



THE
IMPACT
FACILITY

WHITE PAPER

AFRICA'S ENERGY TRANSITION MINERALS AND ARTISANAL AND SMALL-SCALE MINING (ASM)

OCTOBER 2026
R: 26-09-E

AUTHORS: David Sturmes-Verbeek and Gustav Dahlqvist, The Impact Facility

ACKNOWLEDGMENTS

The authors wish to express their gratitude to experts at Levin Sources, the European Partnership for Responsible Minerals, and NRDC for their thoughtful review and advice on this white paper. The authors also wish to thank the QCF, an independent charitable foundation, for its support for this research.

About NRDC

Established in 1970, NRDC (the Natural Resources Defense Council) works to safeguard the earth, its people, its plants and animals, and the natural systems on which all life depends. Our team of more than 800 lawyers, policy experts, scientists, economists, and communications specialists work across the United States and around the world, from offices in Washington D.C., New York City, Chicago, San Francisco, and Santa Monica, as well as a representative office in Beijing and affiliate offices in New Delhi (through NRDC's wholly owned for-profit subsidiary, NRDC India Private Limited) and London (through NRDC International). Visit us at www.nrdc.org and follow us on Instagram @nrdc_org.

NRDC Senior Policy Publications Editor: Leah Stecher

NRDC Director of Peer Review, Science Office: Laurie Geller

Cover image: © David Sturmes

Design and Production: www.suerossi.com

© Natural Resources Defense Council 2026

TABLE OF CONTENTS

List of Abbreviations	4	5.2. Regional and International Bodies	25
Executive Summary	6	5.3. Financial Institutions (FIs)	25
1. Introduction	7	5.3.1 Filling the Financing Gap—Zooming in on Financial Instruments.....	26
1.1 Context and Scope	7	5.4. Supply Chain Actors	26
1.2 Defining Criticality.....	7	5.5. Certification and Industry Platforms.....	26
1.2.1 Criticality as Risk	7	5.6. Civil Society and Watchdog Organizations (African-Led).....	26
1.2.2 Conflict Minerals	8	5.7. International Multi-Stakeholder Platforms.....	27
1.2.3 Alternative Framings to “Criticality”	8	5.7.1 Transferable Lessons from planetGOLD for ASM-ETM Governance	27
1.3 Defining Artisanal and Small-Scale Mining.....	8	5.8. Event-Based Dialogue Platforms	28
1.3.1 ASM Characteristics.....	8	6. Conclusion	28
1.3.2 Levels of Formalization	9	Further Reading	30
1.3.3 ASM as an Energy Transition Mineral Supplier	10	Appendix A—CRM/CM/SM/GM List	31
2. ASM and Energy Transition Minerals	11	Appendix B—Country Profiles	34
2.1. Factors Driving ASM-ETM	11	Country Profile 1: Burundi	35
2.2. Energy Transition Minerals Mined via ASM	12	Country Profile 2: DR Congo	37
2.3. Geographical Clusters	16	Country Profile 3: Madagascar	39
3. Cross-Cutting Challenges	19	Country Profile 4: Morocco	41
3.1. Informality and Legal Ambiguity	19	Country Profile 5: Mozambique	43
3.2. Ecological Harm.....	20	Country Profile 6: Namibia	45
3.3. Labor Conditions and Community Health Impacts	21	Country Profile 7: Nigeria	47
3.3.1. Child and Forced Labor	21	Country Profile 8: Rwanda	49
3.3.2. Gender.....	21	Country Profile 9: Uganda	51
3.4. Illicit Trade and Corruption Challenges	21	Country Profile 10: Zimbabwe	53
3.5. ASM/LSM Dynamics.....	22	Bibliography	55
4. International and Intergovernmental Partnerships	23		
4.1. Africa-Led Strategies and Continental Frameworks	23		
4.2. Intercontinental Agreements.....	23		
4.3. The United Nations	24		
5. High-Level Overview of Key Stakeholders	25		
5.1. Government Actors	25		

LIST OF ABBREVIATIONS

3T	Tin, Tantalum, Tungsten	ECCAS	Economic Community of Central African States
3TGT	Tin, Tantalum, Tungsten and Gold	ECOWAS	Economic Community of West African States
ACP	African, Caribbean and Pacific Group of States	EGC	Entreprise Générale du Cobalt
AfCFTA	African Continental Free Trade Area	EGP	Environmental Governance Programme
AfDB	African Development Bank	ENACT	Enhancing Africa's Response to Transnational Organized Crime
AMCAP-IV	ASEAN Minerals Cooperation Action Plan IV	EPA	Environmental Protection Agency
AMDC	African Minerals Development Centre	EPRM	European Partnership for Responsible Minerals
AMI	Alternative Mining Indaba	ESG	Environmental, Social, and Governance
AMV	Africa Mining Vision	ESS	Environmental Scoping Study
ARM	Alliance for Responsible Mining	EU	European Union
ASEAN	Association of Southeast Asian Nations	ETM	Energy Transition Mineral
ASGM	Artisanal and Small-Scale Gold Mining	FCA	Fair Cobalt Alliance
ASM	Artisanal and Small-Scale Mining	FI	Financial Institution
AU	African Union	G7	Group of Seven
BCMM	Bureau du Cadastre Minier de Madagascar	GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
C4D	Cobalt for Development	GLR	Great Lakes Region
CADETAF	Zone Centrale d'Achat et de Développement de la Région Minière du Tafi-lalet et de Fiquig	GM	Green Mineral
CDC	Centers for Disease Control and Prevention	HREE	Heavy Rare Earth Element
CM	Critical Mineral	ICGLR	International Conference on the Great Lakes Region
CRAFT	Code of Risk-mitigation for ASM engaging in Formal Trade	IEA	International Energy Agency
CRM	Critical Raw Material	IFC	International Finance Corporation
DFC	U.S. International Development Finance Corporation	IGF	Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development
DFI	Development Finance Institution	IIED	International Institute for Environment and Development
DR Congo	Democratic Republic of the Congo	IISD	International Institute for Sustainable Development
EAC	East African Community	ILO	International Labour Organization
ECC	Environmental Clearance Certificate	IPEC+	International Programme on the Elimination of Child Labour and Forced Labour

INAMI	Instituto Nacional de Minas	SMMRP	Sustainable Management of Mineral Resources Project
IPIS	International Peace Information Service	SSA	Sub-Saharan Africa
ITSCI	International Tin Supply Chain Initiative	SSM	Small-Scale Mining
KfW	Kreditanstalt für Wiederaufbau	TIF	The Impact Facility
LBMA	London Bullion Market Association	UN	United Nations
LREE	Light Rare Earth Element	UNCTAD	United Nations Conference for Trade and Development
LSM	Large-Scale Mining	UNEP	United Nations Environment Programme
M23	March 23 Movement / Mouvement du 23 mars	UNDP	United Nations Development Programme
MACUA	Mining Affected Communities United in Action	UNECA	United Nations Economic Commission for Africa
MME	Ministry of Mines and Energy	UNICRI	United Nations Interregional Crime and Justice Research Institute
MoU	Memorandum of Understanding	USDOL	U.S. Department of Labor
MSP	Mineral Security Partnership	USGS	United States Geological Survey
NGO	Non-governmental organization	WiM	Women in Mining
OECD	Organisation for Economic Co-operation and Development	WTO	World Trade Organization
PARC	Pan-African Resource Reporting Code	WWF	World Wide Fund for Nature
PGM	Platinum Group Metal	ZEA	Zone d'Exploitation Artisanale
PPA	Public-Private Alliance for Responsible Minerals Trade	ZELA	Zimbabwe Environmental Law Association
PPE	Personal Protective Equipment	ZMF	Zimbabwe Miners Federation
REE	Rare Earth Element		
RMAP	Responsible Minerals Assurance Process		
RMB	Rwanda Mining Board		
RMI	Responsible Minerals Initiative		
SADC	Southern African Development Community		
SARWatch	Southern Africa Resource Watch		
SEC	U.S. Securities and Exchange Commission		
SM	Strategic Mineral		
SME	Small and Medium-Sized Enterprise		

EXECUTIVE SUMMARY

The global energy transition from fossil fuel dependence to renewable energy and electrified, decarbonized economies is driving rapid growth in demand for energy transition minerals (ETMs), and Africa is set to play a central role in meeting that demand. At the same time, artisanal and small-scale mining (ASM) remains one of the continent's most important livelihood sectors. In sub-Saharan Africa alone, more than 10 million people are directly involved in ASM, with at least a further 60 million estimated to rely indirectly on the sector. As demand for ETMs expands, ASM is likely to become increasingly significant in the extraction and trade of cobalt, copper, lithium, tin, tantalum, tungsten, and other minerals.

This white paper examines how the rise of ETMs is reshaping ASM across Africa. It shows that ASM should be treated not only as a governance challenge or reputational risk, but as a major socioeconomic reality that will influence how inclusive, just, and sustainable Africa's mineral future becomes. Across the continent, ASM is already deeply embedded in local labor markets and rural economies and in some contexts is directly linked to mineral supply chains of growing global importance.

This paper also highlights that mineral “criticality” is not fixed or neutral. What counts as an energy transition or critical mineral depends on who defines it, for what purpose, and in whose interests. African governments often frame strategic minerals in relation to national development, industrialization, mineral processing for value addition, and public revenues, while external actors tend to prioritize supply security and clean energy technologies. These differences matter because they shape investment priorities, governance responses, and the extent to which ASM is included in or excluded from formal mineral strategies.

ETM-related ASM is emerging unevenly across the continent. The African Great Lakes Region remains central for the so-called 3T minerals (tin, tantalum, and tungsten) and conflict-linked trade dynamics; the Central African Copperbelt is especially important for cobalt and copper. Southern Africa is increasingly relevant for lithium, graphite, chromium, and associated minerals; and West Africa, while still dominated by gold ASM, may become more relevant to ETM supply chains over time, particularly in countries such as Nigeria, Ghana, and Mali. These regional differences shape the specific governance, environmental, and market challenges facing the sector.

This paper identifies several persistent cross-cutting challenges. Informality and legal ambiguity remain foundational, limiting access to land, finance, state

support, and formal markets. Environmental risks, including deforestation, water contamination, tailings mismanagement, and acid mine drainage, are significant but still under-documented in many ETM contexts. Labor conditions are often hazardous, and child labor, forced labor, and community health impacts remain serious concerns in a number of settings. ASM is also deeply gendered. Women make up a substantial share of the workforce but are often concentrated in less secure and less visible roles, with weaker access to assets, finance, and decision-making.

A central finding is that formalization is necessary but not sufficient. Where formalization practices are accessible, adapted to ASM realities, and linked to practical support, it can improve regulation, livelihoods, environmental performance, and market access. Where these practices are overly bureaucratic, punitive, or modeled too closely on large-scale mining (LSM), formalization can deepen exclusion and fail to gain traction. More effective approaches combine legal recognition with access to finance, geological information, extension services, appropriate technology, and workable market channels. This paper also shows that illicit trade, corruption, and contested ASM-LSM relations continue to complicate more-inclusive mineral governance.

Ultimately, this paper shows that a just and durable ETM transition in Africa will depend on whether ASM is meaningfully incorporated into governance, finance, environmental management, and market design. Existing initiatives such as planetGOLD (used for ASM gold mining) suggest that progress is most likely to occur where international coordination, locally adapted technology, socioeconomic incentives, and practical support to miners are combined. The key challenge ahead is not simply to make ETM supply chains cleaner, but to ensure that the people and communities already extracting these minerals are not excluded from the benefits of the energy transition itself.

I. INTRODUCTION

I.1 CONTEXT AND SCOPE

The global demand for “critical” minerals (CMs) is forecast to surge remarkably in the coming years. Over the past two decades alone, the global trade value in energy-related commodities has increased sevenfold (Snoussi-Mimouni and Avérous, 2024). The International Energy Agency (IEA) estimates that mineral demand for clean energy technologies will double, or even quadruple, by 2040 (IEA, 2021;2024). As a major source region of CMs, such as cobalt, copper, and platinum group metals (PGMs), many African countries are poised to become central players in enabling the global energy transition. This increase in global CM demand is acting as a catalyst for the growth of the artisanal and small-scale mining (ASM) sector. In sub-Saharan Africa alone, more than 10 million individuals are involved in the ASM sector, with at least an additional estimated 60 million people reliant on the sector indirectly for their livelihoods (World Bank and Pact, 2019).

This white paper focuses on the minerals needed for the clean energy transition and will refer to these minerals as energy transition minerals (ETMs). It provides an overview of the production parameters, legal regimes, and environmental impacts of ETMs currently being recovered (and likely to increase in the future) by ASM operators in Africa. It identifies countries and regions on the continent where we can expect to see a rise in the extraction of ETMs through ASM as demand grows. Finally, this paper identifies some of the many international and African bodies, frameworks, state and non-state actors, and others who have a role to play in ensuring that mineral extraction for the energy transition provides equitable economic opportunities for ASM communities while minimizing environmental and social harm.

While this paper uses “energy transition minerals” as its primary term, parts of the analysis draw on broader “critical minerals” framings where these are more established in policy and literature. The scope therefore includes minerals relevant to energy transition supply chains in Africa while acknowledging that the boundaries of these categories are neither fixed nor universally shared.

The paper’s core aim is to place African ASM more centrally within ETM governance discussions, not only as a source of social and environmental risk but as a major livelihood system and an increasingly relevant component of mineral supply chains.

I.2 DEFINING CRITICALITY

The selection/designation of critical minerals has emerged as a strategic response to the material demands driven by the clean energy transition, the build-out of data centers and other digital infrastructure, and the need to ensure supply chain resilience in national defense sectors. Definitions vary, though they generally refer to raw materials that are vital to economic, defense, and technological functions and are subject to scarcity or bottlenecks in supply due to processing capacity or the extreme geographic concentration of active production and known reserves. Hayes and McCullough (2018), for example, define “western” critical minerals as “the valuable constituent element of a mineral commodity that is subject to risk of supply disruption and which serves a purpose deemed as important based on the evaluators’ perspective”—a definition that highlights “criticality” to be inherently dynamic, subjective, and above all geopolitical (see Laing and Pinto, 2023).

I.2.1 CRITICALITY AS RISK

Focusing on supply chain risks, the European Union¹ and the United States² are among the countries that have published their own lists of critical raw materials (CRM, in EU terminology) or critical minerals (CM, in US terminology), many of which are heavily sourced from (or have reserves located in) African countries. China renewed its own strategic minerals list in 2023 (the previous one was released in 2016).

Countries such as Australia and the United Kingdom have also developed CM lists, although these are not considered in this paper. For consistency purposes, the paper will focus on CMs that are found primarily on the EU/US lists, filtered according to ASM prevalence and relevance to the African context.

1 The European Union first published its CRM list in 2011, naming 14 raw materials. The latest version, listing 34 raw materials, was adopted in 2023 as part of the Critical Raw Materials Act. The EU keeps a separate sub-list, “Strategic Minerals,” relevant only to energy transition minerals.

2 The IGF definition, widely referenced, is: “Artisanal and small-scale mining (ASM) refers to mining conducted by individuals, groups, families, or cooperatives with minimal or no mechanization, often in the informal sector of the market.” (Hentschel et al., 2002).

Finn et al. (2024) note that the criticality discourse that derives from and underpins these lists also securitizes supply chains. With the objective to secure a consistent and accessible flow of these minerals, minimizing risk has become a defining element. This often involves excluding informal producers, such as ASM operators, who still function predominantly informally. This framing has been heavily criticized, as it restricts African countries to suppliers of raw materials for the green energy transition of the Global North, while only about half of the African continent’s population has access to basic energy needs (World Bank, 2024a). This structural contradiction has been referred to as the “decarbonization divide”—where value is exported while risk remains localized, perpetuating historical patterns of natural resource exploitation (see, e.g., Sovacool et al., 2020; Zongwe and Musikavanhu, 2023).

1.2.2 CONFLICT MINERALS

Tin, tantalum, tungsten, and gold (3TG) are commonly referred to as “conflict minerals” when sourced from conflict-affected or high-risk areas where their extraction or trade may contribute directly or indirectly to armed conflict or serious human rights abuses (OECD, 2016; European Commission, 2025). Regulatory frameworks such as Section 1502 of the US Dodd–Frank Act and the EU Conflict Minerals Regulation have increased due diligence and disclosure requirements for companies sourcing 3TG (European Commission, 2025). Section 1502 was specifically developed in response to concerns over 3TG originating from the Democratic Republic of the Congo (DR Congo) and adjoining countries (SEC, 2012), but the EU Conflict Minerals Regulation is global in scope and applies to 3TG sourced from conflict-affected and high-risk areas worldwide (European Commission, 2025). Much of the 3TG produced in eastern DR Congo and the Great Lakes Region originates in ASM. While these regulations aim to break the links between minerals and armed conflict, their effect has been to dismiss ASM entirely, pushing trade underground, harming livelihoods, and leaving many inherent problems unresolved (European Commission, 2024). Since 3TG are also considered critical minerals, a tension arises as demand for these minerals increases, while supply chains remain fragile and exclusionary (ibid.).

1.2.3 ALTERNATIVE FRAMINGS TO “CRITICALITY”

Many questions are rightfully raised regarding for whom the minerals are deemed critical and for what purpose. The African Union (AU), through the African Minerals Development Centre (AMDC), has not defined “criticality” and has instead focused on categorizing “green minerals” (GMs), a grouping grounded in Africa’s development and energy needs rather than in global supply and national security risk (central to the EU/US/Chinese listings), in line with the Africa Mining Vision (AMV) of 2009.

Many African countries have similarly identified mineral lists deemed strategic to their national interests. DR Congo defined cobalt, germanium, and coltan as strategic to their national economic development and sequentially raised royalty taxes on cobalt from 2 percent to 10 percent (IEA, 2018). Zambia has identified copper, cobalt, emeralds, and, interestingly, gold and diamonds (among others) as strategic (Ministry of Mines and Minerals Development, 2024). Zimbabwe designated lithium as a strategic resource, banning the export of non-processed lithium in 2020 (Reuters, 2022). Nigeria also recently defined its strategic minerals, including coal, iron ore, gold, lead-zinc, and barite (with additional interest in tungsten, lithium, and cobalt, among others) (IEA, 2020). The commonality in these definitions of “strategic” is economic value: a prioritizing of minerals that generate essential tax revenue and have the potential to stimulate economic growth through in-country value addition (IGF, 2024). A complete mapping of the four lists of CRMs, CMs, and GMs is found in Appendix A.

1.3 DEFINING ARTISANAL AND SMALL-SCALE MINING

1.3.1 ASM CHARACTERISTICS

There is no uniform definition of artisanal and small-scale mining. As a general concept, it encompasses a highly diverse range of mining activities worldwide. In practice, ASM is usually defined at the national level through a combination of qualitative characteristics and regulatory parameters. These commonly include the degree of mechanization and technology use, level of capitalization, scale of production, modes of organization and labor, and, in some cases, the legal or licensing framework within which operations take place. Most national definitions distinguish between “artisanal” and “small-scale” mining on the basis of such characteristics, although the terms are often used interchangeably in media and academic literature. Quantitative thresholds may also be applied, but these vary significantly across countries. Table 1 summarizes the qualitative characteristics commonly used to differentiate between artisanal and small-scale mining.

The distinction between artisanal and small-scale mining is rarely absolute. In practice, the two often exist on a spectrum, and the characteristics below should be understood as indicative tendencies rather than fixed categories.

TABLE 1: CHARACTERISTICS OF ARTISANAL MINING AND SMALL-SCALE MINING

	Artisanal Mining	Small-Scale Mining
Technology and mechanization	Primarily manual or done with rudimentary tools; limited mechanization may be present	Greater use of mechanized or semi-mechanized equipment; more systematic application of technology
Capitalization	Typically low-capital and resource-constrained, with limited access to finance and equipment	Generally more capitalized, with greater ability to mobilize equipment, finance, and working capital
Production scale	Low-volume production, often irregular and shaped by immediate livelihood needs	Higher and more consistent production volumes, with more planned extraction and processing
Legal and regulatory status	Frequently operates outside formal legal or licensing frameworks, though not inherently illegal	More likely to hold permits, licenses, or some formal legal recognition, although informality may still persist
Organization	Often organized around individuals, households, kinship groups, or informal teams	More structured and coordinated operations, including cooperatives, SMEs, or other business entities
Labor model	Often relies on self-employed labor, family labor, and/or informal hired labor	More likely to involve hired labor within a structured production system and clearer division of roles
Governance and management	Limited managerial systems, recordkeeping, and formal risk controls	More developed managerial structures, operational planning, and capacity to manage risk and compliance
Commercial orientation	Often strongly livelihood or survival oriented, with value capture frequently shaped by external actors in finance and trade	More explicitly profit oriented, with production organized as an enterprise and value maximization as a core objective
Typical operating logic	Production often embedded in household survival, self-employment, and informal local economies	Production organized more as a business operation, with more corporate forms and stronger alignment with commercial growth

In practice, many mining sites fall along a fluid spectrum, organically evolving from artisanal to small-scale, which can complicate progress amid rigid permitting systems that draw hard lines between the two (Brown and Kimani, 2017). Some countries, such as Namibia, have explicitly chosen to award licenses not to artisanal miners but only to small-scale miners (SSMs), with the intention of promoting a more established sector (AfricaMaVal, 2023). Other countries, like Rwanda and the DRC, explicitly outline an ambition to transition from artisanal to small-scale (ibid.). What is often missing in the above examples, however, are adequate extension services working to support the professionalization of artisanal miners to *become* small-scale.³

1.3.2 LEVELS OF FORMALIZATION

As mentioned above, the level of ASM formalization across African countries can be understood as a spectrum rather than a binary divide. Drawing on the OECD (2016) *Due Diligence Guidance's* emphasis on legality, good-faith efforts toward compliance, and engagement in formalization processes, this paper groups national ASM frameworks into three broad categories for analytical purposes.

a. Enabling and regulated

In these contexts, ASM is legally recognized and supported through relatively accessible licensing procedures, designated mining areas, and policy measures aimed at gradual formalization and integration into the mining sector. Tanzania is often cited as a comparatively enabling case, combining regulatory oversight with measures to improve ASM access and recognition.

³ *Professionalization* in the ASM context refers to the transition from informal, subsistence-based activities to regulated, skilled, and economically viable mining practices, often involving training, legal recognition, and improved technical capacity.

b. Recognized but weakly implemented

In these contexts, ASM is recognized in law or policy, but implementation remains inconsistent. Licensing may be bureaucratically difficult, costly, or poorly adapted to ASM realities, while enforcement is uneven and support for formalization limited. As a result, many miners operate in a gray zone between legal recognition and practical exclusion. Countries such as DR Congo and Guinea illustrate this category.

c. Restrictive or exclusionary

In these contexts, legal and regulatory frameworks provide limited space for ASM to operate formally, whether because artisanal mining is not adequately recognized, licensing pathways are inaccessible in practice, or enforcement is predominantly punitive. This can result in widespread criminalization or eviction of miners despite the sector's continued existence. South Africa is often cited as an example of a highly restrictive environment for ASM.

This clustering does not imply that all ASM within a given country falls neatly into one category; rather, it reflects the overall orientation and practical functioning of national frameworks.

Formalization can serve as an effective solution when it is implemented thoughtfully, contextually, and inclusively—and when it is understood not as the end, but as the means by which ASM can be supported to become more professional and thus better at controlling risk and delivering sustainable development for local communities. Successful formalization frameworks typically incorporate flexible licensing processes, gradual compliance pathways, and practical regulatory requirements aligned with ASM miners' operational realities. When formalization is coupled with robust support services, such as access to affordable finance, geological information, technology transfer, and clear market linkages, it significantly enhances ASM operators' economic viability and environmental performance, and thus their contribution to sustainable development. Notably, countries such as Tanzania, Namibia, and Rwanda exemplify how well-designed formalization can lead to improved governance, increased tax revenues, reduced illicit trade, and substantial socioeconomic benefits for local mining communities. In contrast, formalization efforts may fail or even exacerbate existing problems when they impose overly rigid, complex, or unrealistic regulations derived from large-scale mining practices, neglect the structural barriers ASM operators face (e.g., access to land and finance), or inadvertently facilitate elite capture and exclusion (read more about this in section 3.1 under “Cross-Cutting Challenges”).

The classification above will be indicated under each country profile presented in Appendix B.

