of a national strategy to gradually scale processing plants.** Supporting the growth of small-scale mining and processing businesses is important from an economic empowerment and development potential. Governments can pursue conditions that favour ground-up (producer-led / community-based) sector development through organic growth, top down (corporate / investor-led) through merger & acquisition, or a combination of both. This requires efforts to incorporate processing plants into the formal financial sector and supporting them to access debt and equity finance as well as the technical expertise in business strategy and





administration, mineral processing, customer relations that can build resilience into their businesses. There is a role for Central Banks and commercial banks, potentially working together, to structure corporate finance solutions tailored to processing plants.

- **Proportionate and fit-for-purpose regulatory frameworks.** Regulators must strike the right balance between putting in place requirements that ensure legality and responsible business practices and not making compliance so burdensome that processing plants and/or miners are encouraged to (or can only be commercially viable if they) operate outside of the legal framework. Regulations are not adapted to the local reality of commercial viability within the ASGM sector and are instead designed to meet a standard that is unattainable for both miners and processing plants, therefore trapping producers in a state of permanent informality. There are insufficient rewards or incentives for ASM miners to become formalised. Future research can compare formalisation requirements for processing plants and the major barriers they face, as well as solutions that are working.
- **Enable and reward transformation towards formality.** In Peru, processing plants benefit from

being allowed to source from miners who are in the process of formalisation – as opposed to having to wait until they are fully formalised. This progressive improvement model has the advantage that the very business relationship can provide miners with the financial and technical capacity to improve their practices and obtain permits and licenses. However, the model is seen to have its limitations given recent controversies and the fact that the scope for progressive improvement was being abused by large numbers of miners making no real attempt to finalise the process. A progressive improvement model can be adopted by downstream buyers for small-scale processing plants. However, it requires both full transparency and regular monitoring to ensure organisations continue along the improvement pathway. While regulations that support progressive improvement towards full formality are preferable, they risk generating a context where persistent informality exists without evidence of improvement. Inclusion must be conditional upon evidence of gradual improvement and government and downstream actors must take an active role in supporting this. This could include decentralisation of governance and oversight until such time as a plant hits a particular threshold in throughput or capitalisation or time.





Technical factors

- **Scale matters.** A sector with fewer larger plants (instead of many small ones) is easier to oversee and regulate, and traceability is easier to achieve. Furthermore, larger processing plants have more financial resources and technical capacity to become commercially viable. The threshold at which the double holy grail of viability and responsibility becomes possible varies according to a range of factors both inside and outside the control of operators, e.g., cost of compliance, cost of capital, the grade of ore, quality of machinery (recovery rate), business models, technical competence, insurance costs (and availability), and other factors set out below. Where the cost of doing business is higher and/or profit margins are lower, then the scale needed to be both commercially viable and responsible increases.
- **Secure and quality transportation.** The concentration of processing activity in fewer plants requires better transport infrastructure and security along transport routes to allow the transport of material across larger distances. Where transportation is secure and of high quality, risks are lower and it is less costly to move material which grows plants' potential catchment area and thus customer base; it may also decarbonise the value chain.
- **Capacity.** To prevent mercury use, processing plants must be equipped with machinery and have the technical knowledge to implement alternative and environmentally friendlier processing technologies. These technologies must lead to a high gold recovery rate to incentivise miners to process their ore at the plant instead of doing mercury amalgamation themselves. Processing plants would benefit from capacity building on due diligence and Environmental, Social, Governance (ESG) risk management.
- **Financial and technical assistance.** Processing plants need up front capital at a larger scale to allow them to get up and running. They would benefit from financial and technical support to obtain certain required permits (e.g. environmental permits in Mongolia), to upgrade their machinery, to develop their expertise and relevance. There may be scope for a "WGC Visiting Processor" status to be conferred to market leaders that provide guidance to smaller processors who need help to develop; this could even provide a basis for developing deeper commercial relationships over time.
- **Environmental protection.** Processing plants are water- and energy-intensive and produce large volumes of waste. Some larger processing plants are operating with tailings storage facilities, which is preferable to direct dumping of waste into the environment. However, there are substantial risks with tailings management. We recommend investigation



