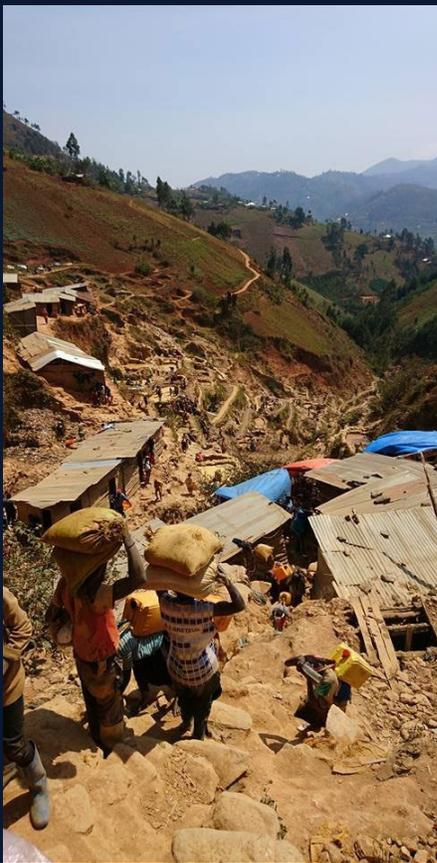


# Mapping Artisanal and Small-Scale Mining to the Sustainable Development Goals

JORDEN DE HAAN, KIRSTEN DALES, JAMES MCQUILKEN



## HIGHLIGHTS:

- Even in its informal state, ASM makes positive contributions to almost all SDGs, and particularly those concerned with social (SDGs 4, 5 and 10) and economic development (1 and 8), nutrition (2), clean energy, infrastructure, and sustainable cities (7, 9 and 11), adaptation to climate change (13), peace, justice and governance (16), and partnerships (17).
- ASM has negative impacts on the majority of the SDGs, and particularly those concerned with human health (SDGs 3 and 6), environment (13, 14 and 15), nutrition (2) social development (4, 5 and to some degree, 10), decent work (8), cleaner production (12), and peace, justice and governance (16).
- Depending on the way it is approached, formalization can help mitigate many of ASM's negative impacts and amplify its positive impacts on the SDGs.
- Given the myriad ASM-SDG interlinkages, ASM formalization needs to be planned in an inclusive and comprehensive manner with all 17 SDGs in mind and prioritized as part of post-COVID-19 reconstruction and broader sustainable development efforts.
- While the SDGs serve as a useful starting point, it remains essential to analyze ASM in relation to national and regional development priorities and integrate the sector into associated policy frameworks.

\*Foreword by Antonio Pedro, UN Economic Commission for Africa

\*\*Case study by Jorden de Haan (Pact), Peter Kapr Bangura (Director of Mines, Sierra Leone) and Mohamed Abdulai Kamara (Environmental Protection Agency, Sierra Leone)

\*\*\*Concrete policy recommendations for harnessing ASM-SDG interlinkages

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## About Pact

Pact is an international NGO that builds the capacity of local communities, leaders and institutions to meet pressing social, political and economic needs in more than 40 countries worldwide. Pact's Mines to Markets program (M2M) uses an integrated, market-based approach and brings together government, industry and miners themselves to make ASM formal, safer and more productive. Learn more at <https://www.pactworld.org/mines-markets>

## About MMS

The University of Delaware's Minerals, Materials and Society's education, research and training program is among the first of its kind in the United States that takes an interdisciplinary approach to linking science and policy with environmental and socio-economic issues around extractive supply chains for all consumer industries of minerals, extractives and related materials. Learn more at <https://sites.udel.edu/ceoe-mms/>.