I.3.3 ASM AS AN ENERGY TRANSITION MINERAL SUPPLIER

The role of ASM in ETM supply is expected to increase as demand expands, presenting several opportunities. These include rapid responsiveness (i.e., quick reactions to market demands), significant livelihood opportunities (higher incomes and the creation of embedded linkages with other local industries), and broad supply chain flexibility (see Paschal et al., 2024). However, the ASM sector also faces several challenges. These include, but are not limited to, its reputation as a risky enterprise; regulatory contradictions that fail, for example, to distinguish between artisanal subsistence mining and more organized small-scale operations; exorbitant licensing costs and complex taxation systems; and a series of environmental and health risks as a consequence of the above (see Arthur-Holmes and Ofosu., 2024). Some of these challenges are inherent to the sector, while others relate more to how the sector is viewed and dealt with by others.

2. ASM AND ENERGY TRANSITION MINERALS

Africa is home to about 30 percent of the world's known ETM reserves, the highest concentration of ETMs by continent globally (UNECA, 2024). Approximately 80–90 percent of workers (representing around 10 million women and men) in the African mining sector operate in the artisanal or small-scale sector (Wakiaga and Gankhuyag, 2024). Given the sheer size of the current and anticipated future workforce, this means that the potential for local value gain and socioeconomic development from mining activities is very promising.⁴ Whereas gold represents the largest subsector (i.e., involving the most people engaged in ASM) in sub-Saharan Africa (SSA), global demand for ETMs is expected to steadily grow; thus, the extraction of ETMs on the continent is expected to intensify. Current estimates suggest that approximately 60 percent of the workforce is involved in gold mining, with all other minerals accounting for the remainder (ASM Inventory, 2022).

This section examines key driving factors behind ASM, identifies regional ETM hot spots, and discusses cross-cutting issues affecting commodities and countries. See Appendix B for specific country profiles across 10 selected African nations.

2.1. FACTORS DRIVING ASM-ETM

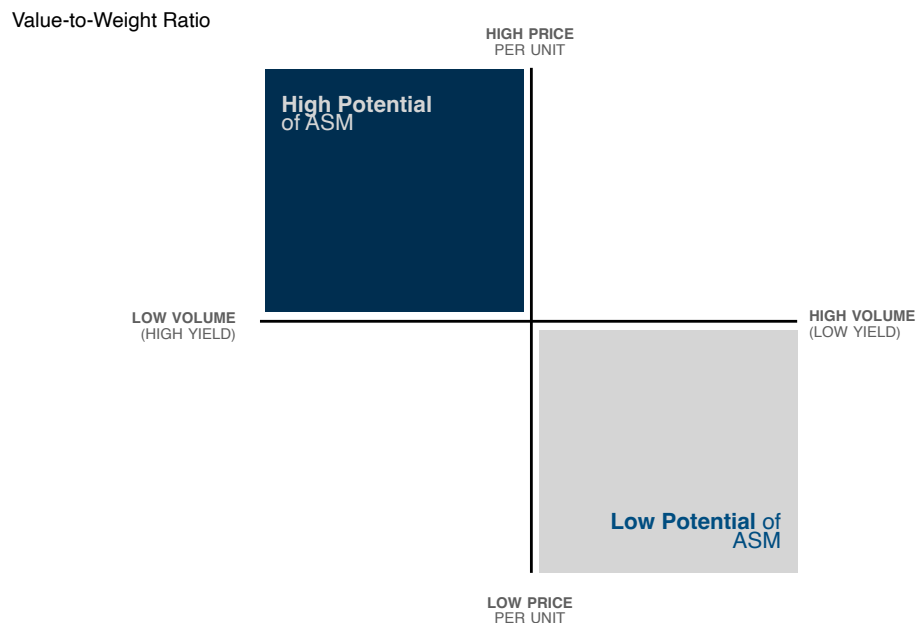
Not all minerals (critical or noncritical) lend themselves to extraction through ASM; the likelihood of ASM is contingent on a confluence of factors.

- **Geological Characteristics/Accessibility:** This reflects the compatibility between the physical accessibility of minerals and the artisanal methods used. Near-surface, weathered, and/or oxidized mineral ores are often mined via ASM. The ore type and distribution equally influence suitability of ASM. Tin, tantalum, and tungsten (3T) are usually alluvial. Cobalt, lithium, and graphite, in contrast, are hard-rock but appear in certain surface-level veins and pegmatites, making them easier to access (see AfricaMaVal, 2023).

- *Weathered ore* refers to ore deposits with altered or decomposed structure, physical properties, or mineralogy due to exposure to the elements. It is often easier to mine since the host rock is broken down, minerals are more concentrated, and it typically occurs near the surface. Weathering from air, rain, and heat transforms hard rock into softer material. It often leads to the formation of oxidized and alluvial deposits, making weathered ore closely linked to these other types.
- *Oxidized ore* is a mineral deposit where metallic ores have undergone a chemical reaction with oxygen and water, often as a result of weathering, and also near the surface. Because it is usually found within weathered zones, oxidized ore is often easier to access and process.
- *Alluvial mining* is the extraction of minerals from loose sediments like sand or gravel. These deposits are mined via placer methods and are the most cost effective, requiring little machinery or skilled labor. Alluvial deposits form through erosion and transport of minerals from weathered or oxidized sources into riverbeds. They are directly linked to those surface processes.
- *Hard rock* refers to solid, consolidated rock formations that host minerals within veins, lodes, or seams. These deposits often require drilling, blasting, and crushing to extract ore, making them more technically demanding and capital intensive. When hard rock is weathered or oxidized, it becomes softer and easier to mine (and is closer to the surface), even for ASM using manual tools. Unlike alluvial deposits, which are already loose, unweathered hard rock usually remains inaccessible to ASM due to cost and technical demands.
- *Pegmatites* are coarse-grained igneous (volcanic) rocks with variable mineralogy and are major sources of lithium, tantalum, tin, REEs, uranium, and gemstones. Nigeria, for example, hosts pegmatite belts mined by ASM for lithium. Formed deep underground, pegmatites can later be weathered, feeding minerals into oxidized or even alluvial deposits, thereby acting as a primary source for more-accessible secondary deposits.

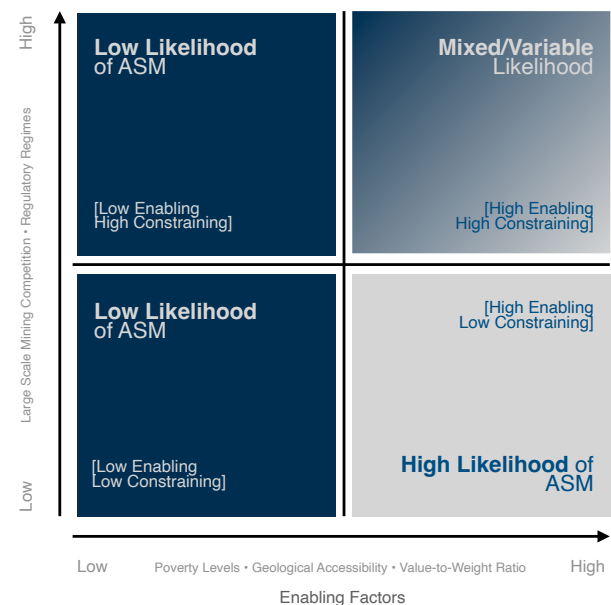
⁴ Studies demonstrate that ASM generates a community multiplier effect within local economies. This refers to the broader economic impact that mining income generates beyond the miners themselves. Each dollar earned by an ASM worker typically supports multiple non-mining livelihoods through spending on goods, services, transport, food, housing, or education, creating a ripple effect across the local economy. Studies estimate that for every ASM job, around 4 to 10 additional livelihoods may be indirectly sustained within the community (World Bank and Pact, 2019).

FIGURE 1: THE RELATIONSHIP BETWEEN THE VALUE PER UNIT OF A MINERAL (ITS PROFITABILITY) AND ITS VOLUME—AND THEREFORE HOW LIKELY IT IS TO BE MINED VIA ASM



- **Value-to-Weight Ratio:** Minerals more accommodating to ASM tend to have a higher value per unit, making the practice economically viable (which is why gold is the main ASM-mined mineral globally, followed by gemstones), illustrated in figure 1. Cobalt, copper, and 3T, for example, all fetch relatively high prices per unit, generating immediate income even with low volumes. This is confirmed by the increase in ASM activity, for example, in lithium and graphite in countries such as Zimbabwe, Madagascar, and Mozambique, which have seen a surge in demand and prices, making both raw and semi-processed lithium viable for sale (see IISD/IGF, 2024).
- **Other Key Factors:** ASM tends to be most extensive in countries where there are legal vacuums and/or policy tolerance for informal ASM, such as REE mining in Madagascar or lithium and tantalum (among other things) extraction in Nigeria. Similarly, where there's a lack of industrial competition, ASM tends to fill the gap. In contrast, where land use regulations and environmental safeguards are stringent and enforced, ASM tends to be minimal.

FIGURE 2: ILLUSTRATION OF THE LIKELIHOOD OF MINERALS BEING SOURCED VIA ARTISANAL OR SMALL-SCALE MINING DUE TO EXTERNAL FACTORS



Source: Authors

Socioeconomic conditions also matter—there is a strong correlation between high levels of rural poverty and ASM (especially in countries where there is legal ambiguity). The above is illustrated in figure 2. For example, there is clear evidence that agricultural poverty is a key driver of livelihood diversification strategies across African countries (Hilson and McQuilken, 2014).

2.2. ENERGY TRANSITION MINERALS MINED VIA ASM

The Intergovernmental Forum on Mining, Metals, Minerals and Sustainable Development (IGF) created a list of ETMs (based on the EU/US lists, attached in Appendix A) that are particularly prone to ASM (corresponding to the above driving factors). We have modified IGF's data (see figure 3) according to the prevalence of these minerals in an African context. Figure 4 describes the typical environmental risks associated with mining of these minerals.

FIGURE 3: COMMODITIES, COUNTRIES AND ASM PREVALENCE

Commodities, Countries & ASM Prevalence

Adapted from the IGF List, Africa Focused

The figure below illustrates the main CMs produced across Africa, highlighting the top two African producers for each commodity and the extent of ASM involvement. Adapted from the IGF list with a focus on the African continent, it offers a snapshot of production dominance and ASM prevalence by mineral. Notably, many of the CMs listed—such as cobalt, tantalum, tin, and lithium—are mined by ASM either as primary minerals or as by-products (coproducts). The DR Congo features prominently across multiple minerals, particularly cobalt, tantalum, and tin. South Africa, Zimbabwe, Nigeria, and Rwanda also emerge as key producers in various CM categories. Where global output shares are known, the visual indicates the relative global contribution of African countries. Importantly, the figure underscores the cross-cutting presence of ASM within the CM sector and its strong geographical variation.

 I ASM IS PREVALENT  I SOME ASM OCCURS/LIMITED DATA  I NO REPORTED ASM

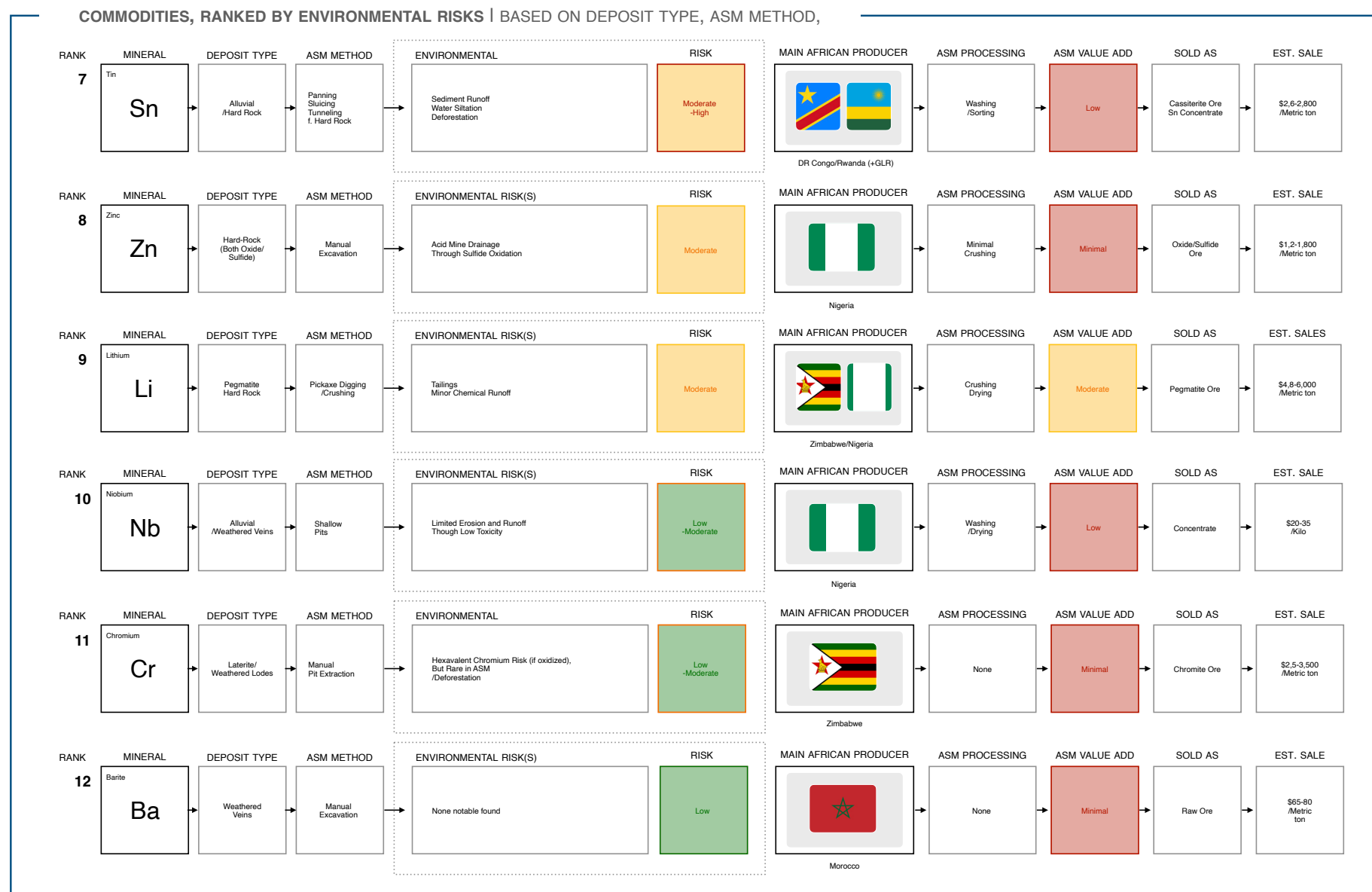
Co Cobalt	Main African Producer DR Congo Global Output (%) 74% I ASM 	2nd African Producer Madagascar ASM Mined Coproducts Cu Copper Ni Nickel
Cr Chromium	Main African Producer South Africa Global Output (%) 44% I ASM 	2nd African Producer Zimbabwe ASM Mined Coproducts None
Sn Tin	Main African Producer DR Congo Global Output (%) ~6% I ASM 	2nd African Producer Nigeria ASM Mined Coproducts Ta Tantalum W Tungsten
Nb Niobium	Main African Producer Nigeria Global Output (%) N/A I ASM 	2nd African Producer Malawi (in dev) ASM Mined Coproducts Ta Tantalum
W Tungsten	Main African Producer Rwanda Global Output (%) 31% I ASM 	2nd African Producer DR Congo ASM Mined Coproducts Ta Tantalum W Tungsten

Pt Platinum	Main African Producer South Africa Global Output (%) 71% I ASM 	2nd African Producer Zimbabwe ASM Mined Coproducts None
Cu Copper	Main African Producer DR Congo Global Output (%) ~15% I ASM 	2nd African Producer Zambia ASM Mined Coproducts Co Cobalt
Zn Zinc	Main African Producer South Africa Global Output (%) 1% I ASM 	2nd African Producer Zimbabwe ASM Mined Coproducts None
Li Lithium	Main African Producer Zimbabwe Global Output (%) N/A I ASM 	2nd African Producer Namibia ASM Mined Coproducts Ta Tantalum Co Tin
Ta Tantalum	Main African Producer DR Congo Global Output (%) N/A I ASM 	2nd African Producer Rwanda ASM Mined Coproducts Sn Tin W Tungsten
Sb Antimony	Main African Producer Zimbabwe Global Output (%) N/A I ASM 	2nd African Producer Tanzania ASM Mined Coproducts Cu Copper Ni Nickel
Ba Barite	Main African Producer Morocco Global Output (%) N/A I ASM 	2nd African Producer Nigeria ASM Mined Coproducts Pb Lead Zn Zinc
Ga Gallium	Main African Producer Guinea Global Output (%) N/A I ASM 	2nd African Producer Ghana ASM Mined Coproducts None
RE Rare Earth Elements	Main African Producer Nigeria Global Output (%) N/A I ASM 	2nd African Producer Madagascar ASM Mined Coproducts Light / Heavy REEs

FIGURE 4: COMMODITIES RANKED BY ENVIRONMENTAL RISKS⁵



FIGURE 4: COMMODITIES RANKED BY ENVIRONMENTAL RISKS⁵ continued



⁵ Estimated sale prices as of October 2025

The distribution of ETM-ASM across the African continent reflects distinct geographic clusters. These hot spots, where critical minerals are increasingly extracted outside and alongside industrial operations, are summarized and depicted in figures 5 and 6 below. National-level research led to the creation of 10 country profiles, focusing on top ASM-ETM producers, which feature in-depth information and can be found in Appendix B.

2.3. GEOGRAPHICAL CLUSTERS

- **Great Lakes Region (GLR):** Tin, tantalum, and tungsten are mined extensively in countries like DR Congo (eastern), Rwanda, Burundi, and to some extent Uganda. Tin and tantalum are mostly alluvial (tin can also be found in hard rock deposits), and tungsten is almost always hard rock. Some beneficiation is done on-site (via washing and crushing).⁶ But refining occurs only at separate refineries (e.g., newly established facilities in Rwanda or downstream). DR Congo also holds one of the world's largest lithium reserves in Tanganyika province.
- Formalization levels vary. Rwanda (the world's fifth-largest tin producer, third-largest tantalum producer, and twelfth-largest tungsten producer) is considered to have a well-formalized sector. In contrast, Uganda, DR Congo, and Burundi are highly informal. Illicit trade is highly prevalent in the GLR, with Rwanda (despite its formalized sector) acting as a central transit hub for smuggled 3T (and gold)—especially from eastern DR Congo, where conflict and human rights abuses are acute (see, e.g., IPIS, 2024).
- **Central African Copperbelt:** In the world's largest copper belt, shared by DR Congo and Zambia, ASM is well documented across Lualaba province and Haut Katanga province (DR Congo), mining both copper and cobalt. Cobalt and copper mined by ASM are found in oxide zones (recall discussion of oxidization above), with pits reaching 30 to 100 meters in depth (whereas, for instance, industrial cobalt mines operating in non-oxidized zones reach 500 to 1,000-plus meters). All copper and cobalt from ASM are sold in their raw, unrefined form.
- DR Congo's cobalt-copper ASM sector has received considerable attention due to the high prevalence of child labor, health and safety issues, and environmental impacts (see, e.g., Amnesty International, 2016, 2020, 2023;). DR Congo accounts for more than 70 percent of global production, with the ASM sector producing 10–20 percent of that amount (fluctuating according to prices and industrial production) (USGS, 2023). To curb ASM on large-scale mining concessions, the government introduced ASM zones (or ZEAs, per the French phrase *zones d'exploitation artisanale*), though implementation has been limited. Entreprise Générale du Cobalt (EGC) was established in 2018 to drive formalization and purchases of ASM cobalt, also with limited success (AfricaMaVal, 2023).

6 Beneficiation is the process of “upgrading” mined ore by removing waste and increasing the concentration of valuable minerals. It is often the step before refining or smelting, which separates the mineral entirely from the ore. In ASM, this is done mostly through crushing (separating high-grade ore from low-grade ore) and washing.

- **Southern Africa:** ASM lithium, chromium, and graphite (alongside some recovery of copper, tin, tantalum, and aluminum) are particularly prevalent in countries like Zimbabwe, Mozambique, and Madagascar (as well as Namibia, with a smaller ASM sector, and South Africa and Botswana, with no [legal] ASM sectors). Graphite and lithium are exclusively mined through hard rock deposits, though via pegmatites or weathered ore in an ASM context. REEs are typically found in monazite sands, which are mined through panning or surface collection.

Historically, ASM in countries such as Mozambique and Madagascar has focused on gemstones and gold; in recent years, however, ETM production in these countries is emerging. Zimbabwe, with significant lithium reserves, has witnessed expanding ASM activities, often adjacent to large-scale operations. None of the countries have made any substantial progress in formalizing their ASM sectors, except Namibia, which has created ASM zones dedicated to, for instance, tantalum and lithium (AfricaMaVal, 2023).

- **West/Northwest Africa:** West Africa has long been one of the continent's major ASM hot spots, particularly for artisanal and small-scale gold mining (ASGM), which remains a significant livelihood source across the region. Alongside this long-standing ASGM legacy, new ASM activity linked to minerals relevant to industrial and energy-transition value chains is also emerging. Nigeria, for example, has developed one of Africa's largest ASM sectors, with activity spanning lithium ore, lead-zinc, and other minerals, though the sector remains weakly formalized and associated with major environmental and public health risks. Beyond Nigeria, however, much of West Africa's ASM remains concentrated in gold and diamonds, with limited documented artisanal production of ETMs at present, although countries such as Ghana and Mali may become more relevant to ETM supply chains as lithium projects advance. Morocco, one of the world's major barite producers, also hosts a significant ASM sector in output terms and represents a more structured and regulated case.
- **High-Potential Countries:** These are countries with significant reserves of critical minerals but limited extraction (and often no ASM). Tanzania and Botswana together hold about 3 percent of the world's nickel. South Africa has 80 percent of the world's known chromium reserves. Mali and Ethiopia are high-potential countries for lithium production. Similarly, Gabon is rich in manganese (25 percent of global reserves), and Guinea in bauxite (also 25 percent of global reserves).

The factors driving ASM's expanding ETM production determine not only where ASM is prevalent, but also how different challenges—social, economic, and environmental—are expressed. This is discussed in the next section.