into inclusion of processing plants in the covered countries into the **Global Tailings Management Institute** to support the development of safe and environmentally effective facilities. Whilst our research did not investigate the climate impacts of processing plants, access to green power is also key in order to reduce the overall carbon footprint of gold value chains as processing plants are power-intensive. Supporting tailings facilities to apply circularity strategies as part of environmental due diligence activities by downstream partners could go a long way in dematerialising processing plants, reducing their environmental and social impacts and driving higher commercial performance. Further efforts must be made to eliminate the use of mercury in the sector.

Business relationships

- **Trust.** Miners often lack trust in processing plants (the sector generally has low trust levels), for fear of being cheated (e.g. unfair prices; inaccuracy of assays). This means they prefer to process gold themselves, often (but not inevitably) leading to mercury use. Strong, long-term partnerships between processing plants and their suppliers as well as their buyers (e.g. Central Banks) is key to their commercial success. Trusted business relationships in particular mean that plants will have a more secure supply of material. Good practice for trust-building can notably include the provision of financial and/or technical support by processing plants to miners and transparent testing and pricing procedures.
- **Fair trading terms.** Part of building trusted relationships with suppliers are fair payment terms. Poor payment terms (especially slow payments e.g. through a government-run system) or mistrust in assay results and therefore a sense of being paid too little can result in miners selling their ore elsewhere. Transparent and efficient payment will encourage miners to sell to formal processing plants and to participate in government programmes such as Central Bank buying schemes. Central Banks need to ensure timely payment to remain attractive to miners and processing plants. Part of this could be addressed by the initial use of XRF technology and the establishment of independent laboratories, or which can provide valuation services that miners trust.
- **Financial partnership.** Processing plants that provide financial and/or technical assistance to miners often find it easier to establish stable and longer-term relationships with them and therefore securing supply as well as having better oversight of their social and environmental practices. Safeguards are needed to prevent relationships of dependence and potential exploitation of miners. By providing financial assistance, processing plants can also free miners from cycles of dependence with informal traders, therefore ensuring more supply. The financial

assistance can include overcoming logistical barriers such as lack of road infrastructure. Innovative partnerships between financial institutions and processing plants can not only support this but build expertise and confidence in the financial sector to engage with ASGM value chains, something that has been a priority challenge for the sector for many years. Partnerships with institutional investors, commercial or Central Banks could unlock the possibility of greater financial inclusion of ASGM through and/or thanks to their processing plants relationship.

- **Toll processing business models v. others.** We judge that processing plants which take ownership of the material before processing it find it easier to implement due diligence processes and ensure traceability, compared to plants which instead rent out their equipment and services (toll processing model). If processing plants buy the ore off miners and are then responsible for selling the gold product on, they become a pinch point in the supply chain, contributing to greater transparency. On the other hand, toll processing models are often more attractive to miners, allowing miners to keep control over the material if they don't trust the processing plant to give them a fair deal on price. (However, it should be noted that some processing plants using the toll method intentionally tune machinery to lower yields so they can reprocess the tailings to their own advantage later). However given miners want cash, they might be interested in selling the ore if trust issues can be overcome. A model where the processing plant takes ownership of the ore should be more commercially viable because the plant can do continuous processing instead of more cumbersome batch processing.

Other Cooperations

- **Franchise.** It may be attractive for the larger, more successful processing plants to franchise their business models, procedures, contracts, etc. into new geographies through local partners.
- **Multistakeholder initiatives and NGOs as enabling partners.** The planetGOLD programme and its partners, as well as other donor-funded activities by international and local NGOs, are working with ASM value chain actors, their regulators and local communities to foster deeper cooperation and innovative technical and financial solutions, such as traceability tools, debt instruments, etc. which increase commercial viability and responsibility of processing plants. These efforts should be leveraged and scaled to develop operations, bridge knowledge and capability gaps, and deepen mutual understanding as the basis for professionalisation, legitimisation and thus formalisation of ASGM value chains. They need to have a strong element of mining-specific technical



support and not just be treated as development projects. These initiatives could happen in conjunction with more peer-to-peer learning within the sector.