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ASM-SDG Wheels

BOTH POSITIVE & NEGATIVE IMPACTS



MAINLY NEGATIVE IMPACTS



MAINLY POSITIVE IMPACTS



'INFORMAL' ASM



'FORMAL' ASM



## Foreword

The 1993 Interregional Seminar on Guidelines for Development of Small and Medium Scale Mining held in Harare, Zimbabwe, was amongst the first global events that recognized the important role played by ASM in national and rural economies, a far cry from earlier views and practice which considered ASM illegal and combated it accordingly. Since then, several frameworks including the Yaounde Vision on ASM adopted at the Seminar on Artisanal and Small-Scale Mining held in Yaounde, Cameroon, in 2002; the Africa Mining Vision of February 2009; and the Mosi-oa-Tunya Declaration on Artisanal and Small-scale Mining, Quarrying and Development adopted in Livingstone, Zambia in September 2018; recognise ASM as both a poverty-driven and poverty alleviation sector with a potential to improve rural livelihoods and foster entrepreneurship. As such, for example, the Yaounde Vision called for ASM to be integrated in poverty reduction strategies and in rural community development programmes.

This 'ASM-SDG Policy Assessment' builds on these narratives and provides a first complete assessment of the interlinkages between the ASM sector and all the 17 SDGs simultaneously, a dimension which was not covered in the United Nations Development Programme (UNDP), World Economic Forum (WEF), Columbia Center on Sustainable Investment (CCSI) and Sustainable Development Solutions Network (SDSN) report *Mapping Mining to the Sustainable Development Goals: A Preliminary Atlas*, which examined the links between the SDGs and mining with an almost exclusive focus on large-scale mining.

Without romanticizing the sector, the Policy Assessment offers a very lucid and balanced characterisation of ASM pointing to the >40

million people whose livelihoods depend directly on the sector, the contribution to income generation and the multiplier effects the sector engenders through vertical and horizontal economic linkages with other sectors such as agriculture, whilst indicating the environmental challenges and social impacts associated with it. It notes that notwithstanding the existence of the above frameworks, progress has been mixed. First, ample evidence is provided that even in its informal state, the ASM sector makes positive contributions to almost all the 17 SDGs, but also impacts negatively on the majority of them.

Rudimentary, inefficient and linear production models contribute to environmental degradation, chemical pollution, wasteful practices and high-grading leading to the sterilisation of ore deposits. Child labour remains a challenge. Equally so is the difficulty in assessing ASM's true contribution to economic growth at the national level given the predominantly informal state and exclusion of the sector in national statistics. Yet without such information the sector will continue to be neglected and off the radar of policymakers.



3T miners at Dumac mine in Rwamagana district, Rwanda

Of note is the recognition that ASM accounts for 15-20 percent of global nonfuel mineral output contributing significantly to the production of many of the minerals (tin, tungsten, tantalum, cobalt, rare earths and copper) that are key to facilitating the transitions to a greener and lower carbon economy. This is but one among several reasons why supporting the ASM sector can help to respond to the UN Secretary-General Antonio Guterres' call to "build back better" in the path to recovery from COVID-19.

The COVID-19 pandemic, "a public health emergency and economic, social and human crisis of unprecedented nature", has "hit the hardest on the most vulnerable, including women, children, the elderly and informal workers". In articulating the response to the pandemic, at the Virtual Leaders' Summit of the Group of Twenty (G-20) on the COVID-19 Pandemic (26 March 2020), the UN Secretary-General made an explicit call to focus it on people – women, youth, low-wage workers, small and medium enterprises, the informal sector and on vulnerable groups who are already at risk. All these factors manifest in the burgeoning ASM sector.

ASM formalisation is a pathway which is absolutely essential if we are to mitigate the sector's negative impacts and realise its full development potential – thus sustaining livelihoods, engendering local development and fostering employment creation. Without formalisation, the negative impacts will be aggravated, deepening the sector's marginalisation and association with human rights abuses and (armed) conflict.

The Policy Assessment exposes the tensions and limitations of existing approaches to ASM formalization, many of them designed in a top-down manner and without proper consultative processes. It offers guidance

on how the next generation of formalisation processes should be designed, to ensure alignment with all 17 SDGs. They must be comprehensive, inclusive and anchored on a bottom-up, human rights-based approach. For sure, this must be evidence-based and supported by a clear analysis of trade-offs to minimize unintended negative consequences. Good profiling of the actors in the ASM ecosystem and a good understating of the political economy and vested interests from within and without would certainly improve policy uptake and maximize the impact of the reforms that are needed in the ASM sector. Finally, the authors provide guidance on integrating ASM in national and regional development frameworks, and conclude with a case study from Sierra Leone which illustrates the recommended processes.