FIGURE 5: REGIONAL OVERVIEW OF 10 SELECTED COUNTRIES

REGIONAL OVERVIEW

OF 10 SELECTED COUNTRIES

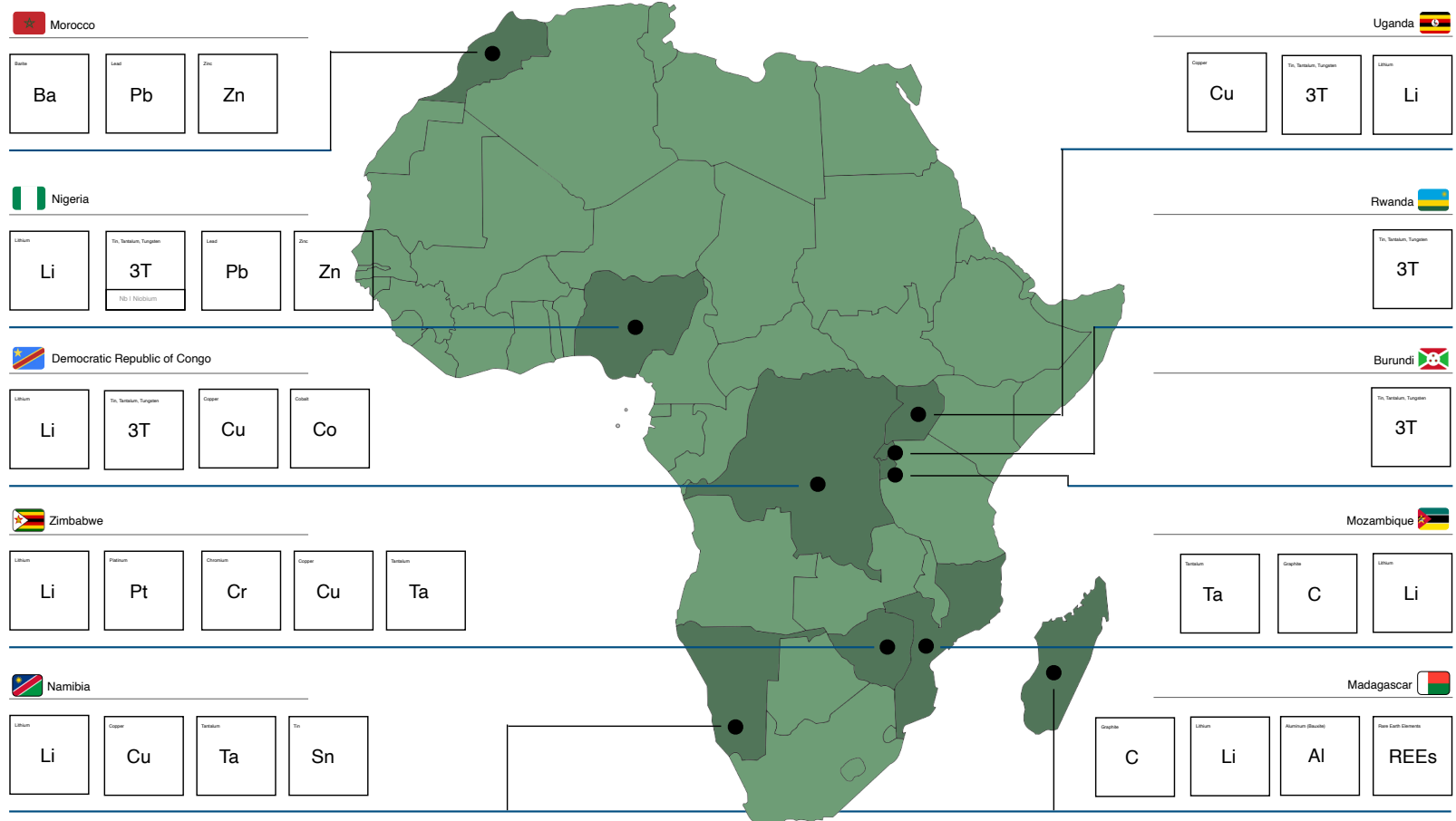
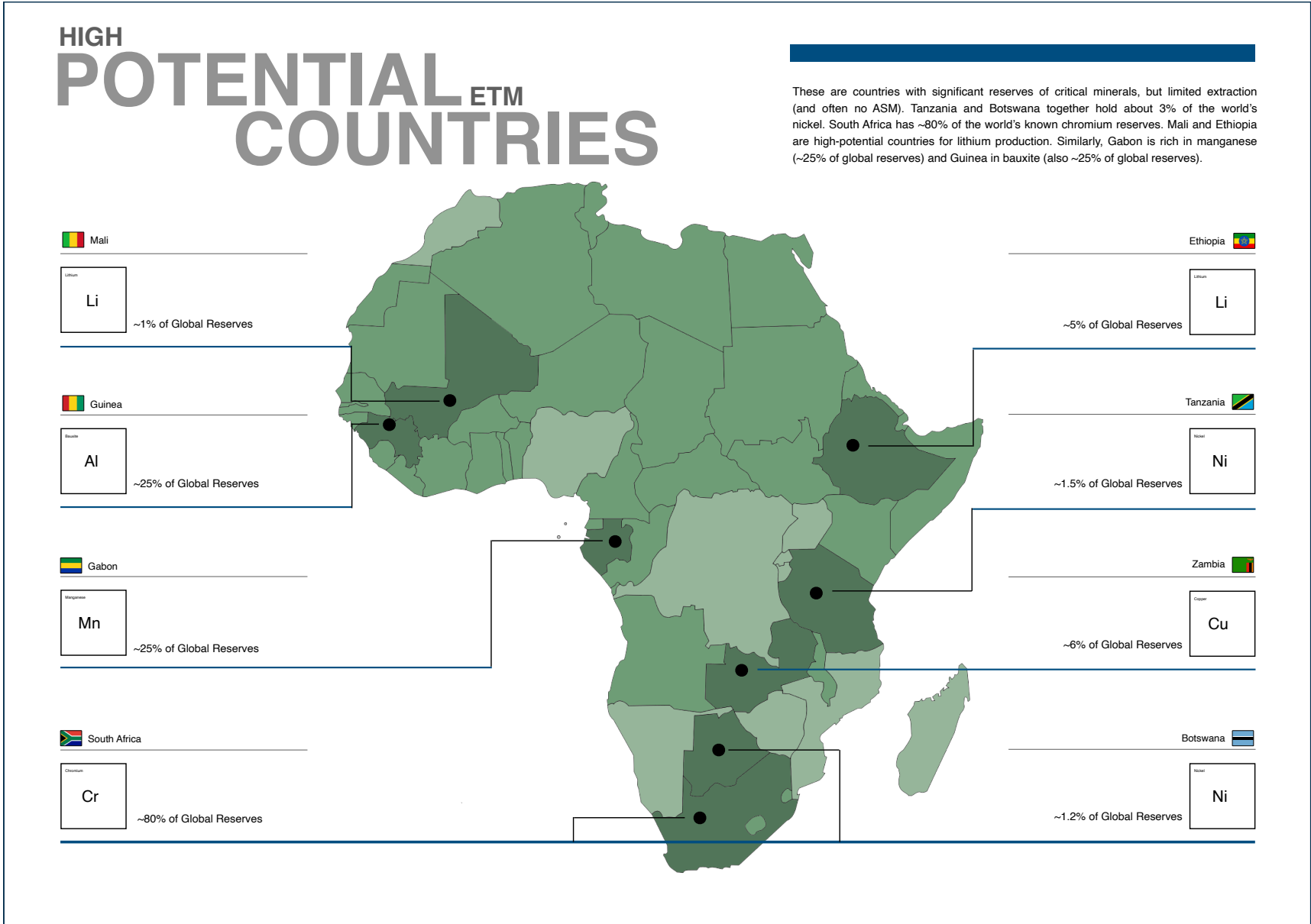


FIGURE 6: HIGH POTENTIAL CM COUNTRIES



3. CROSS-CUTTING CHALLENGES

Mining at any scale has the potential to affect local communities and the environment negatively; a growing body of research and gray literature documents the adverse impacts linked to under-regulated, informal ASM activities. While reported concerns should not be dismissed, they are often isolated incidents and largely unquantified, leaving a harmful information gap with more speculation and generalization than actionable information. It is important to note that this is the case for ASM-ETM and not ASGM, which has taken precedence in research to date and where the adverse effects are well documented. While this section centers on cross-cutting challenges (in no particular order) across various critical minerals, it should be read more as an identification of focal points for engagement and policy priorities than as a list of deterring risks.

Despite the growing relevance of ASM in CM production, quantifiable data remains limited in the ASM-CM space, especially in countries where the practice is emerging. There are multiple contributing factors, above all the broad informality of ASM-CM activities, hence their absence from national mining cadastres (public records of land ownership) and labor statistics. There is also a heavy research bias toward artisanal gold mining. Therefore, most figures like workforce, production, and share of production are based on estimates—or are nonexistent. Similarly, the cumulative environmental impact of ASM activities can be understood only if adequate assessments are made, which is rarely the case. It remains also unclear how far ASM activity overlaps with high-biodiversity areas, with most reports remaining largely unquantified, offering little precise data on impacts. This creates blind spots, undermining both mining engagement and environmental planning.

3.1. INFORMALITY AND LEGAL AMBIGUITY

Many of the challenges associated with ASM activity, as further elaborated below, are inherently linked to the widespread informality of artisanal activities. Without full legal recognition and under the cloak of informality, ASM remains mainly unregulated or under-regulated and unsupported by national governmental agencies (Hilson and McQuilken, 2014). Informally operating ASM is systemically excluded from formal financial service provision and usually sells into informal, illicit, and sometimes illegal supply chains (Gronwald and Grundel, 2017). Mineral purchasers and informal investors are often described as taking advantage of ASM operators through exploitative terms (IISD/IGF, 2022). This exclusion from formal financial services is a consequence not only of informality

itself, but also of lenders' perceptions of ASM as high risk, low transparency, and difficult to assess using conventional credit criteria.

Consequently, formalization is widely understood as the main bottleneck for achieving improved and more sustainable mining practices. Effective sector regulation should lead to a reduction of adverse effects on the environment, workers, and local communities, and legal recognition should pave the way to formal finance and formal markets, boosting the sector's livelihood potential (Arthur-Holmes and Ofosu, 2024). However, legal recognition alone is rarely sufficient to unlock finance; miners and cooperatives often continue to face major barriers related to collateral requirements, informality of records, price volatility, lack of financial literacy, and the limited suitability of conventional financial products to ASM realities. Similarly, formalization as a means of consolidating tax incomes from mining usually makes formalization the first priority for host governments (Hilson, 2020).

Many scholars, however, point out how formalization efforts can also be highly problematic, and not universally beneficial (see, e.g., Hilson 2020). Legal voids and informality often interact with structural constraints; miners face limited access to land, geological information, finance, and markets, as well as broader state services. Formalization initiatives in African countries often impose frameworks designed for industrial, large-scale mining, resulting in compliance expectations that are far removed from local realities, highly bureaucratic, and overly complex for ASM operators (see, e.g., Hilson and Maconachie, 2020). This partially explains why many countries that have recognized ASM in their mining codes have seen only limited uptake, alongside factors such as limited enforcement and corruption (see the subsection on illicit trade and corruption challenges).

Moreover, many caution that government-led formalization efforts often stop at regulatory compliance, ignoring the broader developmental objectives of ASM communities (see, e.g., Hilson et al., 2017). Institutional interventions, such as licensing, the formation of cooperatives, and traceability, have been criticized for being “technocratic fixes” that neglect structural concerns related to land, finance, and market access (see, e.g., Hook, 2019). As a result of all of these factors, different countries have different approaches to and results from formalization (see table 2). Rwanda, Morocco, and Namibia are often used as examples of nations where formalization has led to positive outcomes, with clear demarcation of mineral-rich ASM zones (land access) and government-regulated buying centers (markets). Access to finance, however, remains a challenge due

to the continued perception of high financial risk and the absence of financial products tailored to ASM production cycles and organizational realities (see, e.g., Bliss et al., 2017 for Rwanda). In contrast, formalization of ASM cobalt cooperatives in DR Congo is broadly considered a failure to date, with limited reach and exacerbated marginalization and displacement of ASM operators (see, e.g., Katz-Lavigne, 2020).⁷

TABLE 2: SUMMARY OF THE FORMALIZATION STATUS OF THE ASM SECTOR IN EACH LISTED COUNTRY

10 Selected Countries	Formalization Status	Formalization Level
 Rwanda	Medium-High	Legal/Recognized/Regulated
 Morocco	Medium-High	
 Namibia	Medium	
 Burundi	Low	Partially Recognized/Lacking Regulation/Legitimate
 DR Congo	Low	
 Madagascar	Low	
 Uganda	Low	
 Mozambique	Low	
 Zimbabwe	Low	
 Nigeria	Low	

See more information in Annex B: Country Profiles.

3.2. ECOLOGICAL HARM

While there is no doubt that ASM contributes to environmental degradation and may threaten biodiversity, it is worth noting that the environmental and social consequences of ASM-ETM extraction remain extremely poorly documented, under-analyzed, and unquantified (see, e.g., Devenish et al., 2024). In addition, many tend to arbitrarily frame the environmental harm caused by ASM as a problem of irresponsible “primitive” practices, illegibility, or lax regulatory enforcement rather than a consequence of complex structural dispossession and extractive asymmetry (see, e.g., Maguya et al., 2025).

For example, where artisanal miners lose formal claims to mineralized land, in decisions favoring large-scale operations, they are often pushed into more precarious areas—a displacement from secure and accessible deposits to marginal and environmentally sensitive areas, thereby increasing the environmental footprint of ASM (see, e.g., Verbrugge and Geenen, 2020). Similarly, where formalization efforts have led to elite capture (see the example of DR Congo in Katz-Lavigne, 2020), a large segment of miners remains excluded from monopolized, viable deposits, left economically vulnerable and reliant on informal, exploitative networks and methods without environmental safeguards (ibid.).

That said, documentation of environmental pressure surrounding ASM recovery of ETMs showcases both direct and indirect impacts on ecological health. One impact is deforestation, which can occur regardless of minerals mined, though this is often dependent on geological characteristics (recall that surface-level extraction, for example, is considered more invasive than underground extraction) (see, e.g., MSHA, 2024 and CIFOR, 2023). As indicated by Banza Lubaba Nkulu et al. (2018), however, deforestation often occurs less because of mining activities themselves and more because of supplementary activities such as logging for fuel, camp construction, or charcoal production (none of which are siloed to mining) (see also Devenish et al., 2024, discussing Madagascar).

Moreover, much literature and media attention have been directed toward artisanal cobalt mining in DR Congo (see Buxton, 2021). While not a unique case, cobalt does provide an example of a mineral whose environmental impacts are shared by many ETMs, for example water siltation and turbidity. This often happens during beneficiation, when minerals are washed, also causing acid mine drainage when sulfide minerals are oxidized (when sulfide minerals are put in contact with air or water, sulfuric acid is created). The latter is especially prevalent in cobalt beneficiation (see Cobalt Institute, 2023) but also in 3T

⁷ ASM formalization is usually structured around cooperatives, promoted in many African countries as way to organize miners (facilitating joint licensing) and enable access to, for example, finance. However, unlike agricultural cooperatives, which tend to emerge from collective production, community structures, and shared land use, ASM cooperatives are mostly legal/administrative vehicles only—hastily assembled to meet regulatory requirements and lacking cohesion, clear governance, benefit sharing, and democratic decision making (see, e.g., Katz-Lavigne, 2020).

beneficiation (see, e.g., Maheshe and Beak, 2018). Similar effects occur in (highly prevalent) tailings mismanagement, which can cause toxic runoff and radioactive exposure (see, e.g., Kamara and Bumba, 2025).

Ecological harm is further explored in “Country Profiles,” found in Appendix B. This includes some indicative spatial data flagging biodiversity hot spots at risk of being affected by ASM-ETM.

3.3. LABOR CONDITIONS AND COMMUNITY HEALTH IMPACTS

Comparatively well documented are the health, safety, and labor conditions of ASM, in both non-ETM and ETM extraction. ASM frequently occurs in unventilated, poorly constructed sites, often without personal protective equipment (PPE), resulting in hazardous conditions regardless of the mineral or country. Prevalent for many ETMs (due to the concentration of heavy metals) is inhalation of toxic dust containing, for instance, cobalt or silica particles—or even radioactive particles from uranium (e.g., in cobalt mining) and thorium (e.g., in rare earth mining). Lead, one of the most toxic minerals, also causes serious health problems for workers and communities, with lead mining in Nigeria being a tragic, prominent example (see, e.g., Nota et al., 2025).

Rainy seasons are considered the most hazardous periods for ASM, especially in regions where operations are informal and, consequently, often lack adequate safety infrastructure. Heavy rainfall increases the risk of site collapses, flooding, and landslides in both underground and open-pit operations that lack adequate drainage, shoring, or slope reinforcement (Singo et al., 2022). Saturated soil weakens pit walls and destabilizes overburden, causing collapses, which represent one of the most direct causes of fatal and severe injuries in ASM (ibid.). This also occasionally occurs in surface mining, due to riverbank erosion or the collapse of unconsolidated topsoil (see, e.g., Macháček, 2020).

3.3.1. CHILD AND FORCED LABOR

Forced and child labor⁸ incidents are widely reported, alongside cases of “survival labor,” in many ASM-prone areas (Rushemuka and Côte, 2024). While forced and child labor is reported predominantly in conflict areas (such as eastern DR Congo), it occurs widely across many countries (such as Ghana, Tanzania, and Burkina Faso). In a 2016 report on ASM cobalt communities in DR Congo, Amnesty International estimated that around 40,000 children were working in ASM cobalt mining (though the figure was never verified, and figures

vary) (Amnesty International, 2016). A more recent assessment was made by COTTECO (a program under the US Department of Labor mapping child labor), which registered 5,346 children in 2024. The difference in these numbers indicates the difficulty of tracking this challenge.

3.3.2. GENDER

ASM is deeply gendered in its organization, risks, and distribution of benefits. Women are estimated to make up around 40–50 percent of the ASM workforce in Africa, yet they are often concentrated in lower-paid, less secure, and less visible roles across production, processing, and trade (Delve, 2024). Barriers to land, licensing, finance, equipment, and representation often limit women’s access to more profitable activities and decision-making roles (World Bank 2024b; IISD, 2023). These inequalities also shape exposure to harm. Women may face distinct occupational health and safety risks due to poorer access to PPE, training, and safer tasks, while also bearing a disproportionate share of wider, community-level impacts, including contamination, insecure livelihoods, unpaid care burdens, and harassment or abuse. For ETM and CM supply chains, this means that formalization and responsible sourcing efforts need to address not only compliance, but also unequal access to benefits, resources, and decision-making (World Bank, 2024b; Busia and Arthur-Holmes, 2024).

3.4. ILLICIT TRADE AND CORRUPTION CHALLENGES

Minerals with a high value-to-weight ratio tend to have a greater tendency toward illicit/illegal trade. This is why gold is the most smuggled mineral in the world. In the ETM space, the 3Ts are the most smuggled minerals, and one of the largest smuggling hubs of ETMs is the Great Lakes Region (ICGLR, 2024). Rwandan actors’ role in the smuggling of 3Ts in the region is well known but often oversimplified. The smuggling of conflict minerals is a regional problem, bound in highly complex illicit trade networks stretching between DR Congo, Burundi, Uganda, and sometimes, ultimately, Rwanda (IPIS, 2023). Smuggling decreased during a period of relative stability between, in particular, Rwanda and DR Congo, and it is thought to increase in parallel with rising geopolitical tensions and conflict (such as the resurgence of the Rwanda-backed M23 in 2023) (ibid.). In any event, large volumes of minerals sourced from mines in eastern DR Congo, controlled by armed groups, are laundered through Burundi, Rwanda, or Uganda and ultimately imported into Rwanda, relabeled, and sold under conflict-free certification (IPIS, 2023; Global Witness, 2025). While the Great Lakes Region

⁸ The International Labor Organization (ILO) considers child labor in ASM one of the worst forms of child labor due to its hazardous nature, which includes exposure to toxic substances, heavy loads, and dangerous machinery. Mining is explicitly listed among sectors deemed inherently hazardous and therefore unacceptable for any person under 18. In ASM contexts—where poverty, informality, and family-based operations intersect—children are often engaged in informal tasks such as crushing, panning, or carrying ore. The ILO further notes that child labor in mining can amount to forced labor when children are subjected to coercion, debt bondage, or are unable to leave due to economic or social pressure (ILO, 2019). In such cases, the distinction between child labor and forced labor collapses, particularly where children work under exploitative or non-consensual conditions, which violates both ILO Convention on Minimum Age and Forced labor.

remains central to discussions of conflict-linked 3T smuggling, West Africa is also a major hub for illicit ASM mineral trade, particularly smuggled gold, illustrating how entrenched cross-border trafficking networks extend beyond the CM/ETM space narrowly defined.

Other governance issues are prevalent mostly in ASM areas where government presence is limited or deficient—such as large segments of Mozambique, Madagascar, Nigeria, and Burundi. Corruption and bribery, occurring in licensing procedures, overlooking of environmental and occupational hazards, or access to protected areas, are common (see, e.g., Hilson and Maconachie, 2020). Similarly, where trade is informal, tax evasion is prevalent. Both individually and collectively, these governance deficiencies undermine the legitimacy of formalization efforts for ASM and for the broader state, as well as significantly discourage responsible investments and initiatives.

WANT TO LEARN MORE ABOUT ILLICIT TRADE AND CONFLICT MINERALS?

Check out: “IPIS Open Data dashboard on Artisanal and Small-Scale Mining in eastern DRC”, International Peace Information Service (IPIS).

3.5. ASM/LSM DYNAMICS

The relationship between ASM and LSM is not inherently antagonistic, despite this often being the dominant framing. It is, however, complex—and becoming more so amid rising ETM demand. In practice, ASM–LSM relations are shaped not only by formal concession boundaries, but also by local authority structures, geological conditions, and the differing technical capacities of miners to access different parts of the same ore body (see figure 7). In some settings, this produces conflict and displacement; in others, it gives rise to forms of uneasy coexistence, negotiated access, or informal cohabitation. The following broad issues illustrate these dynamics (Luning and Pijpers, 2017; Katz-Lavigne, 2020):

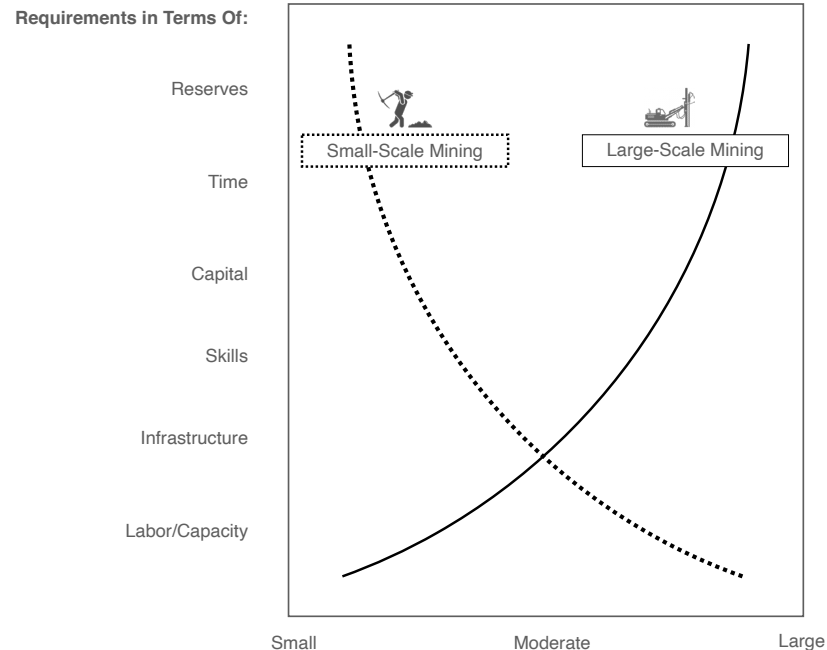
Land access and tenure: Governments often grant exploration and exploitation licenses to large-scale operators, whose concessions frequently overlap with areas historically mined by ASM. Since ASM operators are often informal in such cases, and therefore lack legally recognized claims to land, they typically have limited opportunities to file grievances or resist displacement. At the same time, access in practice is not determined by law alone: Local chiefs, customary authorities, and the physical characteristics of ore bodies may also shape whether exclusion, coexistence, or negotiated access emerges in specific sites (Luning and Pijpers, 2017; Katz-Lavigne, 2020)

Economic interdependencies and shadow integration: While rarely recognized as a part of ASM/LSM dynamics, ASM minerals sometimes end up in aggregates that are sold and exported together with LSM supply (both directly and indirectly). In this scenario, as ASM supply is sold to intermediaries, aggregates are resold to LSM-affiliated refiners or traders, ending up in the same value chain. This can be viewed as a form of shadow integration, as many large-scale mining companies refrain from purchasing ASM-mined materials directly due to, for example, reputational risk (see Hilson et al., 2020).

Human rights and conflict sensitivity: Violent confrontations have emerged frequently, as tensions over land, access, and exclusion accumulate. Secured mine sites (through the use of private security firms and public security forces) have led to multiple human rights abuse investigations, as ASM workers’ attempts to breach LSM sites are met with forced evictions and physical violence (The East African, 2023).

FIGURE 7: GENERAL, CONCEPTUAL COMPARISON OF ARTISANAL AND SMALL-SCALE MINING VERSUS LARGE-SCALE MINING, VIS A VIS THE REQUIREMENTS AND INPUTS LISTED AT THE LEFT OF THE FIGURE

ASM versus LSM | Mining Profile



4. INTERNATIONAL AND INTERGOVERNMENTAL PARTNERSHIPS

Various partnership efforts have emerged to reshape supply chains, investment flows, and governance priorities, materializing through memoranda of understanding (MoUs), strategic dialogues, and investment frameworks. While these partnerships are broadly aligned *in intent* with Africa’s development goals, such as value addition and generation, transparency, and sustainability, there are concerns regarding potential asymmetries in agenda-setting and ownership, as well as the broad exclusion of ASM from formalized strategies and partnerships.

This section provides an overview of the key international intergovernmental partnerships shaping Africa’s ETM landscape.

4.1. AFRICA-LED STRATEGIES AND CONTINENTAL FRAMEWORKS

The Africa Mining Vision (AMV), adopted by the African Union (AU) in 2009, provides the foundation for Africa’s mineral governance agenda. It envisions a transparent, equitable, and sustainable mining sector that contributes to broad-based social and economic development across the continent. The AMV prioritizes local beneficiation, value addition, regional integration, and the protection of community rights—principles that remain central to Africa’s critical minerals positioning (see African Union, 2009).