- **The role of federations.** Future research can explore the role business federations could play in achieving regulatory change and providing support to driver greater commercial viability and responsible business conduct for processing plants and their ASGM suppliers.
- **Other sectoral collaborations:** There could be an opportunity for more mentoring, sharing of best practice and development of relationships between value chain actors that are both supportive and commercial. This could include active management of relations between processing plants and LBMA GDL refineries - as happens between Dynacor and Precinox. There could also be a mentoring role for LSM actors who work to support responsible ASM entities and supply chains.

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7. Annex: Processing plant profiles

Processing plant H, Mongolia

Average grade of material	20-100g/t
Daily processing capacity	5t
Utilisation rate	N/A
Output of doré	100-200g per day (in 2020)
Purity of doré	86-96%
Gold recovery rate	N/A

Overview and legal status

The processing plant was established in 2008 through the SAM project of the SDC to offer mercury-free gold processing services to artisanal miners in nearby regions. It was the first full-circuit processing plant in Mongolia and its methods and model have been adopted by others across the country.

The plant now has one sole owner. There are no foreign investors.

At its peak, the company employed 60 workers. The plant is currently not operational because of a lack of ore supply. ASGM activity across Mongolia has declined, but there are signs that it will begin to pick up again starting this spring, depending on ASGM land permit approvals by the Ministry of Industry and Minerals which have been postponed across Mongolia for the past 2-3 years.

The plant also currently is not considered legal as there has been delay in obtaining the DEIA, due to high costs and delays on behalf of the Ministry of Environment. After completing its FS, the plant has struggled to obtain DEIA due to various regulatory challenges. However, since the FS has already expired after 5 years, the company is required to re-submit the FS as a new application. Currently, obtaining an ASGM land permit is critical for small-scale miners to operate processing plants. The plant is currently waiting for the customer miners to obtain their ASGM land permits. Once the land permit is secured, the process of acquiring other necessary approvals can proceed.

Supply Chain

Ore came predominantly from around 38km away. The furthest source is 1,500km away. Miners on average come between two and three times a month. 80% of them are permanent customers while 20% are ad hoc. At its peak, the processing plant sourced around 30% of its ore from legal miners (those with permits) and

70% from illegal miners. The owner of the processing plant visits mine sites once or twice a year to engage with suppliers and anticipate production levels.

The processing plant does not have any stakes in mines and simply provides a processing service. The processing plant lends money to miners to finance their mining activities, including equipment, fuel and transportation costs. This helps to attract miners to use the processing plant. The plant does typically not offer any technical assistance in combination with the financial support, but they only provide loans to trusted and regular miners and the processing plant owner visits mine sites once or twice a year to assess reserves and gold content.

The plant charges a processing fee of MNT 200,000/t (around USD 58) of ore. This both to clients it pre-financed and to the others. The plant purchases the gold from the miners by deducting these costs, meals and the loans provided. Payments are made directly after doré is produced. Prior to 2013, the plant used cash but has since switched to online bank transfers.

The processing plant has a special permit as a gold trader. The owner travels on average twice a week by car to Ulaanbaatar, to sell the gold to another trader based there. This trader sells it on to the Mongol Bank. The processing plant uses the intermediary who accumulates gold from various sources because quantities below 100g cannot be directly sold to Mongol Bank. According to the owner, gold traders also do not require as many formalities as the Mongol Bank would if the plant was to sell directly to them. He also stated that one of the biggest drawbacks of Mongol Bank is that they assay the gold purity in a special laboratory, which usually takes about 1-3 days.

Operations

The plant has a processing capacity of 2.5t of ore per day per mill. At its peak in 2018, the plant had eight mills in operation, but is now down to two, which means a total capacity of 5t a day. The other mills were sold to other processing plants. The daily throughput of doré was 100-200 grams in 2020. Gold purity varies depending on the source of the ore, with a range between 0.860 and 0.960. This is based on assays conducted by the cyanidation plant that purchases the processing plant's tailings.

Most of the ore comes from hard rock mining in the form of whole ore. The ore contains between 20-100 grams/t of recoverable gold. The processing plant owner assesses gold content based on his experience of the different ASGM sites, the colour and particle size of the ore. They also rely on miners' reports about the average recovery rate per sack or per tonne. Water-density methods further help to determine gold concentration.



Miners process the gold themselves at the processing plant, using the equipment available. The processing plant only uses gravitational methods and water, with no use of chemicals. It has a jaw crusher, two wet pan mills with a sluice box, one shaking table, a melting furnace, as well as water pumps, a wheelchair, mining cart and an electronic scale. The ore is initially broken down by a jaw crusher from 250 mm to 50 mm. The mill grinds the crushed ore into fine particles to liberate the gold. The overflow stream is directed over a rubber sluice box to separate light (gangue) and heavy fractions (heavy metals). After grinding in the wet pan mill, the concentrate accumulates at the bottom of the mill and the rubber sluice box. This concentrate is then processed with a shaking table, which produces concentrates, middling, and intermediate gravimetric tailing. The concentrate is sent to hand-panning to remove heavier or larger gangue materials, while the middling and tailing are accumulated in dedicated ponds. An LPG smelter is used to melt the final gold concentrate, allowing it to be cast into gold doré. The smelting process is carried out with borax to help reduce the melting point of the gold and remove impurities.

Tailings Management

The plant has a tailings pond. Once it reaches full capacity, the tailings are excavated and spread on a surface adjacent to the pond to dry. This is because processing plants typically have small tailings ponds that fill within 7 to 30 days. To prevent overflow, tailings are excavated before the pond reaches full capacity and transferred to a separate area. Drying the tailings in the designated storage area allows excess water to evaporate, reducing their weight and lowering transportation costs to the cyanide plant. While some facilities use concrete-lined tailings ponds, none employ geopolymer membranes because the tailings are chemicals-free, and the area is excavated weekly with an excavator, rendering membranes impractical.

The water that is precipitated from the tailing pond can be reused in the process, as the plant operates without chemicals. The processing plant then sells and delivers tailings with gold content to a cyanidation plant (Chinese investment), located 40 km from their facility. Due to the use of gravimetric technology, the plant loses some gold in the tailings. The plant owner transports the dry tailings to the cyanidation plant using small dump trucks (30t capacity) 2-3 times per year. The average gold content of tailing is 4-6g/t. As per their agreement, the cyanidation plant deducts costs for operations, ore moisture, gold purity, a recovery rate of 90%, income (40%), and income tax. In general, the tailing owner negotiates a 60/40% profit-sharing arrangement with the cyanidation plant.

Due diligence and Esg

In terms of traceability, the processing plant registers miners, along with the amount of ore and gold, each time they use the processing plant. The main purpose of this is to determine the gold's purity based on location. The relationships with miners are very much based on trust and longevity. The traders that purchase the gold do not ask about gold origin. The plant owner hopes the gold ends up with the Mongol Bank but cannot trace it beyond the trader. Some of it may end up being smuggled into China.

The plant is currently working on acquiring the DEIA, which will include a detailed assessment of environmental impact and mitigation measures. At the moment, they do not have environmental expertise on the team.

The plant is not following any specific ESG standards, nor do they seem to check responsible business practices when they visit mine sites.



Processing plant L, Peru

Average grade of material	Fluctuates
Daily processing capacity	250t
Utilisation rate	100%
Output of doré	N/A
Purity of doré	N/A
Gold recovery rate	91.5%

Overview and legal status

Processing plant L was founded in 2001. It grew together with the mining activity in the area. The plant is completely formalised and has an export license.