In response to the accelerating global demand for ETMs, the African Minerals Development Centre (AMDC), the AU body tasked with advancing implementation of the AMV, led the development of Africa’s Green Minerals Strategy (AGMS). The AGMS is dated December 2024 and was adopted by the AU Executive Council in February 2025 (AMDC, 2024a). It emphasizes the role of Africa’s mineral wealth in supporting the green energy transition. This included a mineral classification, the first of its kind in the AU (see AMDC, 2024b). These frameworks aim to advocate for Africa’s agency in shaping how its ETM resources are mined, processed, and traded, to be enabled through intracontinental trade agreements, such as the African Continental Free Trade Area (AfCFTA). AU-wide coordination and implementation, however, remain persistently limited.

The AMV itself is explicit about ASM. It calls for “a mining sector that harnesses the potential of artisanal and small scale mining to stimulate local/national entrepreneurship, improve livelihoods and advance integrated rural social and economic development” (African Union, 2009), and ASM is one of the nine programme clusters of the AMV Action Plan (African Union, 2011).

The AGMS does not carry this through. Its four pillars cover mineral development, people and technological capability, mineral value chains, and mineral stewardship, but ASM appears only once in the strategy, and then as a risk: the perception of “blood cobalt” from some operations in DR Congo, “particularly ASM,” is cited as one reason battery makers may switch to low- or cobalt-free chemistries (AMDC, 2024a, p. 80). The AGMS gives ASM no role in Africa’s green mineral value chains. AMDC’s Pan-African Resource Reporting Code (PARC) does take ASM into account, but as a reporting and classification standard rather than a development strategy (see AMDC, 2023).

AMDC has since moved to address the gap with a dedicated Continental ASM Strategy, developed with support from UNDP and the ACP-EU Development Minerals Programme. Regional consultations began with an East and Southern Africa workshop in Dar es Salaam in April 2024, with further consultations planned for West, Central and North Africa (ACP-EU Development Minerals Programme, 2024; African Newspaper, 2024b). AMDC has said the strategy aims to integrate artisanal and small-scale miners into the formal economy and improve their access to finance, technology, and markets, while addressing environmental stewardship, child labor, occupational hazards, and women’s participation (African Newspaper, 2024a). At the time of writing, the strategy had not been published or adopted.

The ASM Strategy could give ASM the place in Africa’s ETM agenda that the AGMS does not, provided it is explicitly linked to the AGMS and to ETM value chains. Until then, ASM continues to be handled largely through a risk management lens, which is how the AGMS treats it, rather than as an integral part of Africa’s green mineral supply chains. This risks excluding ASM operators from formal markets as international standards for traceability, environmental sustainability, and social responsibility tighten.

4.2. INTERCONTINENTAL AGREEMENTS

Both the EU and the US have formalized bilateral agreements with key suppliers of ETMs in Africa.

The EU has signed MoUs with DR Congo (October 2023), Zambia (October 2023), and Rwanda (February 2024). An EU–Namibia Critical Raw Materials Partnership was also launched in 2022. The MoUs represent a strategic ambition to reduce ETM dependency on foreign sources. A key part of the strategy is to bypass intermediaries and build direct supply chains with the above-listed countries. The MoUs seek to build processing capacity in partner countries

via European investment, with the minerals exported directly to Europe. No investments have been made to date, and the European Parliament has suspended the EU–Rwanda MoU due to concerns over conflict minerals.

The US has pursued similar partnerships, including a trilateral MoU with DR Congo and Zambia (December 2022) and three agreements with DR Congo and Rwanda (December 2025) as part of an effort to establish a flow of ETMs via the Lobito Corridor. These agreements ensure long-term access of US actors to the mineral reserves of DR Congo, with few obligations on the part of the US to its African counterparts. The US also worked with other countries to form the Minerals Security Partnership (MSP), which consists of dialogues and principles rather than formalized engagement. Engaged African countries (who are not members) are DR Congo, Zambia, Angola, Botswana, Tanzania, Uganda, and South Africa. Engagements are mainly in the form of events and meetings, such as the Investing in African Mining Indaba (held annually in Cape Town, South Africa). The MSP also exists as a response to ETM regulation, aiming to decrease dependency on other countries and directly engage with mineral-rich African nations for increased direct investment and trade (the MSP is exclusively Western-based, with the US Department of State leading).

As with the Green Minerals Strategy, and in contrast to the AMV, none of the MoUs nor the MSP framework explicitly engages with or provides a strategy for artisanal and small-scale mining. Stricter traceability and environmental, social, and governance (ESG) requirements (through, for example, the EU's Battery Regulation, the EU Critical Raw Materials Act, or section 1502 of the US Dodd–Frank Act) may also lock out ASM producers from formal value chains. Increased pressure to meet international standards can also lead to disengagement from ASM if compliance is deemed too costly or risky. Large-scale investments driven by MSP/MoUs may also lead to concessions or ASM zones (ZEAs) being withdrawn from ASM operators in favor of LSM (already occurring, for example, in DR Congo and Zimbabwe).

Additional multilateral or global acknowledgment of the importance of ASM in the ETM space comes from the Group of 7's (G7) 2025 G7 Critical Minerals Action Plan and the ASEAN Minerals Cooperation Action Plan (AMCAP-IV) 2026–2030.

4.3. THE UNITED NATIONS

The UN has recently increased its engagement on critical minerals, positioning itself as a normative actor rather than a direct investor or trade partner.

In 2024, the UN Secretary-General launched the Panel on Critical Energy Transition Minerals, which produced a set of voluntary principles for the responsible governance of critical mineral value chains. The principles emphasize human rights, transparency, and benefit-sharing, especially in resource-rich,

low-income countries. While the panel has noted the risks of marginalizing ASM and suggested convening an International Council on Artisanal and Small-Scale Mining, it has yet to present concrete mechanisms to include ASM in global supply chains. The initiative is co-led by the United Nations Environment Programme (UNEP) and the United Nations Conference for Trade and Development (UNCTAD) and is supported by the United Nations Development Programme (UNDP).

The UNDP supports formalization and capacity-building in ASM through projects such as the ACP-EU Development Minerals Program. These efforts focus primarily on industrial minerals and construction materials, currently with limited reach into critical minerals. The UN's International Labour Organization (ILO) addresses labor conditions in ASM, particularly child labor and occupational safety, through its IPEC+ program and engagement with national action plans on decent work in mining. The UN Interregional Crime and Justice Research Institute (UNICRI) launched a Strategic Response Framework in 2024 addressing crimes related to critical minerals, including illicit trade and smuggling. ASM is framed primarily as a security and governance risk.

UNEP is involved in environmental governance and supports life-cycle thinking on mineral value chains, and UNCTAD provides data and policy recommendations for developing countries aiming to benefit from critical mineral extraction. In December 2025, UNEP, UNCTAD, and UNDP also launched a UN Task Force on Critical Energy Transition Minerals, which has an opportunity to address ASM gaps.

While the UN is increasingly vocal on the governance of critical minerals, its engagement remains primarily discursive and fragmented. ASM is acknowledged in high-level documents but rarely addressed in implementation, programming, or investment design. The risk remains that UN-endorsed standards may replicate the same exclusionary dynamics seen in bilateral agreements, raising the bar for entry into formal supply chains without concrete support for ASM operators to meet those standards.

WANT TO LEARN MORE ABOUT THE UN SECRETARY-GENERAL'S PANEL ON CRITICAL ENERGY TRANSITION MINERALS?

Check out "Principles to Guide Critical Energy Transition Minerals Towards Equity and Justice" (United Nations, 2024).



5. HIGH-LEVEL OVERVIEW OF KEY STAKEHOLDERS

There are numerous stakeholder groups whose mandates, influence, or operations intersect, or may intersect, with ASM and critical minerals. The actors identified below are particularly relevant for advancing inclusive governance, financial access, biodiversity conservation, and market recognition for ASM producers. This is not an exhaustive list; however, these stakeholders can play a crucial part in establishing a more collaborative, multi-stakeholder-driven ASM-ETM engagement strategy.

5.1. GOVERNMENT ACTORS

The following government entities are typically involved in ASM regulation, implementation, and enforcement in countries where ASM is recognized.

- **Ministries of Mines:** Oversee licensing, formalization, and ASM zoning.
- **Environmental Protection Agencies:** Regulate ecological compliance, land access, and impact assessments.
- **Ministries of Finance and Central Banks:** Influence fiscal regimes, mineral trading frameworks, gold purchasing programs, and financial inclusion strategies.
- **Ministries of Labor and Work:** Oversee labor practices and regulations.

5.2. REGIONAL AND INTERNATIONAL BODIES

These regional and international actors shape responsible production, responsible sourcing standards, trade, certification protocols, and policies that align with ASM.

- **African Union/African Minerals Development Centre (AMDC):** Leads implementation of the Africa Mining Vision and the Green Minerals Strategy, and is developing a Continental ASM Strategy. Website: <https://amdc.africa>
- **South African Development Community (SADC):** Through its Mining Protocol, supports harmonized mineral policies and growing cooperation on critical minerals like lithium and cobalt (non-ASM). Website: <https://www.sadc.int>

- **Economic Community of West African States (ECOWAS):** Regional Minerals Development Policy similarly seeks to harmonize mining codes. Website: <https://www.ecowas.int>
- **East African Community (EAC):** Shared EAC Mining Bill to promote harmonization. Website: <https://www.eac.int>
- **Economic Community of Central African States (ECCAS):** No explicitly shared mining policy. Website: <https://ceeac-eccas.org>
- **International Conference on the Great Lakes Region (ICGLR):** Oversees the Regional Certification Mechanism for 3Ts. Website: <https://www.icglr.org>
- **Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF):** Provides ASM policy and governance guidance. Website: <https://www.igfmining.org>
- **Organisation for Economic Cooperation and Development:** Develops global due diligence standards that frame ASM's inclusion in critical mineral supply chains. Website: <https://www.oecd.org>

5.3. FINANCIAL INSTITUTIONS (FIS)

These actors are central to unlocking ASM financial inclusion and risk-sharing mechanisms.

- **Local and Regional Commercial Banks:** Potential to engage with ASM through tailored products and phased lending models.
- **Development Finance Institutions (DFIs), e.g., African Development Bank, IFC:** Can catalyze ASM financing through de-risking and blended finance structures.
- **Guarantee Funds and Upstream Assurance Funds:** Provide financial risk-sharing instruments that enable ASM credit access.

5.3.1 FILLING THE FINANCING GAP—ZOOMING IN ON FINANCIAL INSTRUMENTS

While most ASM remains excluded from formal banking systems, several financial instruments and programs have emerged (or could be adapted) to support responsible ASM and ETM-related financing. Below is an overview of the key actors and existing tools.

- **Local and Regional Commercial Banks:** In countries with more formalized ASM sectors (e.g., Tanzania's ASGM sector, Rwanda's 3T sector, or Morocco's barite sector), local banks have begun piloting tailored financial products such as phased lending models, overdraft facilities, or equipment loans secured against mineral sales contracts. However, uptake remains low due to perceptions of high risk, weak credit histories, and lack of collateral. Partnerships with NGOs or development agencies (e.g., through partial guarantees or shared risk schemes) can prove effective in improving access to credit.
- **Development Finance Institutions (DFIs):** DFIs such as the African Development Bank (AfDB) and International Finance Corporation (IFC) can play a catalytic role by structuring blended finance models and supporting responsible supply chains. For example, IFC has invested in responsible sourcing platforms and early-stage mineral processing ventures with potential ASM linkages. The US International Development Finance Corporation (DFC) offers political risk insurance, debt financing, and technical assistance to support strategic supply chains; although not yet directly applied to ASM-ETM, its tool kit could be adapted for responsible cobalt or lithium projects. Similarly, German KfW has financed green mineral supply chains and SME-focused development funds in Africa, which could serve as templates for ASM inclusion.
- **Guarantee Mechanisms and Upstream Assurance Funds:** Tools such as credit guarantees, partial risk-sharing facilities, and revolving funds can help offset ASM-specific risks (e.g., fluctuating prices, informal tenure, environmental liabilities). Guarantee funds have been applied successfully in agriculture and could be replicated in mining—for example, a dedicated ASM risk-sharing facility could incentivize banks to lend to ASM cooperatives. Additionally, upstream assurance funds (as tested in gold) can offer pre-financing tied to responsible production and traceability standards.

5.4. SUPPLY CHAIN ACTORS

These market participants directly influence ASM's ability to participate in formal critical mineral supply chains.

- **Large-Scale Mining (LSM) Companies:** Share land with ASM, may pursue cohabitation models (where they coexist on or near the same land) or offtake partnerships (wherein LSM buys the minerals produced by ASM miners).
- **Traders, Exporters, and Processors:** Serve as ASM's primary financiers and market access points.
- **Refiners (especially LBMA and RMI certified):** Their sourcing policies define ASM's entry into international supply chains.

5.5. CERTIFICATION AND INDUSTRY PLATFORMS

These bodies shape responsible production, responsible sourcing standards, ASM assurance mechanisms, and traceability schemes.

- **Responsible Minerals Initiative (RMI):** Oversees the Responsible Minerals Assurance Process (RMAP) for ASM. Website: <https://www.responsiblemineralsinitiative.org>
- **International Tin Supply Chain Initiative (iTSCI):** 3T traceability system active in ASM, with some civil society critique. Website: <https://www.itri.co.uk/itsci>
- **CRAFT Code/Alliance for Responsible Mining (ARM):** Develops responsible sourcing pathways for ASM. Website: <https://www.responsiblemines.org/en>

5.6. CIVIL SOCIETY AND WATCHDOG ORGANIZATIONS (AFRICAN-LED)

These African-led civil society organizations and watchdogs engage in advocacy, independent monitoring, and policy. (Note that this list is not exhaustive.)

- **Afrewatch (African Resources Watch):** DR Congo-based NGO advocating for community rights and environmental protection in mining. Website: <https://afrewatch.org>
- **Southern Africa Resource Watch (SARWatch):** Regional organization promoting citizen oversight and mining governance. Website: <https://sarwatch.org>
- **Mining Affected Communities United in Action (MACUA):** South Africa-based coalition advancing mining-affected community rights. Website: <https://macua.org.za>
- **Environmental Justice Atlas:** Tracks environmental and human rights grievances linked to mining across Africa. Website: <https://ejatlas.org>

- Africa Institute/TrustAfrica: Conduct African-led research and convene dialogues on mining sector reforms and governance. Website: <https://www.trustafrica.org>
- ENACT (Enhancing Africa's Response to Transnational Organized Crime): Provides research and policy analysis on resource-linked organized crime. Website: <https://enactafrica.org>
- Zimbabwe Environmental Law Association (ZELA): Works in Zimbabwe and the southern Africa region as a natural resources governance organization focused on legal and policy research, advocacy, impact litigation, conflict resolution, and civic education. Website: <https://zela.org>
- Women in Mining Africa (WiM Africa): Pan-African organization supporting women's participation, leadership, and economic empowerment across the mining sector, including through advocacy, networking, and capacity-building. Website: <https://womeninminingafrica.org>

5.7. INTERNATIONAL MULTI-STAKEHOLDER PLATFORMS

These are action-driven platforms that bring together key industry actors.

- Fair Cobalt Alliance (FCA): Multi-stakeholder initiative improving ASM cobalt sites in DR Congo. Website: <https://www.faircobaltalliance.org>
- European Partnership for Responsible Minerals (EPRM): Public-private partnership supporting responsible sourcing and ASM formalization globally. Website: <https://www.europeanpartnership-responsibleminerals.eu>
- Public-Private Alliance for Responsible Minerals Trade (PPA): US-hosted coalition supporting ASM due diligence and market access. Website: <https://www.resolve.org/site-ppa>
- planetGOLD: Global multi-stakeholder program supporting formalization, financial inclusion, mercury-free technology adoption, and responsible supply chains in artisanal and small-scale gold mining. Website: <https://www.planetgold.org>

5.7.1 TRANSFERABLE LESSONS FROM PLANETGOLD FOR ASM-ETM GOVERNANCE

The planetGOLD program, though designed to combat mercury pollution from ASGM, offers relevant lessons for ASM in energy transition minerals (ETMs). Many of the structural challenges are similar across both contexts, including informality, poor access to finance, limited technology uptake, opaque supply chains, and weak alignment between environmental objectives and miners' economic realities. The program should be seen not as a direct model for ASM-ETMs, but as a useful point of comparison when considering what more inclusive and effective governance could require.

A first lesson is that planetGOLD is funded by the Global Environment Facility in its capacity as one of the financial mechanisms for the Minamata Convention on Mercury. As a vehicle for compliance with the Convention, the program has created a shared policy anchor, an accountability framework, and a basis for international cooperation. No comparable global framework currently exists for ASM-ETMs, contributing to fragmented approaches across responsible sourcing, environmental management, and market governance.

A second lesson is that environmental improvements require socioeconomic incentives. Experience from ASGM shows that miners are more likely to adopt safer and more sustainable practices when these are linked to tangible benefits, such as improved recovery rates, better prices, healthier working conditions, or access to formal markets. Environmental messaging alone is rarely sufficient in contexts where miners face immediate livelihood pressures.

A third lesson is that technology and finance must be adapted to local realities. Mercury-free gold processing technologies often failed where they were too expensive, poorly suited to local ore types, or incompatible with miners' routines. Similarly, financial inclusion depends not only on the availability of capital, but also on de-risking, tailored products, trust-building, financial literacy, and support to cooperatives or other producer organizations. For ASM-ETMs, this suggests that traceability systems, environmental technologies, and finance models will succeed only if they are affordable, practical, and socially accepted.

A fourth lesson is that formalization alone is not enough. planetGOLD and related ASGM experience show that regulatory compliance, licensing, and traceability can be important but are insufficient if broader structural constraints remain unaddressed. Land access, informality, entrenched intermediary networks, weak organizational capacity, and exclusion from markets all shape whether formalization leads to meaningful improvements in practice.

Finally, multi-country learning and programmatic coordination can accelerate impact. planetGOLD's cross-country structure has enabled exchange on tools, approaches, and implementation challenges, helping to shorten learning cycles across very different country contexts. Given the cross-border nature of many ETM supply chains, similar forms of coordination could be valuable for harmonizing approaches to responsible sourcing, financial inclusion, and environmental risk management in ASM-ETM sectors.

5.8. EVENT-BASED DIALOGUE PLATFORMS

These platforms facilitate policy discussions, stakeholder alignment, and ASM representation at national, regional, and international levels.

- Mining Indaba: Africa's largest mining investment conference, with increasing ASM representation. Website: <https://miningindaba.com>
- Alternative Mining Indaba (AMI): Civil society-led event with a strong focus on ASM, human rights-based, and critical minerals governance. Website: <https://alternativeindaba.org>
- Future Minerals Forum: Global platform for critical minerals dialogue, increasingly featuring African ASM voices. Website: <https://www.futuremineralsforum.com>

6. CONCLUSION

Africa's role in the energy transition is frequently discussed in relation to reserves, supply chains, and strategic competition. This paper has shown that these dimensions are important but not sufficient on their own to give us a full understanding of how the transition is likely to unfold on the continent. The future of energy transition minerals in Africa will be shaped not only by geology or by the policy priorities of importing economies, but also by the political, economic, and social conditions under which extraction takes place. In this context, artisanal and small-scale mining is not a peripheral consideration. It is one of the areas in which the practical terms of the transition are already being negotiated.

Across Africa, there is no single pattern of ASM in energy transition minerals, but rather a highly uneven and evolving landscape. ETM-related ASM is taking shape across distinct mineral systems, political economies, and regulatory environments, ranging from the conflict-affected 3T corridors of the Great Lakes Region, to cobalt and copper in the Central African Copperbelt, to emerging lithium, graphite, and other mineral frontiers in Southern and West Africa. This variation is significant. It indicates the limits of universal assumptions, imported governance templates, and standardized responsible sourcing models. It also points to a broader question that is likely to become increasingly important: not whether ASM forms part of ETM supply chains, but how it is incorporated, by whom, and under what conditions.

Many challenges associated with ASM are not incidental to the sector; they stem from the conditions in which it operates. Informality, legal ambiguity, insecure land access, weak state support, limited market access, and exclusion from finance are not merely background constraints. Together, they form a governance environment that can produce and sustain environmental harm, hazardous labor conditions, exploitative trading arrangements, illicit flows, and conflict-prone relations with large-scale mining. Formalization remains important, but it should not be treated as a technical end point in and of itself. When disconnected from land access, finance, market structures, administrative accessibility, and local legitimacy, formalization risks becoming less a pathway to improvement than a narrow mechanism for sorting and exclusion.

There is, additionally, a wider tension within current ETM governance. Much of the international debate is structured around urgency: securing supply, meeting climate targets, reducing dependency, and de-risking value chains. At the same time, the evidence reviewed here suggests that accelerated mineral development,

if pursued without adequate attention to inclusion, may reproduce many of the established asymmetries of extractive development. African countries may remain concentrated in low-value positions within supply chains. For instance, mining communities may continue to bear disproportionate environmental and social costs; ASM operators may face growing expectations of compliance while remaining excluded from the conditions necessary to meet them. The issue, therefore, is not only whether ETM governance becomes more efficient, but also whether it becomes more equitable and developmentally meaningful in the places where extraction is occurring.

This is also why this paper's treatment of "criticality" is important. The term is often used as if its meaning were self-evident, yet the research indicates that mineral priority is always defined from a particular vantage point. Different actors assign strategic value through different logics: industrial policy, climate mitigation, geopolitical risk, fiscal potential, or livelihood significance. Recognizing this helps clarify why African priorities (relating, for instance, to beneficiation, value addition, public revenues, employment, and local control) are central to the legitimacy of the energy transition.

Another important implication concerns the evidence base itself. One of the clearest themes running through this paper is the extent of the current knowledge gap. Compared with artisanal gold mining, ETM-related ASM remains under-documented, unevenly measured, and often discussed through inference rather than robust empirical evidence. This does not suggest that the associated risks are overstated; rather, it indicates that they are often insufficiently specified. Better evidence is therefore not only a research priority, but also a governance requirement. In its absence, policy is likely to oscillate between neglect and overgeneralization, neither of which is well suited to a sector that is both economically significant and highly sensitive to poorly designed intervention.

ASM should not be understood merely as the informal underside of the energy transition. It is already part of the way in which the transition is materializing on the ground in many African contexts. The relevant question, therefore, is not whether ASM should be present in ETM supply chains, but whether it will continue to be marginalized within them or become more visible, recognized, and supported as a legitimate part of mineral governance. That question extends beyond compliance alone. It concerns the broader character of the transition itself: whether it is organized primarily around securing minerals more efficiently, or whether it also creates more inclusive patterns of benefit, responsibility, and opportunity around their extraction.

If the energy transition is to be credible as well as rapid, it will need to engage seriously with that reality. This does not require romanticizing ASM or minimizing the significant environmental, labor, and governance concerns currently associated with it. It requires recognizing the sector for what it is: heterogeneous, often precarious, at times deeply problematic, but nonetheless central to the political economy of extraction in many African countries. On that basis, ASM is best understood not as a side issue in ETM governance, but as one of the areas through which its broader developmental and political legitimacy will be tested.

FURTHER READING

AfricaMaVal, 2023. “*Country profiles of artisanal and small-scale — ECRM mine production and processing developments*”, EU-Africa Partnership on Raw Material Value Chains (AfricaMaVal). Horizon Europe Framework Programme (HORIZON). Available at: https://africamaval.eu/wp-content/uploads/2024/04/AfricaMaVal_BGR_D1.4_ASM_country_profiles_CRM.pdf.

This report provides a focused overview of 18 countries where ASM recovers minerals listed in the European Critical Raw Materials (ECRM) framework. It provides extensive elaboration about geological context, production, trade, ASM context, and extraction techniques, for each country in a standard format—including, at times, key challenges (including environmental) as well as future prospects. Its purpose is to provide a structured and technical resource for informed engagement.

EPRM, 2025. “Fostering responsible artisanal and small-scale mining for reliable mineral supply chains”, European Partnership for Responsible Minerals (EPRM). Available at: <https://europeanpartnership-responsibleminerals.eu/attachment/entity/91fb9670-e4bc-4998-bbe4-343277dfbbeb>.