The plant is run as a closed joint stock company with two partners. There are no foreign shareholders or investors.

The plant is usually self-financed. They have had access to bank credits in the past.

As there are large numbers of processing plants in the region, there is competition about their efficiency and the market conditions they offer. This plant benefits from a good location and they aim to be transparent and to make timely payments to suppliers.

Supply Chain

The processing plant has no stakes in mine sites. It buys from mines which are mostly ASM mines that are formalised or in process of formalisation. In case of the latter the miners need to be registered on REINFO. The plant maintains a list of suppliers, most of which are regular.

The processing plant previously provided technical assistance to the miners. This is less and less needed as miners become more self-sufficient. Similarly they used to provide financial assistance, something they currently not do.

Previously, miners delivered all their material to the processing plant. Now they also have collectors which visit the mine sites. During the visits they additionally verify that mining is taking place in the declared areas.

Once the material arrives at the plant, it takes 3-5 days for miners to be paid. This is because material is often tested in an external laboratory.

Operations

The plant takes ownership of the ore upon receipt and sell doré.

Almost 200 people work at the plant in two shifts (morning and evening).

While the plant has its own laboratories, ore is often tested in an external laboratory as well before negotiations take place with the suppliers.

The plant has primary and secondary crushers, ball mills (of various sizes), stirrer tanks, and activated carbon absorption systems. They have two processes: CIP and flotation.

The doré in its entirety is transported to the processor and exporter, on a weekly basis. The gold is usually exported to Dubai or India.

Between the arrival of the ore at the plant and export, around 20 days pass.

Tailings Management

The processing plant currently does not reprocess tailings.

Due diligence and Esg

The processing plant verifies documentation from suppliers and checks mineral origin. The compliance officer regularly visits suppliers. They are concerned about the legality of mineral origin.

All transactions are done via bank transfer.

There are security concerns with regards to robbery. The plant has internal and external security services.

They have an occupational and environmental health and safety department and an environmental management plan.

The plant creates a lot of local employment and has invested heavily in social causes.



Processing plant N, Tanzania

Average grade of material	30g/t
Daily processing capacity	500t
Utilisation rate	89.3%
Output of doré	250g per day
Purity of doré	85-95%
Gold recovery rate	90%

Overview and legal status

The development of processing plant N was initiated in 2023, with production having started in November 2024.

The plant aimed to provide mercury-free, CIP processing services for ASGM miners in Tanzania. The business model evolved to create a vertically integrated, mercury-free supply chain. This because previous business models of merely operating as a broker or provider of a supply chain and traceability platform were not commercially viable.

The plant is legally registered and has an export license. It is owned by a limited company, which owned by a parent company with Tanzanian owners, as well as investment from a capital advisory firm and US-based investors.

Supply Chain

The plant has a stake in mines through two different systems. Sometimes it contracts with a license holder to open a new shaft in which case the plant receives 80% of the ore produced in return for mine development and operation services. Other times it contracts with a pit owner to take over and upgrade an existing shaft. In this case it receives 54-64% of the produced ore in return for mine development and operation services. The exact share of production depends on existing royalty obligations to stakeholders such as the license holder, landowner, mining cooperation and others. These joint venture mines are all located in close proximity (<5km) to the processing plant.

The plant also purchases ore from other verified ASGM miners and plans to purchase tailings from gravity or vat leaching local processing plants, in order to clean up the local environment.

The demand for its services is reportedly very high and the main limitation is not supply but rather the plant's current processing capacity. The plant is competitive because miners lack capital and expertise to build and operate their own processing facilities, because they offer quicker gold production and higher gold yields

(95% vs 60%) compared with vat leaching providers. The latter are further only available for rent and require miners to pay cash up front for the services.

The plant currently does not provide pre-financing to miners. Through its platform, however, it will record suppliers' production and mineralisation data, helping determine miner/project credit worthiness to curate investment opportunities to banking partners.

The plant takes custody of ore at either the mine site or at the processing site, depending on miner preference. A related company later takes custody of doré produced at the plant site – it is part government owned and offers sellers a 2% royalty discount in an effort to capture the supply and increase local gold reserves. The refinery is based locally. The plant is currently developing a sales channel to a LBMA refiner in Switzerland. Only ore originated gold will be sold through this channel. The plant will sell its tailings originated materials to the related company once the LBMA channel is operational.

Operations

In January 2025, the plant began expanding its processing capacity to 500t per day, with plans to expand further to 1000t per day by the end of 2025.

In its current royalty-based system, the plant retains custody of all client ore materials, with ASGM miners receiving 50% of Net Smelter Return as payment. They are transitioning to an ore purchasing model wherein the plant pays miners 35% of the contained gold value as determined by metallurgical testing. In the current royalty structure, payments are made to the supplier upon sale of gold. In the new ore-purchase model, payments are made to miners after the initial site visit and at time of ore-pickup or drop-off via digital means (Mobile Money or banking). The shift away from cash payments aims to minimise overhead from Financial Intelligence Unit (FIU) reporting requirements and to mitigate financial crime risks like money laundering, illicit gold trade, and tax evasion.

The plant has a full metallurgical lab at the processing plant. They are using a water purity scale which has been verified by the Government Weights and Measures Agency (WMA). The range of the grade is 1.5g/t to 20g/t and the average grade is 3g/t.

The plant has the following equipment on site: a wheel loader, dump trucks and a feeder, and equipment for crushing, screening, grinding, leaching and elution. The primary crusher feeds into a secondary crusher, with a double-deck vibrating screen in between. Crushed materials are stockpiled before moving to the fine ore bin via conveyors. Material from the fine ore bin is transported to a ball mill using another conveyor. Grinding media include water and steel balls; the resultant slurry is pumped to a cyclone for



separation. Desired materials proceed to Carbon-in-Leach (CIL) tanks for cyanidation. The slurry flows through the tanks by gravity, proceeding to a trommel screen and then to the Tailings Storage Facility (TSF).

Tailings Management

The plant produces in the region of 200 cubic meters of tailings per day. Tailings are not re-used and are simply monitored for minimal gold content. The plant has an industrial TSF and a water treatment system in place. They further have an environmental risk management expert.

Due diligence and Esg

The plant is in the process of installing an inner security fence with secure search and seizure checkpoints to secure the processing and elution area. This to protect themselves against scavenging by ASGM miners who pick low grade rocks from surrounding roads.

Before doing a transaction with miners, the plant evaluates the suppliers' mining practices, legality and environmental and safety conditions. They verify the validity of permits. The plant is revamping its sourcing procedures to align with LBMA. They will do bi-monthly monitoring of vendors; and continuous monitoring for partner mines managed by the plant. This is to ensure compliance with labour, safety, and environmental standards, compliance with tax and royalty requirements, and to verify production levels against reported figures. Monitoring also includes occasional surprise audits. The plant documents ore origins and movements, using standardised forms and GPS tagging. Using a field survey tool, field geologists record information about shaft format, equipment, production levels and ore characteristics to ensure the ore really originates from shaft in question. Mwamba currently uses the fulcrum field survey platform to record and consolidate key KYC and mine information in a list/spatial map view. By the end of Q1 2025, the plant plans to implement its supply chain traceability solution for vendor and partner mines. The tool will automate provenance and KYC tracking and due diligence for ore sourced and gold produced.

The plant has a full-time safety and environmental officer with experience in the role at other processing facilities. It further follows the Responsible Cyanide Code. Mwamba Mining is in the process of defining environmental and safety procedures at partner ASGM mines beyond what is required to maintain PML licenses. The company has made reforestation commitments and commitments to close legacy pits. In terms of social impact, it has an apprenticeship programme training young adults in technical and professional skills. The workforce is largely from the local area. It reinvests 1% of revenues into community projects, with additional voluntary contributions, with a focus on education and healthcare.



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