This white paper outlines how responsible ASM can contribute to secure, ethical mineral supply chains, particularly for EU industries. It details barriers to formalization, highlights best practices in due diligence and impact investment, and offers policy and private sector recommendations to improve ASM governance, traceability, and local development outcomes in producer countries.

AMDC, 2024. “Africa’s Green Minerals Strategy”, In: African Union’s Mineral Resources Strategy for the Just Transition and Decarbonising Future. African Minerals Development Centre | An Entity of the African Union (AU). Available at: https://au.int/sites/default/files/documents/44539-doc-AGMS_Final_doc.pdf. See African Minerals and Energy Resources Classification and Management System Here: https://au.int/sites/default/files/documents/44206-doc-AMREC_-_English_-document_.pdf.

This strategy outlines Africa’s collective vision for harnessing green minerals in support of climate goals and industrialisation. It situates ASM within broader value chain development, advocating formalization, beneficiation, and alignment with the African Green Industrialisation Initiative. The report emphasises continental ownership, regional cooperation, and governance reforms to unlock ASM’s development potential.

IISD/IGF, 2024. “Artisanal and Small-Scale Mining and Critical Minerals”, Available at: <https://www.iisd.org/system/files/2024-12/artisanal-small-scale-mining-critical-minerals.pdf>.

This briefing note explores the role of ASM in critical mineral supply, highlighting both opportunities and governance challenges. It presents policy recommendations on formalization, environmental safeguards, and social inclusion. The paper encourages governments and donors to integrate ASM into critical minerals strategies to ensure just and secure energy transitions.

APPENDIX A—CRM/CM/SM/GM LIST

The following table compares materials included on different geographies' lists of “critical,” “raw,” “strategic,” or “green” minerals. See section 1.2 for a discussion of these various definitions. “By-product” here refers to intentional derivative materials, not unwanted waste products.

Mineral/Material	By-product	EU ¹⁰	US ¹¹	AU ¹²	China ¹³	ASM Activity (Africa Only)
1 Aluminum (Bauxite)	Gallium, Vanadium	YES	YES	YES	YES	None/Minimal
2 Antimony	Gold, Silver	YES	YES	NO	YES	None/Minimal
3 Arsenic	Gold, Copper	YES	YES	NO	YES	None/Minimal
4 Barite (Baryte)	Lead, Zinc	YES	YES	NO	YES	Prevalent
5 Beryllium	Fluorspar, Lithium	YES	YES	NO	YES	None/Minimal
6 Bismuth	Lead, Tungsten	YES	YES	NO	YES	None/Minimal
7 Borates	Lithium, Potash	YES	NO	NO	NO	None/Minimal
8 Cerium (REE)	Other Light REEs (LREEs)	NO	YES	NO	YES	Prevalent
9 Cesium	Lithium, Tantalum	NO	YES	NO	YES	None/Minimal
10 Chromium	Nickel, Platinum	NO	YES	YES	YES	Prevalent (Zimbabwe)
11 Cobalt	Copper, Nickel	YES	YES	YES	YES	Prevalent
12 Coking Coal	Coal Bed Methane	YES	NO	NO	NO	None/Minimal
13 Copper	Gold, Silver, Molybdenum	YES	NO	YES	YES	Prevalent
14 Dysprosium (REE)	Other Heavy REEs (HREEs)	NO	YES	NO	YES	Prevalent
15 Erbium (REE)	Other HREEs	NO	YES	NO	NO	Prevalent
16 Europium (REE)	Other HREEs	NO	YES	NO	YES	Prevalent
17 Feldspar	Quartz, Mica	YES	NO	NO	NO	Prevalent
18 Fluorspar	Lead, Zinc	YES	YES	NO	YES	Prevalent (Kenya)
19 Gadolinium (REE)	Other HREEs	NO	YES	NO	YES	Prevalent
20 Gallium	Aluminum, Zinc	YES	YES	NO	YES	None/Minimal

10 “Fifth List 2023 of Critical Raw Materials for the EU.” (European Commission 2023). https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en#fifth-list-2023-of-critical-raw-materials-for-the-eu.

11 “2025 List of Critical Minerals.” U.S. Geological Survey, U.S. Department of Interior. <https://www.usgs.gov/programs/mineral-resources-program/science/about-2025-list-critical-minerals>.

12 African Green Minerals Strategy. African Minerals Development Centre, p. 13. https://au.int/sites/default/files/documents/44539-doc-AGMS_Final_doc.pdf.

13 China's catalogue of strategic minerals is not public, so the categorizations listed here are inferred from: “China's Curbs on Exports of Strategic Minerals.” Reuters, 15 August 2024. <https://www.reuters.com/markets/commodities/chinas-curbs-exports-strategic-minerals-2024-08-15/>; and “What Does China's Undisclosed Strategic Minerals Catalogue Reveal About Its Industrial Priorities?” by Patrik Andersson, Swedish National China Centre, 28 April 2026. <https://kinacentrum.se/en/publications/what-does-chinas-undisclosed-strategic-minerals-catalogue-reveal-about-its-industrial-priorities/>.

Mineral/Material		By-product	EU ¹⁰	US ¹¹	AU ¹²	China ¹³	ASM Activity (Africa Only)
21	Germanium	Zinc, Lead	YES	YES	NO	YES	None/Minimal
22	Graphite (Natural)	None significant	YES	YES	YES	YES	Prevalent (Madagascar)
23	Hafnium	Zirconium	YES	YES	NO	YES	None/Minimal
24	Helium	Natural Gas	YES	NO	NO	NO	None/Minimal
25	Holmium	Other HREEs	NO	YES	NO	NO	Prevalent
26	Indium	Zinc	YES	YES	NO	YES	None/Minimal
27	Iridium	Platinum, Nickel	NO	YES	NO	NO	None/Minimal
28	Lanthanum	Other LREEs	NO	YES	NO	YES	Prevalent
29	Lithium	Cesium, Tantalum	YES	YES	YES	YES	Prevalent
30	Lutetium	Other HREEs	NO	YES	NO	NO	Prevalent
31	Magnesite	None significant	YES	NO	NO	NO	None/Minimal
32	Magnesium	None significant	YES	YES	NO	NO	None/Minimal
33	Manganese	Iron	YES	YES	YES	YES	None/Minimal
34	Neodymium	LREEs	NO	YES	NO	YES	Prevalent
35	Nickel	Cobalt, Copper	YES	YES	YES	YES	Prevalent (Madagascar)
36	Niobium	Tantalum	YES	YES	NO	NO	Prevalent (DR Congo)
37	Palladium (as PGM for EU)	Platinum, Nickel	YES	YES	YES	NO	None/Minimal
38	Phosphate Rock	Uranium (in some deposits)	YES	NO	YES	NO	None/Minimal
39	Phosphorus	None significant	YES	NO	NO	YES	None/Minimal
40	Platinum (as PGM for EU)	Palladium, Nickel	YES	YES	YES	NO	None/Minimal
41	Praseodymium (REE)	Other LREEs	NO	YES	NO	YES	Prevalent
42	REE (Heavy) individual REEs listed separately for US	Other HREEs	YES	YES	YES	NO	Prevalent
43	REE (Light) individual REEs listed separately for US	Other LREEs	YES	YES	YES	NO	Prevalent
44	Rhodium (as PGM for EU)	Platinum, Nickel	YES	YES	YES	NO	None/Minimal
45	Ribidium	Cesium	NO	YES	NO	NO	None/Minimal
46	Ruthenium (as PGM for EU)	Platinum, Nickel	YES	YES	YES	NO	None/Minimal
47	Samarium	Other LREEs	NO	YES	NO	YES	Prevalent
48	Scandium	Uranium, Thorium	YES	YES	NO	YES	Prevalent
49	Silicon Metal	None significant	YES	NO	NO	YES	None/Minimal

Mineral/Material		By-product	EU ¹⁰	US ¹¹	AU ¹²	China ¹³	ASM Activity (Africa Only)
50	Strontium	None significant	YES	NO	NO	NO	None/Minimal
51	Tantalum	Niobium	YES	YES	NO	YES	Prevalent (Rwanda/DR Congo)
52	Tellurium	Copper, Gold	NO	YES	NO	NO	None/Minimal
53	Terbium (REE)	Other HREEs	NO	YES	NO	YES	Prevalent
54	Thulium (REE)	Other HREEs	NO	YES	NO	NO	Prevalent
55	Tin	Tantalum, Tungsten	NO	YES	NO	YES	Prevalent (Rwanda/DR Congo)
56	Titanium	Zirconium	YES	YES	YES	YES	Prevalent (Kenya/Mozambique)
57	Tungsten	Tin	YES	YES	NO	YES	Prevalent (Rwanda/DR Congo)
58	Vanadium	Uranium	YES	YES	YES	YES	None/Minimal
59	Ytterbium (REE)	Other HREEs	NO	YES	NO	NO	Prevalent
60	Yttrium (REE)	Other HREEs	NO	YES	NO	YES	Prevalent
61	Zinc	Germanium, Cadmium, Indium	NO	YES	YES	YES	Prevalent (Nigeria/DR Congo)
62	Zirconium	Hafnium	NO	YES	NO	YES	Prevalent (Nigeria/Sierra Leone)

APPENDIX B—COUNTRY PROFILES

The country profiles presented here offer a concise overview of ASM-ETM in select nations. The information provided in each profile derives from different sources; relevant ones are referenced in the narrative text either preceding or following the visualization. The map data is not precise, but instead gives a general indication of locations (such as biodiversity hot spots). See below for a detailed explanation. The country profiles consist of the following information:

MINERAL DATA

The choropleth map visualizes the geographic distribution of critical minerals reported to be recovered via ASM (not industrial). The maps are administrative, indicating either regions, states, or districts (depending on the country). Gold mining, although often prevalent, is not explicitly indicated on the map (although its presence has been included in the underlying data used to generate the choropleth values, as disaggregation can be challenging).



BIODIVERSITY HOT SPOTS

The biodiversity hot spot data indicates selected known conservation areas, national parks, reserves, and generally biodiverse areas reportedly affected by, or at risk of being affected by, ASM activities. It does not indicate all areas affected by ASM

or at risk, and the locations are indicative rather than precise. Notably, gold mining constitutes the most serious ASM-related threat to biodiversity, and many areas indicated on the map may be impacted by critical mineral and/or gold mining. Separating detailed sources of pressure would require additional site-specific research beyond the scope of this paper.



CONFLICT DATA

Similarly, the visualized conflict data is indicative, based on currently active open conflict areas where ASM is prevalent.

FORMALIZATION DATA

On the basis of our analysis, we indicate each country’s formalization level (low, medium, or high) as well as what formalization category (see section 1.3) befits each country best. “Formalization Tools” are based on available information (which may sometimes be limited) about key ASM engagement components.



Reportedly In Place
/Well Functioning



Partially in Place
/Not Well Functioning



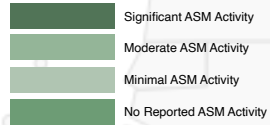
Reportedly Not in Place
/No Data Found

MAIN ESG CONCERNS

Also on the basis of our own analysis and available information, each country’s ESG assessment provides a generic overview of key concerns (also rated as low, medium, or high) and whether issues seem to be worsening (↑), stable (→), or improving (↓). It has not always been possible to differentiate among concerns relating to gold and critical minerals, making it a more general overview than an ETM-specific one.



BURUNDI

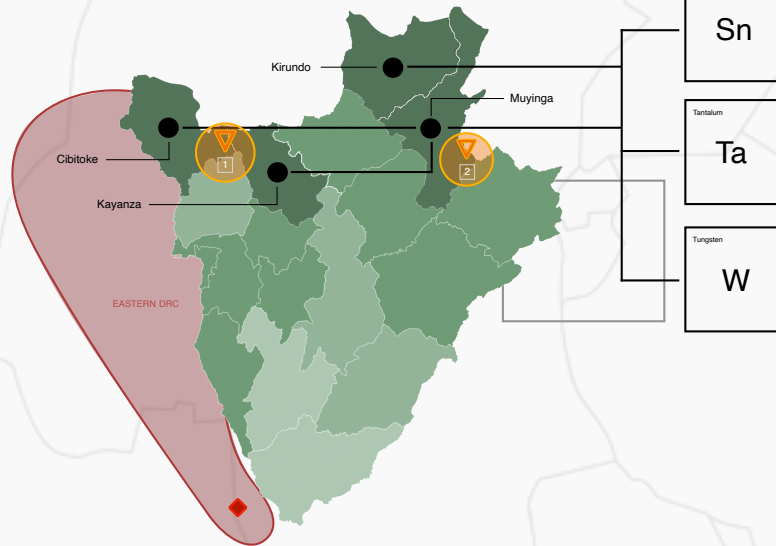


Key Biodiversity Hotspots At Risk

- 1 | Kibira NP (Nyungwe Ecosystem)
- 2 | Ruvubu NP



ASM in Conflict-Affected Areas



ASM Formalization Level



ASM Legal Status:

PARTIALLY RECOGNIZED/LACKING REGULATION/LEGITIMATE



Legal Recognition Legitimacy



ASM Strategy Engagement

Formalization Tools in Place



Mining Cooperatives Legal Form



ASM Zones (AEZs) Land Rights



Traceability Transparency

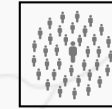


Formalized ASM Market Fair Trade



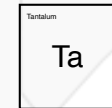
Extension Services Professionalization

Population + ASM Workforce



Population | • 13,800,000
Workforce | ASM • ~34,000
Dependents | ASM • ~200,000

Main ASM Mineral (CM Cat.)



% of World Output Negligible
In-Country Processing
Legal Exports
ASM Co-products

*Tin (Sn) | Tungsten (W)

Main ESG Concerns

HIGH MEDIUM LOW



Environmental Degradation



Child Labor & Unsafe Working Conditions



Informality & Poor Regulatory Oversight



Conflict and Land Tenure Disputes



Illicit Trade

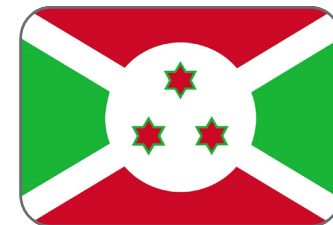
Key Government Actors (ASM)



Ministry of Hydraulics, Energy and Mines
The main authority responsible for issuing mining licenses, regulating the sector, and overseeing ASM formalization efforts, including the implementation of mining codes and policies.



Bureau Burundais des Mines et de la Géologie
The national geological service that supports mineral exploration, provides technical advice, and maintains geological data relevant to mining operations, including ASM zones.



COUNTRY PROFILE I: BURUNDI

DATA LIMITATIONS

Comprehensive and up-to-date data on ASM activities in Burundi is limited. Most reports are dated 2015/2016, with a few notable sources more recent. This limitation includes disaggregated production and trade statistics, workforce numbers, and, above all, environmental impacts.

ENERGY TRANSITION MINERALS SUSCEPTIBLE TO ASM

Burundi's ASM sector targets primarily tin, tantalum, and tungsten (3Ts), extracted from pegmatite-hosted deposits within the Kibaran Belt (stretching across the Great Lakes Region). The 3T in Burundi is usually found in mixed concentrates (common across the Kibaran Belt). While gold dominates by value and number of people involved, the 3Ts remain a key ASM-linked ETM (see AfricaMaVal, 2023). No in-country processing was found to occur via ASM.

REGULATORY OVERVIEW

ASM is legally recognized in the 2013 Mining Code, which restricts licenses to cooperatives that must sell to authorized traders. Due to a lack of enforcement and weak governance, much of the sector still operates informally or semi-informally, with cooperatives often acting as intermediaries without delivering substantial benefits to miners or supporting responsible mining and labor conditions (ibid.).

MAIN ENVIRONMENTAL PRESSURES

Extensive historical, largely unregulated operations have resulted in significant mine waste, with an example being four million tonnes of waste stockpiled at the Kivuvu mine, posing serious environmental and ecological challenges (ibid.). Deforestation, soil erosion, river turbidity, and chemical contamination within and around the Nile Basin and Albertine Rift have been reported, exacerbated by (but not exclusively because of) artisanal mining (Bandushubwenge et al., 2009).

OTHER ESG CONCERNS

No verified data has been found on issues such as child labor; however, a 2021 US Department of Labor report notes that it occurs in gold mining (U.S. Department of Labor, 2021). Illicit trade and smuggling are, however, long-standing issues—Burundi has been a transit hot spot for smuggled 3T and gold (mainly from eastern DR Congo, transiting to Rwanda) (Abbott et al., 2018).

KEY PROJECTS AND CIVIL SOCIETY

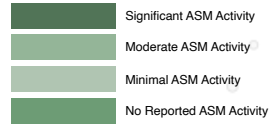
The iTSCi (tin traceability) program has been operational since 2014 but has only certified specific segments of Burundi's 3T supply, leaving data gaps and undermining anti-smuggling efforts. iTSCi is typically implemented in conjunction with the host country's government.

FUTURE ASM-ETM OPPORTUNITIES

Recent indications suggest that Burundi's ASM sector is stagnant, especially in the 3T space. Opportunities have been identified in reprocessing the millions of tonnes of still mineral-rich tailings left unmanaged across various sites, creating both economic opportunities and opportunities to mitigate environmental impact (AfricaMaVal, 2023). Much, however, depends on the Burundian government's ability to formalize, which is currently considered low (ibid.).



DRC

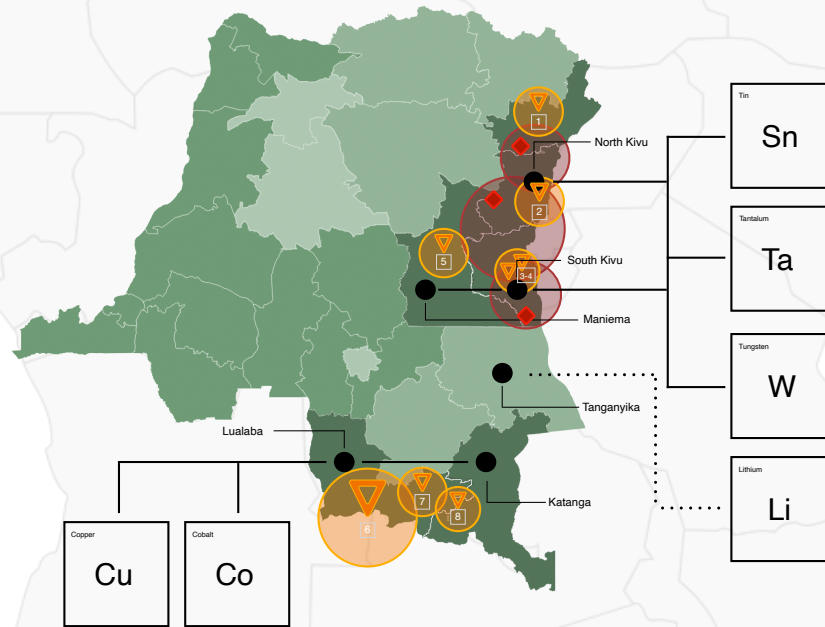


Key Biodiversity Hotspots At Risk

- 1 | Okapi Wildlife Reserve (Ituri)
- 2 | Virunga NP (N. Kivu)
- 3 | Kahuzi-Biega NP (S. Kivu)
- 4 | Itombwe Nature Reserve (S. Kivu)
- 5 | Lomami NP (Maniema)
- 6 | Mkombo Woodlands (Lualaba)
- 7 | Lufira River Basin (Katanga)
- 8 | Upemba NP (Katanga)



ASM in Conflict-Affected Areas

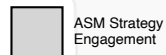
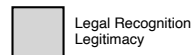


ASM Formalization Level

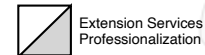
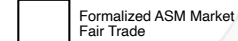
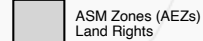


ASM Legal Status:

PARTIALLY RECOGNIZED/LACKING REGULATION/ESTIMATE



Formalization Tools in Place

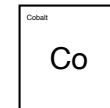


Population + ASM Workforce



Population | • 106,000,000
Workforce | ASM • ~2,000,000
Dependents | ASM • ~10,000,000

Main ASM Mineral (CM Cat.)



74% of World Output (ASM ~15%)
In-Country Processing
Legal Exports
ASM Co-products

*Copper (Cu) | Nickel (Ni)

Main ESG Concerns



- Environmental Degradation
- Child Labor & Unsafe Working Conditions
- Informality & Poor Regulatory Oversight
- Conflict and Land Tenure Disputes
- Illicit Trade

Key Government Actors (ASM)



Gecamines
Allocates mining permits and designates ZEAs (AEZs), which are the only legal areas where ASM can operate. Plays a critical role in enabling or constraining access to legal ASM zones.



Ministry of Mines/SAEMAPE
Primary government agency responsible for registering miners, providing technical assistance, organizing cooperatives, and overseeing formalization efforts at ASM sites.

Other



EGC
State-owned company mandated to purchase, process, and market all ASM-produced cobalt under controlled, traceable, and responsible conditions. Focused on formalizing the ASM cobalt supply chain.

THE IMPACT FACILITY



COUNTRY PROFILE 2: DR CONGO

DATA LIMITATIONS

DR Congo's copper-cobalt mining has received increasing attention in recent years, followed by a series of assessments on issues related to ASM. Given the informality of the sector, however, data usually faces several limitations, for example relating to disaggregation, especially in the east.

ENERGY TRANSITION MINERALS SUSCEPTIBLE TO ASM

DR Congo hosts what is probably the largest ASM sector in Africa. ASM contributes 10–15 percent of the country's cobalt output, which is more than 70 percent of the world's supply (mined alongside copper). It also produced about 40 percent of the world's coltan (tantalum ore) in 2023, mined in the east alongside tin and tungsten. While significant lithium reserves exist in Tanganyika, no ASM has been reported there to date. No in-country processing occurs via ASM (AfricaMaVal, 2023).

REGULATORY OVERVIEW

ASM is legally recognized in the 2018 revision of the Mining Code, introduced to formalize ASM through the registration of cooperatives. The code also increased royalties on cobalt. Very few cooperatives have been licensed to date, and informality persists. In 2019, the Entreprise Générale du Cobalt (EGC) was established to drive formalization and obtain a purchasing monopoly on ASM-mined cobalt, although with limited success so far (Umpula and Bisil, 2023).

MAIN ENVIRONMENTAL PRESSURES

Sensitive ecosystems such as the Okapi Reserve have reportedly experienced significant deforestation and habitat loss (Tatoutchoup, 2025), and riverbanks are severely affected by mercury pollution (in gold mining) and acid drainage from cobalt soils, affecting areas like the Lualaba/Lufira River Basin (Balasha and Peša, 2023). In Kolwezi, a hot spot for artisanal cobalt-copper mining, ASM reworks uranium-laced tailings, exposing communities to elevated radon levels and radioactive dust (National Geographic, 2023).

OTHER ESG CONCERNS

In the east, conflict has recently escalated, further intensifying both massive humanitarian challenges and major worries about the vast diversity of ecosystems located in conflict-affected areas. Armed groups have in past decades exploited mining operations—imposing illegal taxes, erecting roadblocks, and perpetuating widespread insecurity (de Brier and Walschot, 2024). Child labor is a critical concern across the entire country, with an estimated 40,000 children working in cobalt-copper mines (Amnesty International, 2016).

KEY PROJECTS AND CIVIL SOCIETY

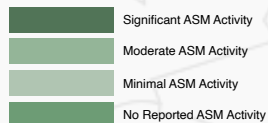
The Fair Cobalt Alliance (FCA) drives a multi-stakeholder initiative in Kolwezi, having recently established a consortium comprising EGC, Cobalt for Development (C4D), and the Responsible Minerals Initiative (RMI), all of which have projects in the area. Other notable organizations include Pact, Trafigura (South), and IPIS (East).

FUTURE ASM-ETM OPPORTUNITIES

DR Congo's vast mineral wealth presents significant opportunities for ASM, especially in cobalt-copper and lithium, also depending on the success of the multiple efforts currently underway to formalize ASM and ensure inclusive regulation for future ETM extraction.

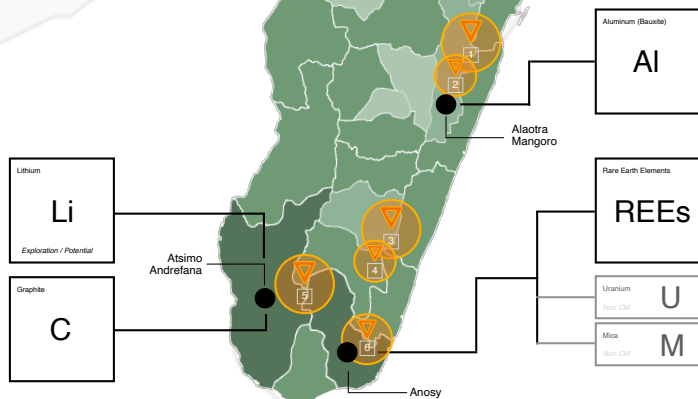


MADAGASCAR



Key Biodiversity Hotspots At Risk

- 1 | Ankeniheny-Zahamena Corridor
- 2 | Zahamena NP
- 3 | Andringitra NP
- 4 | Ambatovy Reserve
- 5 | Iakaka-Sakaratra Corridor
- 6 | Tsilongamabarika Forest

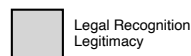


ASM Formalization Level

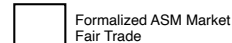
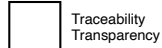
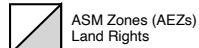


ASM Legal Status:

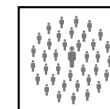
PARTIALLY RECOGNIZED/LACKING REGULATION/LEGITIMATE



Formalization Tools in Place

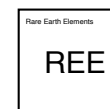


Population + ASM Workforce



Population | 32,700,000
Workforce | ASM • 500,000+
Dependents | ASM • 2,000,000+

Main ASM Mineral (CM Cat.)



% of World Output Negligible
In-Country Processing
Legal Exports
ASM Co-products

*Uranium (U)

Main ESG Concerns



- Environmental Degradation
- Child Labor & Unsafe Working Conditions
- Informality & Poor Regulatory Oversight
- Conflict and Land Tenure Disputes
- Illicit Trade

Key Government Actors (ASM)

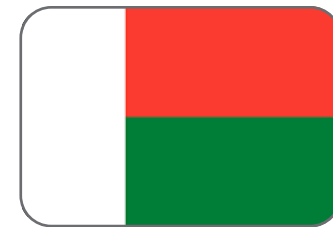


Bureau du Cadastre Minier de Madagascar
Responsible for allocating mining permits and managing the cadastre system, including permits for artisanal miners. Plays a key role in legal access to mining areas, although delays and overlaps with industrial permits often disadvantage ASM.

Ministère des Mines et des Ressources Stratégiques
Sets mining policy and oversees the legal and regulatory environment for both industrial and artisanal mining. Also responsible for developing ASM strategies and coordinating formalization efforts, although capacity and outreach are limited.

Bureau National de Gestion de l'Or
Regulates and monitors gold trading, much of which originates from ASM. Though its remit is focused on gold, its actions significantly affect ASM market dynamics, especially in terms of legal trade and smuggling control.

THE IMPACT FACILITY



COUNTRY PROFILE 3: MADAGASCAR

DATA LIMITATIONS

There is very limited, disaggregated data on ETM production in Madagascar. Where data exists, it typically explores gold and gemstone mining, occasionally including mica.

ENERGY TRANSITION MINERALS SUSCEPTIBLE TO ASM

Madagascar hosts a diverse range of ETMs, though not all are mined via ASM. Some activities are reported for tantalum, lithium (spodumene), barite, copper-cobalt, manganese, and rare earth elements (REEs). These minerals are mined mainly through pegmatites or sedimentary basins (alluvial). Mining has become the second-largest employer in Madagascar, after agriculture, largely via non-ETMs like gold, gemstones, and mica (AfricaMaVal, 2023).

REGULATORY OVERVIEW

ASM is regulated through small-scale mining permits known as PRE—Permis de Réserve Exclusive. These permits are issued by the Bureau du Cadastre Minier de Madagascar (BCMM), only to Malagasy nationals. However, formalization has been limited due to bureaucratic delays in issuing permits and limited state presence in remote regions where ASM is prevalent (ibid.).

MAIN ENVIRONMENTAL PRESSURES

Madagascar is home to some of the world's most unique biodiversity and ecosystems. While reports are sometimes unsubstantiated (see section 3.2, “Ecological Harm”), mining contributes to deforestation, with Madagascar tree cover decreasing by 32 percent in the past 25 years alone (Global Forest Watch, 2025). Most ETM mining is conducted through pegmatite extraction, and unreclaimed pits are often left behind, resulting in significant waste that can lead to erosion and sedimentation. However, very little research has been done on the subject, making it hard to find impact assessments that are not related to gold or gemstones.

OTHER ESG CONCERNS

While some reports note common ASM-related challenges such as health and safety, conflict between LSM and ASM over land, and occurrences of child labor (see, e.g., IIED, n.d.), we have found little to no viable research on ETM-specific issues.

KEY PROJECTS AND CIVIL SOCIETY

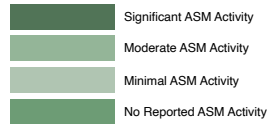
Organizations such as Pact (via Delve Initiatives), the International Institute for Environment and Development (IIED), and the World Wildlife Fund (WWF) engage with Madagascar's ASM sector, though mostly non-ETM. However, overlaps may exist (or develop in the future). No direct work linked to ETM was found.

FUTURE ASM-ETM OPPORTUNITIES

Madagascar pegmatite belts offer untapped opportunities for formalized ASM production. Lithium and REE mining will continue to increase, but there are significant risks unless Madagascar resolves bureaucratic hurdles to licensing and addresses the broad environmental threats exemplified by previous mining rushes in Madagascar.



MOROCCO



Key Biodiversity Hotspots At Risk

No Data Found

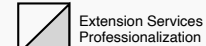
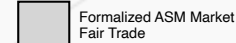
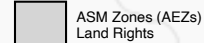
ASM Formalization Level



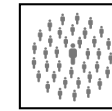
ASM Legal Status:



Formalization Tools in Place



Population + ASM Workforce

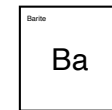


Population | 38,000,000

Workforce | ASM 10,000+

Dependents | ASM N/A

Main ASM Mineral (CM Cat.)



10% of World Output (ASM 5%)

In-Country Processing

Legal Exports

None ASM Co-products

Main ESG Concerns



Environmental Degradation

Child Labor & Unsafe Working Conditions

Informality & Poor Regulatory Oversight

Conflict and Land Tenure Disputes

Illicit Trade

Key Government Actors (ASM)

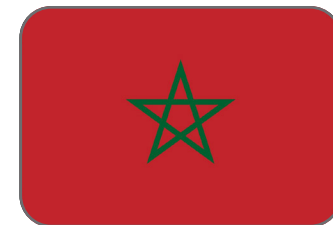


Ministère de la Transition Énergétique et du Développement Durable
Oversees the national mining strategy, including reforms to modernize and formalize ASM. The Ministry is responsible for defining artisanal zones and facilitating small-scale operators' legal access to resources, particularly in barite, fluorspar, and cobalt sectors.



Office National des Hydrocarbures et des Mines
Provides geological data and mapping crucial for identifying ASM-suitable deposits. ONHYM supports exploration and helps guide the allocation of resources toward zones with artisanal potential, although its focus is primarily upstream and industrial.





COUNTRY PROFILE 4: MOROCCO

DATA LIMITATIONS

As indicated below, very little information exists concerning Morocco's ASM sector, which is surprising given the extent of ASM activities in barite extraction.

ENERGY TRANSITION MINERALS SUSCEPTIBLE TO ASM

ASM activities in Morocco primarily involve the extraction of barite, 50 percent of Morocco's output originating from ASM (+/- 7.5 percent of global production). All barite is sold as found to government buying centers, meaning no beneficiation occurs. Minimal (and unspecified) cobalt, lead, zinc, and fluorspar mining also occurs (AfricaMaVal, 2023). Morocco also holds 77 percent of the world's known phosphate reserves, though none of it is mined via ASM (UNECA, n.d).

REGULATORY OVERVIEW

A special zone designated exclusively for ASM operations has been established, exempt from all requirements of the main mining regulation of 1951, which covers the rest of the country and sector. This zone is called Zone Centrale d'Achat et de Développement de la Région Minière du Tafilalet et de Figuig (CADETAF), which was also created as a public institution reporting to the Ministry of Energy, Mines, Water and Environment (Delve, 2019).

MAIN ENVIRONMENTAL PRESSURES

No ETM-specific information was found.

OTHER ESG CONCERNS

No ETM-specific information was found.

KEY PROJECTS AND CIVIL SOCIETY

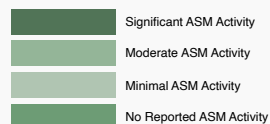
No ETM-specific information was found.

FUTURE ASM-ETM OPPORTUNITIES

As an already important player in the supply of barite (currently imported mainly by the petroleum industry), Morocco's ASM sector could expand its supply by introducing more sophisticated extraction and processing methods, which are presently rudimentary. However, because most mining in the east occurs in desert areas, and because of general water scarcity in the country, processing seems unlikely (AfricaMaVal, 2023).



MOZAMBIQUE



Key Biodiversity Hotspots At Risk

- 1 | Mount Mabu
- 2 | Gorongosa National Park
- 3 | Chimanimani Reserve



ASM in Conflict-Affected Areas

ASM Formalization Level



ASM Legal Status:

PARTIALLY RECOGNIZED/LACKING REGULATION/ESTIMATE



Legal Recognition Legitimacy



ASM Strategy Engagement

Formalization Tools in Place



Mining Cooperatives Legal Form



ASM Zones (AEZs) Land Rights



Traceability Transparency



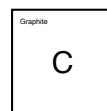
Mercury Free Initiatives Environmental



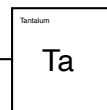
Formalized ASM Market Fair Trade



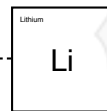
Extension Services Professionalization



C

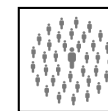


Ta



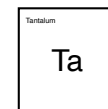
Li

Population + ASM Workforce



Population | 34,000,000
Workforce | ASM ~200,000
Dependents | ASM ~1,000,000+

Main ASM Mineral (CM Cat.)



No Production Data Exists

In-Country Processing
Legal Exports
None ASM Co-products

Main ESG Concerns

HIGH MEDIUM LOW

- Environmental Degradation
- Child Labor & Unsafe Working Conditions
- Informality & Poor Regulatory Oversight
- Conflict and Land Tenure Disputes
- Illicit Trade

Key Government Actors (ASM)



Ministry of Mineral Resources and Energy (MIREME)
MIREME is the principal government body regulating the mining sector, including ASM. Responsible for granting mining concessions and developing policies to formalize and monitor ASM activities. It also leads efforts to integrate ASM into national strategies.



Instituto Nacional de Minas (INAMI)
INAMI operates under MIREME and handles licence processing, mapping of ASM zones, and technical inspections. It plays a direct role in managing legal ASM areas, collecting data, and liaising with provincial offices to supervise small-scale operators.

Provincial Directorates of Mineral Resources and Energy
These decentralized offices of MIREME enforce mining regulations at the provincial level. They are the first point of contact for ASM communities, handling permit applications, inspections, and conflict resolution. DPMREs are crucial for ground-level engagement with artisanal miners, though often under-resourced.

THE
IMPACT
FACILITY



COUNTRY PROFILE 5: MOZAMBIQUE

DATA LIMITATIONS

Quantitative data on Mozambique's ETM production seems to be virtually absent. We have found no production or export figures connected to ASM, and environmental impacts are severely underreported.

ENERGY TRANSITION MINERALS SUSCEPTIBLE TO ASM

Mozambique's ASM sector extracts tantalum and niobium via pegmatites in Zambezia. Estimates indicate around 10–20 percent of the country's tantalite production originates from ASM. These minerals occur in association with lithium. Lithium extraction via ASM, however, is currently limited. About 100,000 to 200,000 individuals are estimated to be involved in ASM, about 60 percent of whom mine gold (Hilson et al., 2021). Graphite, found in conflict-affected Cabo Delgado, is mined mainly via LSM, but with adjacent ASM activities potentially occurring (AfricaMaVal, 2023).

REGULATORY OVERVIEW

The majority of Mozambican ASM occurs on government-owned land, without mining permits. The Instituto Nacional de Minas (INAMI) is responsible for regulating ASM. The government, however, rarely closes artisanal mines unless they are located on LSM concessions, instead trying to formalize the sector by building cooperatives (ibid.). The government has tried primarily to formalize gold mining operations, although it has lost momentum after three decades of virtually no licensing (Hilson et al., 2021).

MAIN ENVIRONMENTAL PRESSURES

The extraction of tantalum often involves shallow, surface-level digging into weathered pegmatites, often without post-mining rehabilitation. This has reportedly led to deforestation, though very little data exists as to the exact environmental implications of ASM beyond that of gold mining (which occurs extensively) (AfricaMaVal, 2023).

OTHER ESG CONCERNS

ASM occurs widely and sporadically in Cabo Delgado, primarily through the mining of gemstones (such as rubies), but is also potentially associated with graphite mining on industrial mining concessions. Cabo Delgado has a long history of insurgencies, with multiple armed groups operating in the area (Botha, 2024).

KEY PROJECTS AND CIVIL SOCIETY

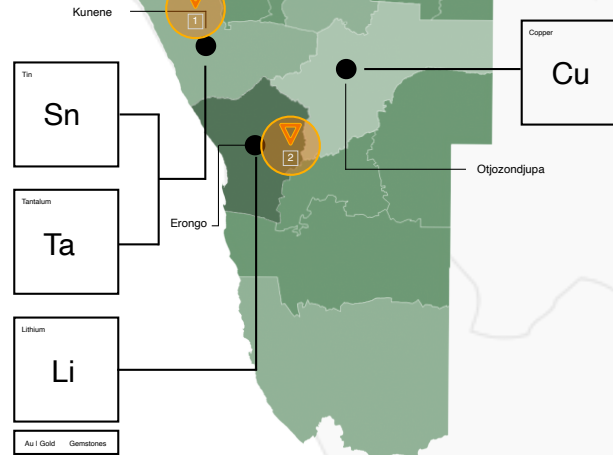
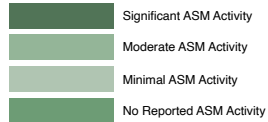
Formal support for ETM-focused ASM activities in Mozambique seems to be minimal to date.

FUTURE ASM-ETM OPPORTUNITIES

The pegmatite belts in Zambezia contain potential for lithium-bearing minerals, though they are difficult to mine via ASM. Graphite mining in Cabo Delgado may also become more prominent in the future, alongside tantalum, although prospects are unclear amid continued regional instability.



NAMIBIA



Key Biodiversity Hotspots At Risk
1 | Erongo Mountains / Brandberg
2 | Kaokoveld Centre of Endemism

ASM Formalization Level

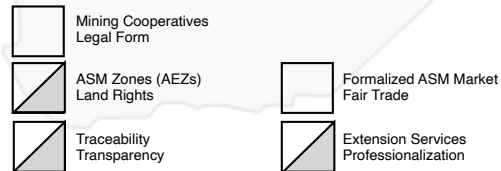


ASM Legal Status:

PARTIALLY RECOGNIZED/LACKING REGULATION/LEGITIMATE



Formalization Tools in Place

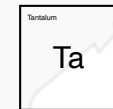


Population + ASM Workforce



Population | 2,700,000
Workforce | ASM <10,000
Dependents | ASM N/A

Main ASM Mineral (CM Cat.)



Limited Production Data
In-Country Processing
Legal Exports
ASM Co-products

Main ESG Concerns



Key Government Actors (ASM)



Ministry of Mines and Energy (MME)
MME is the lead authority for mining governance, including artisanal and small-scale mining. It sets policy, oversees sector development, and guides formalization efforts. It also collaborates with other ministries on mineral beneficiation and ASM support programs.



Mining Commissioner's Office
Operating under the MME, this office handles the issuance of mining claims, including small-scale mining licenses, and ensures compliance with legal and technical requirements. It is the main interface for ASM operators seeking legal status.



Environmental Commissioner (MEFT)
Responsible for granting Environmental Clearance Certificates (ECCs) for all mining activities, including ASM. It evaluates environmental impacts and ensures that artisanal miners comply with national environmental management standards.

THE IMPACT FACILITY



COUNTRY PROFILE 6: NAMIBIA

DATA LIMITATIONS

Namibia's ASM-ETM production is also notably underreported, with fragmented data and no disaggregation in government statistics on mineral supply. This is mainly because most ASM production (approximately 80 percent) is of precious stones rather than ETMs. This may change, however, as Namibia's ASM sector expands into ETMs.

ENERGY TRANSITION MINERALS SUSCEPTIBLE TO ASM

Compared with many neighboring countries, Namibia hosts a relatively small ASM sector with 5,000 individuals actively engaged in ASM. While most ASM occurs in gemstone mining, Namibia's ASM sector also extracts several ETMs, such as lithium, tin, tantalum, and some REE, copper, and fluor spar. These minerals are found in pegmatite-hosted deposits in Erongo and Kunene (AfricaMaVal, 2023). The tin and tantalum, together with fluorite and copper, constitute approximately 5 percent of small-scale mining (SSM) production.

REGULATORY OVERVIEW

The Minerals Policy of 2002 is considered highly favorable to SSM operators, with a dedicated division in the Ministry of Mines and Energy (MME) to support SSM operators in all aspects of mining procedures (ibid., IISD, 2018). Informality persists, however, mainly due to the high costs of obtaining an Environmental Clearance Certificate (ECC)—a prerequisite for obtaining an SSM license (AfricaMaVal, 2023). To address this issue, UNDP (in partnership with the Swedish EPA) has provided funding for district-scale Environmental Scoping Studies (ESS) in SSM hot spots, facilitating the acquisition of ECCs. Formal associations have formed primarily in Erongo, Kunene, and //Kharas; anything beyond that operates informally (ibid.; see also EGP 2022).

MAIN ENVIRONMENTAL PRESSURES

Large segments of Namibia are protected areas, with sensitive ecosystems and rare desert-adapted wildlife. While mining occurs in and between these protected areas, wildlife displacement, erosion, and so on are considered only medium to low risks (L Hauptfleisch et al., 2011)—though there are few recent studies. Mine closure remains an issue, since the penalty costs of leaving mines open are seemingly lower than the cost of closure (IGF, 2018).

OTHER ESG CONCERNS

No ETM-specific information was found.

KEY PROJECTS AND CIVIL SOCIETY

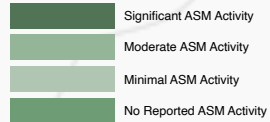
See the EGP, a UNDP-Sweden project, for an example of funding of ECCs. The IIED/IGF has also worked on developing codes of practice and training for ASM in southern Africa, though not specific to (even if inclusive of) Namibia.

FUTURE ASM-ETM OPPORTUNITIES

Namibia's ASM sector has the potential to become a notable player in the global lithium supply, should the government prioritize SSM scaling and improved extension services.



NIGERIA

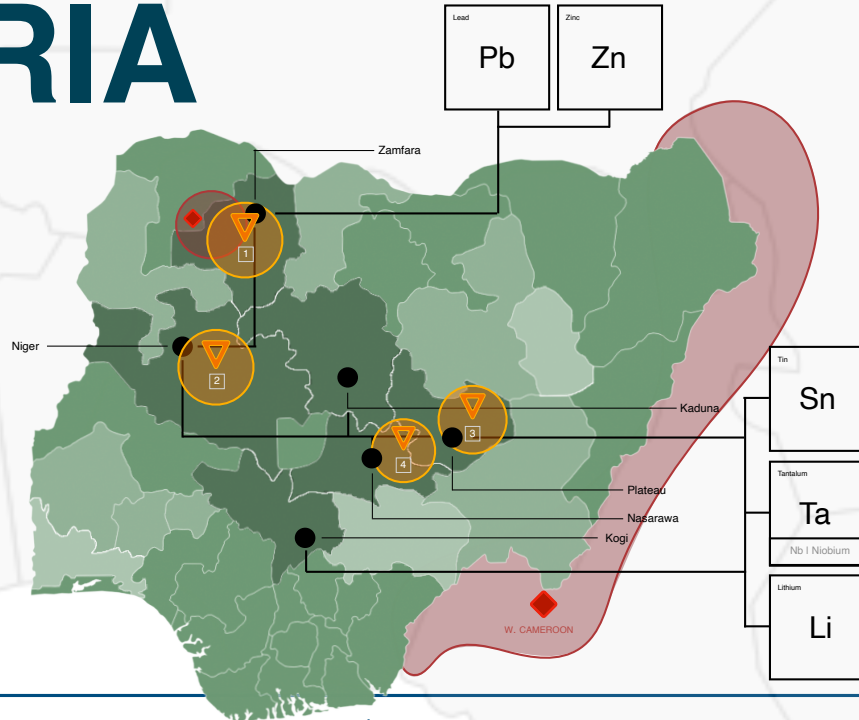


Key Biodiversity Hotspots At Risk

- 1 | Sudano-Sahelian Zone
- 2 | Kainji NP
- 3 | Montane Wetlands Systems
- 4 | Bakin Ayen, Forest-Savanna mosaic



ASM in Conflict-Affected Areas

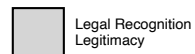


ASM Formalization Level

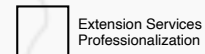
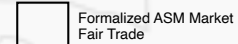
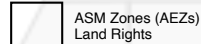


ASM Legal Status:

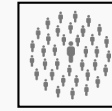
PARTIALLY RECOGNIZED/LACKING REGULATION/ESTIMATE



Formalization Tools in Place

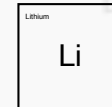


Population + ASM Workforce



Population | 223,000,000
Workforce | ASM • 2,000,000
Dependents | ASM • 10,000,000

Main ASM Mineral (CM Cat.)



Limited Production Data
In-Country Processing
Legal Exports
ASM Co-products

Main ESG Concerns



- Environmental Degradation
- Child Labor & Unsafe Working Conditions
- Informality & Poor Regulatory Oversight
- Conflict and Land Tenure Disputes
- Illicit Trade

Key Government Actors (ASM)



Ministry of Solid Minerals Development (MSMD)
The MSMD sets the overarching policy framework for Nigeria's mining sector, incl. strategies for ASM formalization and development. It leads initiatives to support artisanal miners, integrates ASM into national mineral value chains, and coordinates donor-supported interventions aimed at sector improvement.

Mining Cadastre Office (MCO)
MCO is responsible for issuing mining titles, including *Small Scale Mining Leases* and *Artisanal Mining Permits*. It manages the national mining cadastre, ensuring legal access to mining land and preventing title overlaps.

Mines Inspectorate Department (MID)
MID conducts site inspections, monitors operational compliance with safety and environmental standards, and enforces regulatory provisions. The MID plays a key role in monitoring working conditions, use of explosives, and environmental impacts—although capacity limitations often constrain its field presence.



COUNTRY PROFILE 7: NIGERIA

DATA LIMITATIONS

Specific production and workforce figures for ASM-ETM are virtually nonexistent for Nigeria, at least partially because of Nigeria's stark focus on oil and gas.

ENERGY TRANSITION MINERALS SUSCEPTIBLE TO ASM

Nigeria's ASM sector is surging. Estimates are that its workforce increased from 500,000 to 1.5 million in less than 10 years (AfricaMaVal, 2023). Today ASM represents virtually the entire mining sector in Nigeria, extracting a wide range of minerals including tantalum, niobium, tin, and lithium as well as zinc, lead, and barite. Nigeria hosts a rich lithium-pegmatite belt, with ASM surging in parallel with increasing prices (ibid.).

REGULATORY OVERVIEW

The Nigerian federal government owns the rights to all mineral resources in any land, as regulated by the Constitution of Nigeria (1999) and overseen by the Nigerian Minerals and Mining Act of 2007, which also governs the transfer of land rights for beneficiation purposes (ibid.). Both artisanal mining and small-scale mining are regulated under the Small-Scale Mining Lease, with their distinctive definitions. While the ASM policy is supportive in principle, its implementation remains limited, and the sector operates almost exclusively informally.

MAIN ENVIRONMENTAL PRESSURES

Due to the widespread informality of the sector in Nigeria coupled with its rapidly growing workforce, environmental pressures are estimated to be severe, but are extremely under-quantified and underreported. A tragic, widely reported example is the extensive lead poisoning occurring in gold mining villages in 2010, leading to the deaths of hundreds of children. Lead remains a significant ETM mined via ASM, often alongside gold (CDC, 2024).

OTHER ESG CONCERNS

Informal and unsafe working conditions characterize Nigeria's ASM sector. While most documentation exists for gold mining, child labor has been reported in lithium mines across the country (see Associated Press, 2024a). The government has also deployed military operations against illegal miners (including those involved in tin and lithium) despite formalization enforcement remaining limited (Associated Press, 2024b).

KEY PROJECTS AND CIVIL SOCIETY

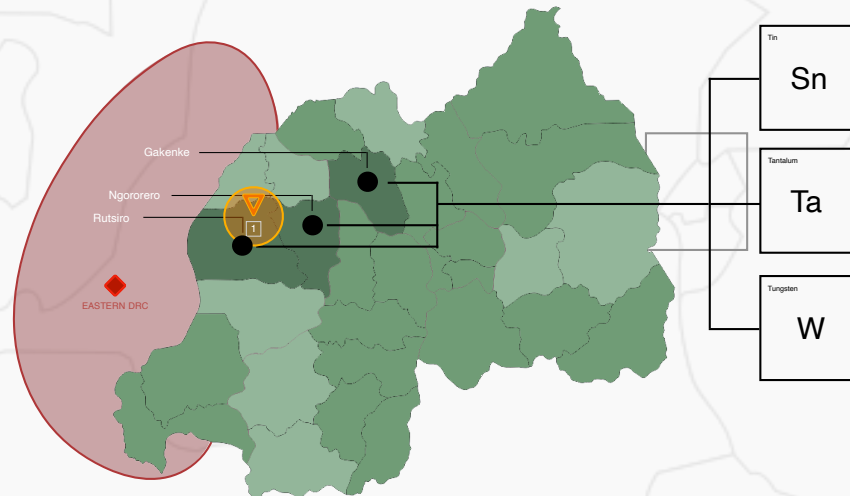
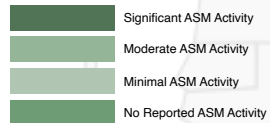
Most projects have focused on gold, since much of gold mining occurs in lead-rich deposits (gold ore contains almost 10 percent lead), causing, for example, the 2010 lead poisoning catastrophe mentioned above (Nota et al., 2025). The World Bank has supported initiatives to map lithium potential, though scaling remains to be done (World Bank, 2024c).

FUTURE ASM-ETM OPPORTUNITIES

In terms of deposits, Nigeria is well positioned to become a major source of ETM supply globally, and ASM can play a defining role. Significant challenges, however, remain in formalizing ASM for the millions of people now involved in multiple globally essential commodities.



RWANDA



Key Biodiversity Hotspots At Risk
1 | Giswati Forest Reserve (Chimpanzee Habitat)



ASM in Conflict-Affected Areas

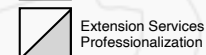
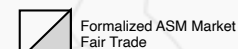
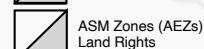
ASM Formalization Level



ASM Legal Status:



Formalization Tools in Place



Population + ASM Workforce



Population | 13,600,000
Workforce | ASM ~50,000
Dependents | ASM ~200,000

Main ASM Mineral (CM Cat.)



30% of World Output (all ASM)
In-Country Processing
Legal Exports
Sn | Ta
ASM Co-products

*Tn (Sn), Tantalum (Ta)

Main ESG Concerns



- Environmental Degradation
- Child Labor & Unsafe Working Conditions
- Informality & Poor Regulatory Oversight
- Conflict and Land Tenure Disputes
- Illicit Trade

Key Government Actors (ASM)



Rwanda Mines, Petroleum and Gas Board (RMB)
RMB is the primary regulatory authority for the mining sector in Rwanda. It formulates policies, issues licences (including for small-scale mining), and leads formalization and compliance efforts. RMB actively supports ASM integration through cooperatives, training, and value addition initiatives—particularly in the 3Ts sector.



Rwanda Environment Management Authority
REMA ensures that mining activities, including ASM, comply with Rwanda's environmental laws. It reviews EIAs and oversees the implementation of environmental management plans, especially for ASM cooperatives and small-scale miners.



Rwanda Development Board (RDB)
The Rwanda Development Board (RDB) supports ASM by promoting investment, facilitating business registration, and helping formalize mining operations through its One Stop Centres.





COUNTRY PROFILE 8: RWANDA

DATA LIMITATIONS

The Rwandan government does not disclose specific mineral-related data, making it difficult to fully understand the scope of the sector in terms of production, workforce, and exports. This also hampers legitimate claims of non-conflict-related minerals transited through and exported by Rwanda.

ENERGY TRANSITION MINERALS SUSCEPTIBLE TO ASM

Rwanda's ASM sector centers on 3T production. Rwanda is currently ranked the world's fifth-largest tin producer, third-largest tantalum producer, and twelfth-largest tungsten producer (USGS, 2023).

REGULATORY OVERVIEW

The mining sector is regulated by a 2024 law, categorizing mining activities into artisanal, small-scale, and large-scale operations. Whereas previous mining codes were seen as beneficial for ASM, the recent update tends more toward attracting multinational actors and foreign investment into large-scale exploration and excavation (IISD, 2017). The Rwanda Mines, Petroleum and Gas Board (RMB), established in 2017, oversees the implementation of mining policies and regulations. The ASM sector in Rwanda is considered highly formal and is used as a model example in the region.

MAIN ENVIRONMENTAL PRESSURES

Bendixen et al. (2024) mapped a series of consequences of surface-level mining in Rwanda. These include sand dredging, the creation of mining ponds (thought to increase the risk of malaria), and substantial shifts in habitat types. Some deforestation has also been reported around the Giswhati ecosystem, but little supporting data exists (see IMPACT, n.d.).

OTHER ESG CONCERNS

Rwanda is also subject to Section 1502 of the US Dodd-Frank Wall Street Reform and Consumer Protection Act, defining due diligence requirements for the 3TGs (the so-called conflict minerals). While significant production indeed takes place in Rwanda and cross-border smuggling of the 3Ts has significantly decreased (see IPIS, 2024)—at least before a recent resurgence of violence in eastern DR Congo and the occupation of Goma by the Rwanda-backed M23—a variable part of Rwandan 3T exports originates in DR Congo and remains undeclared as such. (No data, however, exists as to how much.)

KEY PROJECTS AND CIVIL SOCIETY

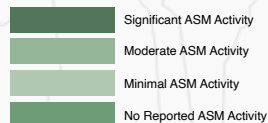
iTSCi is widely present in Rwanda, alongside actors like Better Mining, focusing on risk identification and traceability of minerals, in collaboration with RMB. Only some segments of the supply chain have been certified, however, and major critiques have been directed toward these programs, as illegally imported 3T minerals have reportedly been re-stamped and declared conflict-free via certification programs (Global Witness, 2022a; 2022b).

FUTURE ASM-ETM OPPORTUNITIES

Rwanda is positioning itself as a central supplier of critical minerals, having signed MoUs with the EU and established multiple refineries, prioritizing the processing of minerals including gold, tin, and (in an early phase) lithium, to add additional value to exports. The high incidence of smuggling, however, remains a significant concern.



UGANDA

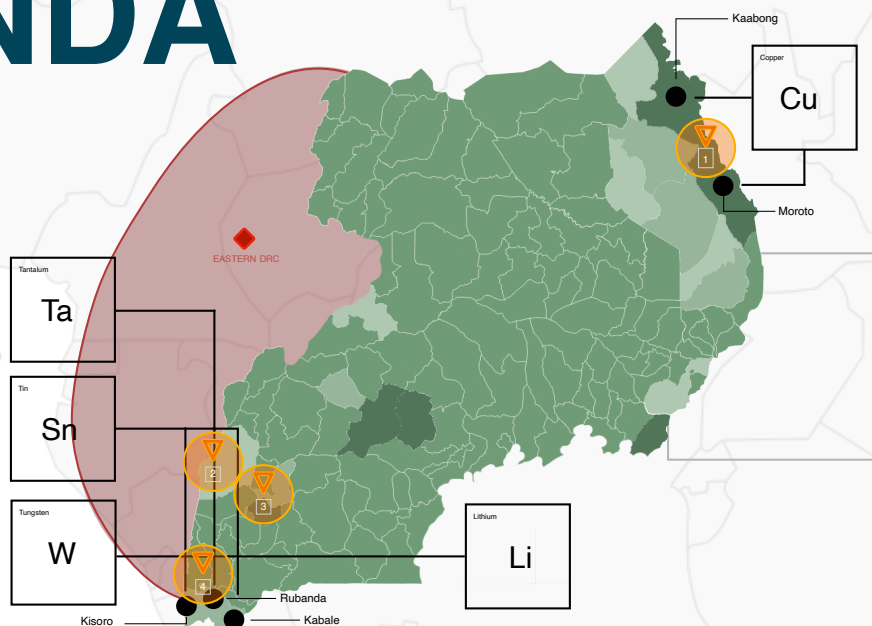


Key Biodiversity Hotspots At Risk

- 1 | Matheniko Reserve
- 2 | Queen Elizabeth NP
- 3 | Buhweju Wetlands
- 4 | Bwindi Impenetrable Forest (Mountain Gorilla Habitat)



ASM in Conflict-Affected Areas



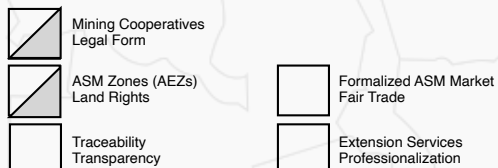
ASM Formalization Level



ASM Legal Status: PARTIALLY RECOGNIZED/LACKING REGULATION/ESTIMATE



Formalization Tools in Place

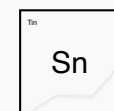


Population + ASM Workforce



Population | 48,000,000
Workforce | ASM ~300,000
Dependents | ASM ~1,000,000

Main ASM Mineral (CM Cat.)



Limited Production Data
In-Country Processing
Legal Exports
W | Ta* ASM Co-products

*Tungsten (W), Tantalum (Ta)

Main ESG Concerns



Key Government Actors (ASM)



Ministry of Energy and Mineral Development
Provides national leadership on mining policy and strategy. It drives the legal and institutional reforms that aim to integrate ASM into Uganda's formal economy and ensure responsible mineral development.



Directorate of Geological Survey and Mines
The core regulatory body for ASM under the MEMD. It handles licensing (location licences), geological mapping, field inspections, and oversees the Mining Cadastre system to track legal operations and promote formalization.



National Environmental Management Authority
Oversees environmental regulation of mining, including ASM. It enforces Environmental and Social Impact Assessments (ESIA), restoration obligations, and monitors ASM activities in ecologically sensitive zones.

THE
IMPACT
FACILITY



COUNTRY PROFILE 9: UGANDA

DATA LIMITATIONS

As in other African countries, most of the spotlight in Uganda is on gold. We have found no environmental assessments on the impact of ETM mining in southwestern or northeastern Uganda.

ENERGY TRANSITION MINERALS SUSCEPTIBLE TO ASM

Found primarily in the southwestern region, ASM is engaged in 3T mining (in part of the Kibara Belt) and, to a currently limited extent, lithium mining. About 90 percent of mineral output is attributed to ASM activities. Uganda is considered to have one of the highest concentrations of raw materials (50+ different minerals) in the region. However, the commercial viability of most of these remains to be determined (AfricaMaVal, 2023).

REGULATORY OVERVIEW

With around 300,000 artisanal miners total, half of whom mine gold, the Ugandan government has faced significant challenges in regulating and formalizing the sector (Levin Sources, 2021). The latest Mining and Minerals Act came into effect in 2022, replacing a 20-year-old mining code. The new act acknowledges ASM (as small-scale) and seeks to push formalization alongside the allocation of designated artisanal mining areas. Buying centers of 3T (and gold) are to be established, to hypothetically combat the historically high incidence of 3T smuggling to neighboring Rwanda (Levin Sources, 2021). None of these efforts have yet materialized (AfricaMaVal, 2023).

MAIN ENVIRONMENTAL PRESSURES

No ETM-specific information was found.

OTHER ESG CONCERNS

No ETM-specific information was found.

KEY PROJECTS AND CIVIL SOCIETY

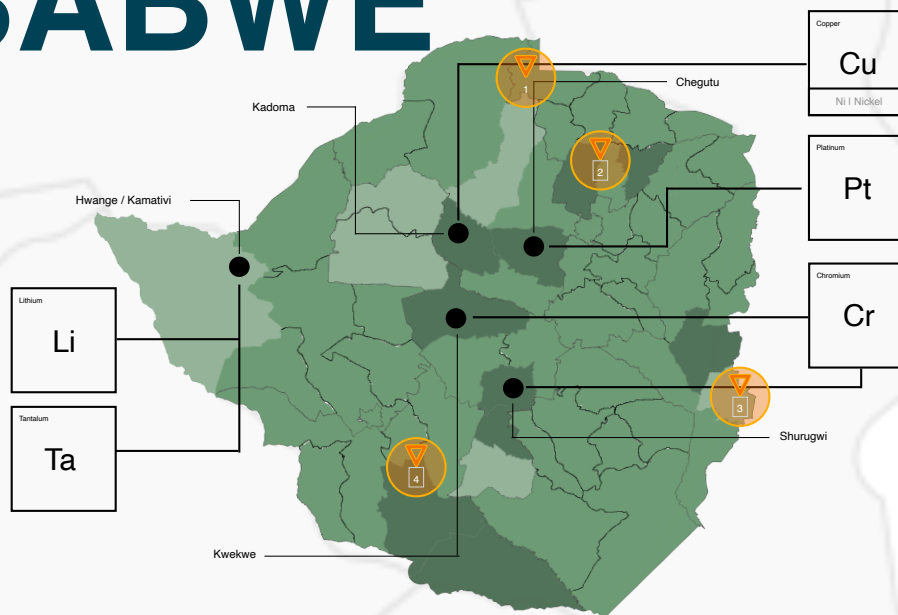
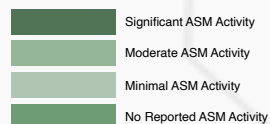
The World Bank, through the Sustainable Management of Mineral Resources Project (SMMPR), has supported the development and licensing structure of the 2022 Mining Code, which also covers 3T mining. Organizations like GIZ (German Development Agency) have done ongoing work on mining, though focused entirely on gold, alongside, for example, planetGold. ICGLR and iTSCi are also active, via certification schemes. No organization focuses on the sustainable development of critical minerals.

FUTURE ASM-ETM OPPORTUNITIES

ASM in Uganda will continue to produce 3T supply, potentially through more formal channels following the government's plans to establish 3T buying centers. Lithium mining is currently limited, if not nonexistent, but it can potentially become a key ASM-mined mineral, albeit in an unprocessed form.



ZIMBABWE



Key Biodiversity Hotspots At Risk

- 1 | Chewore Safari Area / Mana Pools
- 2 | Mazowe District
- 3 | Chimanimani National Park
- 4 | Filabusi Area

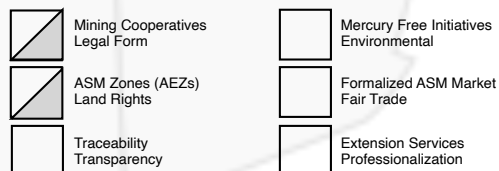
ASM Formalization Level



ASM Legal Status: PARTIALLY RECOGNIZED/LACKING REGULATION/ESTIMATE



Formalization Tools in Place

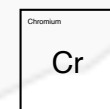


Population + ASM Workforce



Population | 16,700,000
Workforce | ASM ~500,000
Dependents | ASM ~1,500,000

Main ASM Mineral (CM Cat.)



Limited Production Data
In-Country Processing (checked)
Legal Exports (checked)
ASM Co-products (None)

Main ESG Concerns



Key Government Actors (ASM)



Ministry of Mines and Mining Development
The MMD is the principal authority for mining governance in Zimbabwe. It oversees the issuance of mining titles, development of mining policies, and coordination of sectoral reforms. The ministry also manages the Mining Industry Loan Fund, which provides financial support to formalized small-scale miners.

Environmental Management Agency
EMA is responsible for regulating environmental compliance within the mining sector. It enforces environmental laws, conducts Environmental Impact Assessments (EIAs), and monitors mining activities to ensure sustainable environmental practices are upheld.





COUNTRY PROFILE 10: ZIMBABWE

DATA LIMITATIONS

In Zimbabwe, research is more abundant in the artisanal chromium sector than in other ETM sectors, such as lithium. Gold mining, however, remains the primary focus for most research, as in other countries.

ENERGY TRANSITION MINERALS SUSCEPTIBLE TO ASM

Of the minerals classified as ETM, Zimbabwe's ASM sector predominantly extracts chromite, with more than 50 percent of chromite production historically estimated to originate from small-scale mining (Mkodzongi and Mujere, 2025). Lithium ore was previously mined via ASM, but the Zimbabwean government has banned exports of raw lithium ore after declaring it strategic (instead requiring in-country processing before export), which has halted (legal) small-scale production (AfricaMaVal, 2023). The 3Ts were also previously mined via ASM, but this activity has also halted.

REGULATORY OVERVIEW

While ASM is formally regulated by the Ministry of Mines and Mining Development, a large segment, predominantly artisanal, remains informal (whereas a smaller segment of formalized actors are more small-scale than artisanal). The artisanal sector is heavily poverty driven, stimulated by harsh economic conditions resulting from nationwide retrenchment of workers from paid employment, poor agricultural yields, and subsequent high unemployment levels (Ngwenya et al., 2024). A new export ban on lithium concentrates is planned for 2027, aimed at stimulating further local refining (Reuters, 2025).

MAIN ENVIRONMENTAL PRESSURES

Mining in Zimbabwe has contributed to the loss of approximately 200,000 hectares of forest, due primarily to gold and diamond mining (United Zimbabwe Alliance, 2024). While little data exists on lithium mining, Mkodzongi and Mujere (2025) mapped the environmental consequences of chromium mining in Zimbabwe's Great Dyke region, finding multiple deep, unrehabilitated pits and subsequent effects on both livestock and wildlife (see also EHN, 2023; Ncube-Phiri, 2018).

OTHER ESG CONCERNS

In the same article, Mkodzongi and Mujere (2025) found that the buyers who dominate the chromium market (as well as lithium, gold, and other minerals), leverage the informality of operations to purchase ore for very low prices. Working and living conditions (especially for women) are harsh, and often violent disputes arise over land, access, and general mineral claims, mirroring trends in the gold sector (see also Mwandiringana and Ye, 2023).

KEY PROJECTS AND CIVIL SOCIETY

In 2024 the Zimbabwe Miners Federation (ZMF) introduced a tailored ESG strategy for ASM, outlining measures around drainage systems, solar power, and broader responsible sourcing (see Mapuranga, 2024). The Zimbabwe Environmental Law Association (ZELA) has committed to supporting the implementation of the ESG strategy. Most initiatives are, however, targeting gold mining, with limited intervention in the ETM space (such as lithium mining).

FUTURE ASM-ETM OPPORTUNITIES

Zimbabwe's lithium deposits position the country to become a major player in the global trade of critical minerals. This will require that formalization be tailored to support ASM in subsections like lithium mining to enable, rather than hinder, legal operations.

BIBLIOGRAPHY

- Abbott, P., Malunda, D., and Festo, N., 2018. “Rwanda Case Study: Economic Contributions of Artisanal and Small-Scale Mining” (Commodities selected: cassiterite, tantalite, wolframite). Responsible Mines, March. https://www.responsiblemines.org/wp-content/uploads/2018/03/Rwanda_case_study.pdf.
- ACP-EU Development Minerals Programme, 2024. “East and Southern Africa Regional Consultative Workshop: Towards an Artisanal and Small-scale Mining Continental Strategy.” Dar es Salaam, 24–26 April 2024. <https://developmentminerals.org/events/>.
- AfricaMaVal (EU-Africa Partnership on Raw Material Value Chains), 2023. “Country Profiles of Artisanal and Small-Scale-ECRM Mine Production and Processing Developments,” Horizon Europe Framework Programme (HORIZON). https://www.bgr.bund.de/DE/Themen/Rohstoffe/Downloads/Downloads-MR/proj_AfricaMaVal_D1_4_ASM_country_profile.pdf?__blob=publicationFile&v=2.
- African Newspaper, 2024a. “AMDC: Towards a Continental Artisanal Mining Strategy.” 16 May. <https://www.africannewspage.net/2024/05/amdc-towards-a-continental-artisanal-mining-strategy/>.
- African Newspaper, 2024b. “Interview: How We’re Coordinating Implementation of Africa Mining Vision – AMDC.” Interview with Mkhululi Ncube, AMDC. 26 May. <https://www.africannewspage.net/2024/05/interview-how-were-coordinating-implementation-of-africa-mining-vision-amdc/>.
- African Union, 2009. *Africa Mining Vision*. https://au.int/sites/default/files/documents/30995-doc-africa_mining_vision_english_1.pdf. AMDC (African Minerals Development Centre), 2023. “The Pan African Public Reporting Standard for Minerals and Energy Resources” (PARC 2023). African Union/AMDC, October. https://au.int/sites/default/files/documents/43674-doc-Pan_African_Resource_Reporting_Code-PARC_-_ENG.pdf.
- African Union, 2011. Building a Sustainable Future for Africa’s Extractive Industry: From Vision to Action. Action Plan for Implementing the Africa Mining Vision. Addis Ababa: African Union, December. https://au.int/sites/default/files/documents/31003-doc-action_plan_final_version_jan_2012_2.pdf.
- AMDC, 2024a. “Africa’s Green Minerals Strategy.” In African Union’s Mineral Resources Strategy for the Just Transition and Decarbonising Future. December 2024; adopted by the AU Executive Council, February 2025. https://au.int/sites/default/files/documents/44539-doc-AGMS_Final_doc.pdf.
- AMDC, 2024b. “African Minerals and Energy Resources Classification and Management System”. https://au.int/sites/default/files/documents/44206-doc-AMREC_-_English_-document_.pdf.
- Amnesty International, 2016. “This Is What We Die For: Human Rights Abuses in the Democratic Republic of the Congo Power the Global Trade in Cobalt,” AFR 62/3183/2016, 19 January. <https://www.amnesty.org/en/documents/afr62/3183/2016/en/>.
- Amnesty International, 2020. “DRC: Alarming New Research Shows Harms from Cobalt Mine Abuses,” 14 May. <https://www.amnesty.org/en/latest/news/2020/05/drc-alarming-research-harm-from-cobalt-mine-abuses/>.
- Amnesty International, 2023. “DRC: Cobalt and Copper Mining for Batteries Leading to Human Rights Abuses,” 21 September. <https://www.amnesty.org/en/latest/news/2023/09/drc-cobalt-and-copper-mining-for-batteries-leading-to-human-rights-abuses/>.
- Andersson, Patrik, 2026. “What Does China’s Undisclosed Strategic Minerals Catalogue Reveal About Its Industrial Priorities?” Swedish National China Centre. 28 April. <https://kinacentrum.se/en/publications/what-does-chinas-undisclosed-strategic-minerals-catalogue-reveal-about-its-industrial-priorities/>.
- Arthur-Holmes, F., and Ofosu, G., 2024. “Rethinking State-Led Formalization of Artisanal and Small-Scale Mining (ASM): Towards Mining License Categorization, Women Empowerment and Environmental Sustainability.” *Resources Policy* 93, 105058, June. <https://doi.org/10.1016/j.resourpol.2024.105058>.
- ASM Inventory, 2022. “World Maps of Artisanal and Small-scale Mining” [online]. <http://artisanalmining.org/Inventory/>.

Associated Press, 2024a. “Nigeria Government Cracks Down on Illegal Lithium Mining Operations.” <https://apnews.com/article/nigeria-illegal-critical-minerals-lithium-arrests-tin-4c639e034f6bca724bf26cdc55805d4e>.

Associated Press, 2024b. “In Nigeria’s Lithium Boom, Many Mines Are Illegal and Children Do Much of the Work.” <https://apnews.com/article/lithium-mining-energy-transition-child-labor-nigeria-africa-22155590ddd7ecc0b9fd55b221c6d9f>.

Balasha, A. M., and Peša, I., 2023. “‘They Polluted Our Cropfields and Our Rivers, They Killed Us’: Farmers’ Complaints About Mining Pollution in the Katangese Copperbelt.” *Helijon* 9, no. 4, 1–14.

Banza Lubaba Nkulu, C., Casas, L., Haufroid, V., et al., 2018. “Sustainability of Artisanal Mining of Cobalt in DR Congo.” *Nature Sustainability* 1, 495–504. <https://doi.org/10.1038/s41893-018-0139-4>.

Bendixen et al., 2024. Freshwater Ecosystem Transitions Due to Artisanal Sand Mining in Inland Rwanda.” *Science of the Total Environment* 957 (December). <https://www.sciencedirect.com/science/article/pii/S004896972407949X>.

Botha, A., 2024. “Insurgency, Organized Crime and Resource Exploitation in Cabo Delgado.” ENACT (Enhancing Africa’s Response to Transnational Organized Crime) Research Paper No. 48, December. <https://enact-africa.s3.amazonaws.com/uploads/pages/1734536554759-research-paper-48.pdf>.

Brown, E. K. A., and Kimani, E., 2017. Artisanal and Small-Scale Mining: The Paradox of Extraction.” African Center for Economic Transformation (ACET). <https://acetforafrica.org/publications/artisanal-and-small-scale-mining-the-paradox-of-extraction/>.

Busia, K. A., and Arthur-Holmes, F., 2024. “Women and Gender in Artisanal and Small-Scale Mining: A Review and Future Research Directions.” *Resources Policy* 98, 105357. November. <https://doi.org/10.1016/j.resourpol.2024.105357>.

Business & Human Rights Resource Centre, 2023. “DRC: Reports Reveal Negative Environmental and Health Impacts of Industrial and Artisanal Cobalt Mining; Incl. Company Responses.” <https://www.business-humanrights.org/en/latest-news/drc-reports-reveal-negative-environmental-and-health-impacts-of-industrial-and-artisanal-cobalt-incl-co-response/>.

Buxton, A., 2021. “Mining Cobalt Better.” International Institute for Environment and Development (IIED), 2021. *Insight* blog, 29 September. <https://www.iied.org/mining-cobalt-better>.

CDC (Centers for Disease Control and Prevention), 2024. “Lead poisoning investigation in Northern Nigeria.” 16 April. <https://www.cdc.gov/one-health/php/stories/lead-poisoning.html>.

CIFOR, 2023. Mining in the Congo Rainforest Causes More Deforestation.” <https://forestsnews.cifor.org/89558/mining-in-the-congo-rainforest-causes-more-deforestation>.

Cobalt Institute, 2023. “Towards a Circular Value Chain of Cobalt.” December. <https://www.cobaltinstitute.org/responsible-sustainable-cobalt/circularity/towards-a-circular-value-chain-of-cobalt/>.

de Brier, G. and Walschot, M., 2024. “EU acknowledges shortcomings of Conflict Minerals Regulation: What next?” International Peace Information Service (IPIS), Policy Paper, 4 December. <https://ipisresearch.be/publication/eu-acknowledges-shortcomings-of-conflict-minerals-regulation-what-next/>.

Delve, 2019. Country Profile: Morocco. <https://www.delvedatabase.org/resources/2019-country-profile-morocco>.

Delve, 2024. *African Women in Artisanal and Small-Scale Mining*. <https://www.delvedatabase.org/resources/african-women-in-artisanal-and-small-scale-mining>.

Delve Database, 2025. “Morocco—Country Profile: Artisanal and Small-Scale Mining.” <https://www.delvedatabase.org/data/countries/morocco>.

Devenish, K., et al., 2024. “No Evidence of Increased Forest Loss from a Mining Rush in Madagascar’s Eastern Rainforests.” *Communications Earth & Environment* 5, 489. <https://doi.org/10.1038/s43247-024-01655-6>.

Environmental Governance Programme (EGP), 2022. “Namibia.” Joint initiative of the Swedish EPA and UNDP. 24 May. <https://www.environmentalgovernanceprogramme.org/namibia>.

- Environmental Health News (EHN), 2023. “Zimbabwe’s Lithium Mining Faces Scrutiny over Environmental and Social Issues.” <https://www.ehn.org/zimbabwe-s-lithium-mining-faces-scrutiny-over-environmental-and-social-issues>.
- European Partnership for Responsible Minerals (EPRM), 2025. “Fostering Responsible Artisanal and Small-Scale Mining for Reliable Mineral Supply Chains.” <https://europeanpartnership-responsibleminerals.eu/attachment/entity/91fb9670-e4bc-4998-bbe4-343277dfbbeb>.
- European Commission, 2023. “Fifth List 2023 of Critical Raw Materials for the EU.” https://single-market-economy.ec.europa.eu/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en#fifth-list-2023-of-critical-raw-materials-for-the-eu.
- European Commission, 2024. “Study to Review the Functioning and Effectiveness of Regulation (EU) 2017/821 (EU Conflict Minerals Regulation). Final Report.” Directorate-General for Trade. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52024DC0415>.
- European Commission, 2025. “Conflict Minerals Regulation: The Regulation Explained.” Directorate-General for Trade. https://policy.trade.ec.europa.eu/development-and-sustainability/conflict-minerals-regulation/regulation-explained_en.
- Finn, B.M., Simon, A. and Newell, J., 2024. “Decarbonization and social justice: The case for artisanal and small-scale mining.” *Energy Research & Social Science*, 117, 103733. <https://doi.org/10.1016/j.erss.2024.103733>.
- Global Forest Watch (University of Maryland and World Resources Institute), 2025. “Madagascar Deforestation Dashboard.” <https://www.globalforestwatch.org/dashboards/country/MDG/>.
- Global Witness, 2022a. ITSCI Is Unwilling to Address Failures of Its Due Diligence Scheme—Companies Must Now Pressure It to Take Strong Action.” Press release, 4 November. <https://globalwitness.org/en/press-releases/itsci-is-unwilling-to-address-failures-of-its-due-diligence-scheme-companies-must-now-pressure-it-to-take-strong-action/>.
- Global Witness, 2022b. “The ITSCI Laundromat: How a Due Diligence Scheme Appears to Launder Conflict Minerals.” Natural Resource Governance campaign page. <https://www.globalwitness.org/en/campaigns/natural-resource-governance/itsci-laundromat/#itsci>.
- Global Witness, 2025. “New investigation suggests EU trader Traxys buys conflict minerals from DRC.” 15 April. <https://globalwitness.org/en/campaigns/transition-minerals/new-investigation-suggests-eu-trader-traxys-buys-conflict-minerals-from-drc/>.
- Gronwald, V. and Grundel, H., 2017. “The Importance of Understanding the Financial Flows of ASM.” Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development, 24 November. <https://www.igfmining.org/importance-understanding-financial-flows-asm/>.
- Gulley, A.L., 2023. “China, the Democratic Republic of the Congo, and artisanal cobalt mining from 2000 through 2020.” *Proceedings of the National Academy of Sciences*, 120(26), e2212037120. DOI: 10.1073/pnas.2212037120.
- Hauptfleisch, M., Leonard, R., and Ellmies, R., 2011. “An Artisanal Mining Environmental Code of Practice for Namibia.” Conference paper, IGCP/SIDA Project 594, Inaugural Workshop, Kitwe, Zambia, April. https://the-eis.com/elibrary/sites/default/files/downloads/literature/An%20Artisanal%20Mining%20Environmental%20Code%20of%20Practice%20for%20Namibia_2011.pdf.
- Hayes, K., and McCullough, E., 2018. “Critical Minerals and the Role of Artisanal and Small-Scale Mining.” *Resources Policy* 59. DOI 10.1016/j.resourpol.2018.06.015.
- Hilson, G., and McQuilken, J., 2014. “Four Decades of Support for Artisanal and Small-Scale Mining in Sub-Saharan Africa: A Critical Review.” *The Extractive Industries and Society* 1, no. 1, 104–118. <https://doi.org/10.1016/j.exis.2014.01.002>.
- Hilson, G., et al., 2017. “Artisanal and Small-Scale Mining (ASM) in Sub-Saharan Africa: Re-Conceptualizing Formalization and ‘Illegal’ Activity.” *Geoforum* 83, 80–90. <https://doi.org/10.1016/j.geoforum.2017.05.004>.
- Hilson, G., 2020. “The ‘Zambia Model’: A Blueprint for Formalizing Artisanal and Small-Scale Mining in Sub-Saharan Africa?” *Resources Policy* 68, 101765. <https://doi.org/10.1016/j.resourpol.2020.101765>.
- Hilson, G., Sauerwein, T., and Owen, J., 2020. “Large and Artisanal Scale Mine Development: The Case for Autonomous Coexistence.” *World Development* 130, 104919. <https://doi.org/10.1016/j.worlddev.2020.104919>.

Hilson, G. and Maconachie, R., 2020. “Entrepreneurship and innovation in Africa’s artisanal and small-scale mining sector: Developments and trajectories.” *Journal of Rural Studies*, 78, 149–162. DOI: 10.1016/j.jrurstud.2020.06.004.

Hilson, G., et al., 2021. “Formalizing Artisanal and Small-Scale Mining in Mozambique: Concerns, Priorities and Challenges.” *Resources Policy* 71, 102001. <https://doi.org/10.1016/j.resourpol.2021.102001>.

Hook, A., 2019. The Multidimensionality of Exclusion in the Small-Scale Gold Mining Sector in Guyana: Institutional Reform, Landlordism, and Mineral Uncertainty.” *World Development* 123, 104607. <https://doi.org/10.1016/j.worlddev.2019.06.030>.

ICGLR (International Conference on the Great Lakes Region), 2024. “The Six Tools of the ICGLR’s Regional Initiative Against Illegal Exploitation of Natural Resources as Key Allies in Boosting Mineral Trust in the Great Lakes Region.” Press release, 27 December. <https://icglr.org/the-six-tools-of-the-icglrs-regional-initiative-against-illegal-exploitation-as-key-allies-in-boosting-mineral-trust-in-the-great-lakes-region/>.

International Energy Agency (IEA), 2018. Cobalt: Market Developments and Supply Risks. Paris: International Energy Agency. <https://www.iea.org/reports/cobalt>.

IEA, 2020. “The Role of Critical Minerals in Clean Energy Transitions—Country Focus: Nigeria.” <https://www.iea.org/countries/nigeria>.

IEA, 2021. “The Role of Critical Minerals in Clean Energy Transitions.” <https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions>.

IEA, 2024. “Global Critical Minerals Outlook 2024.” <https://www.iea.org/reports/global-critical-minerals-outlook-2024/outlook-for-key-minerals>.

IEA, 2025. “National Plan for Mineral Resources 2016–2020.” <https://www.iea.org/policies/15519-national-plan-for-mineral-resources-2016-2020>.

Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF), 2018. “The Importance of Understanding the Financial Flows of ASM.” IGF blog, 31 January. <https://www.igfmining.org/importance-understanding-financial-flows-asm/>.

IGF, 2024. “What Makes Minerals and Metals ‘Critical?’ A Practical Guide for Governments on Building Resilient Supply Chains.” May 2024. <https://www.igfmining.org/resource/what-makes-minerals-and-metals-critical/>.

International Institute for Environment and Development (IIED), 2023. Formalising Artisanal Cobalt Mining in the DRC: Much Work Remains.” 25 July. <https://www.iied.org/formalising-artisanal-cobalt-mining-drc-much-work-remains>.

IIED, 2023. “Improving Governance in Madagascar’s Artisanal and Small-Scale Mining Sector from the Ground Up.” <https://www.iied.org/improving-governance-madagascars-artisanal-small-scale-mining-sector-ground>.

IISD (International Institute for Sustainable Development), 2018. “IGF Mining Policy Framework Assessment: Namibia.” March. <https://www.iisd.org/system/files/publications/namibia-mining-policy-framework-assessment-en.pdf>.

IISD, 2017. “IGF Mining Policy Framework Assessment: Rwanda.” <https://www.iisd.org/system/files/publications/rwanda-mining-policy-framework-assessment-en.pdf>.

IISD, 2023. “Women and the Mine of the Future: Global Report.” <https://www.iisd.org/system/files/2023-04/women-mine-of-the-future-global-report.pdf>.

IISD and IGF, 2022. “Illicit Financial Flows and Conflict in Artisanal and Small-Scale Gold Mining: Burkina Faso, Mali, and Niger.” September. <https://www.iisd.org/system/files/2022-09/illicit-financial-flows-conflict-artisanal-small-scale-gold-mining.pdf>.

IISD/IGF, 2024. “Artisanal and Small-Scale Mining and Critical Minerals.” <https://www.iisd.org/system/files/2024-12/artisanal-small-scale-mining-critical-minerals.pdf>.

ILO (International Labor Organization), 2019. “Forced Labour” (policy brief). <https://www.ilo.org/media/480496/download>.

IMPACT, n.d. “IMPACT in Rwanda.” <https://impacttransform.org/en/countries/rwanda/>.

IPIS (International Peace Information Service), 2023. “Analysis of the Interactive Map of Artisanal Mining Areas in Eastern Democratic Republic of Congo” (2023 update). IPIS, July. <https://ipisresearch.be/publication/analysis-of-the-interactive-map-of-artisanal-mining-areas-in-eastern-democratic-republic-of-congo-2023-update/>.

- Kamara, J., and Bumba, S., 2025. “Protecting Miners’ Health in Democratic Republic of Congo.” Think Global Health, Council on Foreign Relations. 10 February. <https://www.thinkglobalhealth.org/article/protecting-miners-health-democratic-republic-congo>.
- Katz-Lavigne, S., 2020. “Distributional impact of corporate extraction and (un)authorised clandestine mining at and around large-scale copper- and cobalt-mining sites in DR Congo.” *Resources Policy*, 65, 101584. DOI: 10.1016/j.resourpol.2020.101584.
- Laing, T., and Pinto, A., 2023. “Geopolitical Drivers of Critical Minerals Policy in the Global South.” *Extractive Industries and Society* 10, no. 3, 101171. <https://doi.org/10.1016/j.envsci.2023.103563>.
- Landrigan, P., et al., 2022. “Reducing Disease and Death from Artisanal and Small-Scale Mining (ASM)—The Urgent Need for Responsible Mining in the Context of Growing Global Demand for Minerals and Metals for Climate Change Mitigation.” *Journal of Public Health and Emergency* 21, no. 1. <https://pmc.ncbi.nlm.nih.gov/articles/PMC9412790/>.
- Levin Sources, 2021. “Madini Project: Comparative Analysis of the Fiscal Regimes & Implications for Mineral Trade of ASM 3TGs in Rwanda, Uganda, Burundi and the DRC.” <https://ipisresearch.be/wp-content/uploads/2022/02/Comparative-analysis-of-the-fiscal-regimes-and-implications-for-mineral-trade-of-ASM-3TGs-in-Rwanda-Uganda-Burundi-and-the-DRC.pdf>.
- Luning, S., and Pijpers, R. J., 2017. “Governing Access to Gold in Ghana: In-Depth Geopolitics on Mining Concessions.” *Africa* 87, no. 4, 758–79. <https://doi.org/10.1017/S0001972017000353>.
- Macháček, J., 2020. “Alluvial Artisanal and Small-Scale Mining in a River Stream—Rutsiro Case Study (Rwanda).” *Forests*, 11(7), 762. DOI: 10.3390/f11070762.
- Maguya, S., Chikuvadze, P., and Masocha, W., 2025. “Artisanal Mining Practices and Their Impact on Environmental Management: Experiences from a Selected Marginalized Community in Zimbabwe.” *Futurity of Social Sciences* 3, no. 1, 43–58. DOI:10.57125/FS.2025.03.20.03.
- Maheshe, P., and Beak, K., 2018. “Acid Mine Drainage Problem in Democratic Republic of Congo.” *Geophysical Research Abstracts* 20, p. 45. ui.adsabs.harvard.edu/abs/2018EGUGA..20...45M.
- Mapuranga, R., 2024. “ZMF Creates ASM Tailor-Made ESG Strategy.” *Mining Zimbabwe*, 13 July. <https://miningzimbabwe.com/zmf-creates-asm-tailor-made-esg-strategy/>.
- Ministry of Mines and Minerals Development (Zambia), 2024. “National Critical Minerals Strategy 2024–2028.” Government of the Republic of Zambia. <https://www.mmmmd.gov.zm/wp-content/uploads/2024/09/1-National-Critical-Minerals-Strategy-2024-%E2%80%932028-Booklet-August-27-2024.pdf>.
- Mkodzongi, G., and Mujere, J., 2025. Agrarian Transformation and Artisanal and Small-Scale Chrome Mining on Zimbabwe’s Great Dyke Geological Formation.” *Journal of Rural Studies* 117, 103675. <https://doi.org/10.1016/j.jrurstud.2025.103675>.
- MSHA Safety Services, 2024. “Differences Between Surface and Underground Mining.” <https://mshasafetyservices.com/differences-between-surface-and-underground-mining/>.
- Mwanderingana, E., and Ye, J., 2023. “Mining What Is Not Mine: Artisanal Gold Mining in Gwanda, Zimbabwe.” *The Extractive Industries and Society* 13, 101217. <https://doi.org/10.1016/j.exis.2023.101217>.
- National Geographic*, 2023. “Cobalt Powers Our Lives. What Is It—and Why Is It So Controversial?” 21 December. <https://www.nationalgeographic.com/environment/article/cobalt-mining-congo-batteries-electric-vehicles>.
- Ncube-Phiri, S., et al., 2018. “Artisanal Small-Scale Mining: Potential Ecological Disaster in Mzingwane District, Zimbabwe.” *Journal of Environmental and Public Health* 7, no. 1. <https://pmc.ncbi.nlm.nih.gov/articles/PMC6014108/>.
- Ngwenya, D. M., Matambo, S., and Phiri, K., 2024. “The Socio-Economic Impacts of Artisanal Mining on Ordinary Villagers in Insiza District, Zimbabwe.” *The Extractive Industries and Society* 17, 101422. <https://doi.org/10.1016/j.exis.2024.101422>.
- Nile Basin Initiative, 2009. “Macro Policies on Deforestation: Burundi.” https://nilebasin.org/sites/default/files/2023-09/mp_br.pdf.

- Nota, M. M., et al., 2025. “Airborne Lead Exposures During Artisanal Lead Mining and Gold Ore Processing in Zamfara, Nigeria.” *Journal of Occupational and Environmental Hygiene* 22, no. 9. <https://www.tandfonline.com/doi/full/10.1080/15459624.2025.2491490>.
- OECD (Organisation for Economic Co-operation and Development), 2016. “OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas. 3rd ed. Paris: OECD Publishing. <https://www.oecd.org/daf/inv/mne/OECD-Due-Diligence-Guidance-Minerals-Edition3.pdf>.
- Paschal, M., Kauangal, J. and Nuhu, S., 2024. “The existing financial sources for artisanal and small-scale mining in mineral-rich countries in Sub-Saharan Africa: a review.” *Mineral Economics*, 37(1), 45–53. <https://doi.org/10.1007/s13563-023-00397-9>.
- Reuters, 2022. “Zimbabwe Bans Raw Lithium Exports to Curb Artisanal Mining.” 21 December. <https://www.reuters.com/world/africa/zimbabwe-bans-raw-lithium-exports-curb-artisanal-mining-2022-12-21/>.
- Reuters, 2024. “China’s Curbs on Exports of Strategic Minerals. 15 August. <https://www.reuters.com/markets/commodities/chinas-curbs-exports-strategic-minerals-2024-08-15/>.
- Reuters, 2025. “Zimbabwe to Ban Export of Lithium Concentrates from 2027.” 10 June. <https://www.reuters.com/business/energy/zimbabwe-ban-export-lithium-concentrates-2027-2025-06-10/>.
- Rushemuka, M. N., and Côte, M., 2024. “Artisanal and Small-Scale Mining Through a ‘Labor Regime’ Lens: Consolidating a Research Agenda on Labor Exploitation.” *Journal of Environmental Psychology* 105, 103189. <https://www.sciencedirect.com/science/article/pii/S0743016723002553>.
- Singo, J., Isunju, J.B., Moyo, D., Steckling-Muschack, N., Bose-O’Reilly, S. and Mamuse, A., 2022. “Hazards and Control Measures among Artisanal and Small-Scale Gold Miners in Zimbabwe.” *Annals of Global Health*, 88(1), 21. <https://annalsofglobalhealth.org/articles/10.5334/aogh.3621>.
- Sovacool, B. K., et al., 2020. “The Decarbonization Divide: Contextualizing Landscapes of Low-Carbon Exploitation and Toxicity in Africa.” *Global Environmental Change* 60, 102028. <https://www.sciencedirect.com/science/article/pii/S0959378019305886>.
- Tatoutchoup, D., 2025. “Okapi Survival Threats: A Population Reconstruction and Threat Analysis.” *African Journal of Ecology* 63, no. 2. <https://doi.org/10.1111/aje.70032>.
- The East African*, 2023. “Forced Evictions from DR Congo Mineral-Rich Villages Blights Outlook. 25 September. <https://www.theeastafrican.co.ke/tea/sustainability/forced-evictions-from-dr-congo-mineral-rich-villages-blights-outlook-4377410>.
- United Nations Economic Commission for Africa (UNECA), 2024. “Africa’s critical mineral resources, a boon for intra-African trade and regional integration.” 22 December. <https://www.uneca.org/stories/africa%E2%80%99s-critical-mineral-resources%2C-a-boon-for-intra-african-trade-and-regional-integration>.
- United Nations Economic Commission for Africa (UNECA), n.d. “Morocco ASM Profile.” ECA Knowledge Hub—Artisanal and Small-Scale Mining. <https://knowledge.uneca.org/ASM/morocco>.
- United Nations Panel on Critical Energy Transition Minerals, 2024. *Resourcing the Energy Transition: Principles to Guide Critical Energy Transition Minerals Towards Equity and Justice*. New York: United Nations. <https://www.unep.org/resources/report/resourcing-energy-transition>.
- United States Geological Survey (USGS), US Department of Interior, 2023. “Mineral Commodity Summaries 2023.” <https://pubs.usgs.gov/periodicals/mcs2023/mcs2023.pdf>.
- United States Geological Survey (USGS), US Department of Interior, 2025. “About the 2025 List of Critical Minerals.” <https://www.usgs.gov/programs/mineral-resources-program/science/about-2025-list-critical-minerals>.
- United States Department of Labor, 2021. *2021 Findings on the Worst Forms of Child Labor: Burundi*. <https://www.dol.gov/agencies/ilab/resources/reports/child-labor/burundi>.
- United Zimbabwe Alliance, 2024. “Environmental Implications of Mining in Zimbabwe.” United Zimbabwe Alliance blog, 3 June. <https://unitedzimbabwe.org/blog/environment-implications-of-mining/>.

- Verbrugge, B. and Geenen, S., 2020. “Global Expansion.” In B. Verbrugge and S. Geenen (eds), *Global Gold Production Touching Ground: Expansion, Informalization, and Technological Innovation*. Cham: Palgrave Macmillan, pp. 53–67. https://doi.org/10.1007/978-3-030-38486-9_3.
- Wakiaga, J. and Gankhuyag, U., 2024. “Transforming Artisanal Mining Can Be Beneficial for People and the Planet.” *Africa Renewal*, 29 April. <https://africarenewal.un.org/en/magazine/transforming-artisanal-mining-can-be-beneficial-people-and-planet>.
- World Bank and Pact, 2019. “State of the Artisanal and Small-Scale Mining Sector 2019.” <https://documents1.worldbank.org/curated/en/939441630571322749/pdf/State-of-the-Artisanal-and-Small-Scale-Mining-Sector-2019-from-Delve.pdf>.
- World Bank and Pact, 2023. “2023 State of the Artisanal and Small-Scale Mining Sector.” <https://documents1.worldbank.org/curated/en/099092225121558277/pdf/P177009-9e10446f-c635-4d6b-8f6a-ca41b2e7fb7c.pdf>.
- World Bank, 2024a. “Achieving Sustainable and Inclusive Artisanal and Small-Scale Mining (ASM): A Renewed Framework for World Bank Engagement.” September. <https://www.worldbank.org/en/topic/extractiveindustries/publication/asm-report>
- World Bank, 2024b. “World Bank Urges Action for Gender Equality in Artisanal and Small-Scale Mining.” 5 February. <https://www.worldbank.org/en/news/press-release/2024/02/05/world-bank-urges-action-for-gender-equality-in-artisanal-and-small-scale-mining>.
- World Bank, 2024c. “Nigeria: Mineral Sector Support for Economic Diversification Project— Disclosable Environmental and Social Assessment (Version 6).” <https://documents.worldbank.org/curated/en/099650002082236107/pdf/Disclosable0Ve01000Sequence0No00006.pdf>.
- World Health Organization (WHO), 2026. “Lead Poisoning and Health.” 10 June. <https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health>.
- Zongwe, L., and Musikavanhu, V., 2023. “Decolonising the Just Energy Transition: Community Expectations.” University of Cape Town, Mineral Law Department, 4 January. <https://law.uct.ac.za/mineral-law/articles/2023-01-04-decolonising-just-energy-transition-community-expectations>.