The ASM-SDG Policy Assessment represents a seminal contribution to the body of knowledge on ASM and sustainable development, filling a gap in assessments of the role of the sector in the attainment of the SDGs.

**Antonio Pedro**

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# Introductory letter to the ASM-SDG Policy Assessment

The COVID crisis has made the world more aware of the complex supply chains of minerals and materials that power our global economy. At the grassroots are artisanal and small-scale miners (ASM) who toil through tons of earth to find us critical minerals that make basic necessities, modern life and luxuries possible. ASM is not only a poverty-driven livelihood for millions of people worldwide, but also a vibrant, dynamic and emerging economy – although its linkage to development imperatives is systematically understated in global metrics.

The University of Delaware's Minerals, Materials and Society and Pact are pleased to collaborate on this ground-breaking Policy Assessment that clearly lays out the nexus between ASM and the United Nations Sustainable Development Goals (SDGs). The authors have years of field experience with ASM communities and international development organizations, and combine this experiential knowledge with data from a range of research over the past two decades to synthesize a primer with a set of concrete recommendations that we hope will be of practical use to governments, donors, the private sector and civil society.

While a comprehensive formalization of the ASM sector is key for harnessing its full sustainable development potential, this remains a formidable challenge and if approached inadequately it may in fact exacerbate social and economic inequalities. The authors have been sensitive to these concerns and laid out clearly how such a process can be designed and integrated in national and regional policy frameworks to ensure net development dividends for each of the 17 SDGs. There is also a candid recognition that ASM will continue to have environmental health and safety concerns, and that a process

of effective risk management through education, formalization and integrated land-use planning is essential.

We are delighted to support such a realistic and integrative approach, and to charting economically and ecologically efficient, human rights-based pathways by which ASM can contribute to UN 2030 Agenda for Sustainable Development.

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# ASM-SDG Summary Matrix

SDG	GOAL	POSITIVE IMPACTS	NEGATIVE IMPACTS	FORMALIZATION
 <p><b>1 NO POVERTY</b></p>	<p><b>End poverty in all its forms everywhere</b></p>	<p>Direct livelihood benefits for rural people in impoverished regions.</p> <p>Indirect livelihood benefits for families and host communities.</p> <p>Improved community resilience to cope with shocks.</p>	<p>Informal miners are vulnerable to shocks and may become stuck in an 'ASM poverty trap', though in most cases no better options are available.</p>	<p>Accelerates poverty reduction, and facilitates equal rights to land and mineral resources, basic services, technology, finance and training.</p>
 <p><b>2 ZERO HUNGER</b></p>	<p><b>End hunger, achieve food security and improved nutrition and promote sustainable agriculture</b></p>	<p>ASM revenues pay for land, seeds, fertilisers, and farming equipment – enhancing local agricultural productivity.</p> <p>ASM revenues enable rural communities to increase food security and meet basic needs.</p> <p>ASM and its road development decentralizes markets for nearby farmers.</p>	<p>ASM degrades and pollutes productive agricultural land – threatening food security, farming livelihoods and ecosystem health.</p> <p>Informal mining is a threat to livestock, fish, crops and wildlife.</p> <p>Increased demand for food can push up local prices.</p>	<p>Helps to leverage synergies between ASM and agriculture, and encourage miners to reduce pollution hazards in agricultural areas.</p> <p>It can also support to ensure safe post-mining land-use.</p>
 <p><b>3 GOOD HEALTH AND WELL-BEING</b></p>	<p><b>Ensure healthy lives and promote well-being for all at all ages</b></p>	<p>ASM directly and indirectly provides a regular source of income to spend on health care.</p> <p>Infrastructure development generated by ASM activity can facilitate improved access to health care in rural areas.</p>	<p>Informal ASM is characterized by poor OHS conditions.</p> <p>Poor practices employed in ASM pose a health threat for nearby communities.</p> <p>Living and working conditions in (especially 'rush') ASM communities enable HIV, TB, zoonotic and other diseases to thrive.</p>	<p>Provides and facilitates access to technical training to improve OHS conditions, as well as health care services for miners and communities to mitigate the sector's local and global health impacts.</p>

SDG	GOAL	POSITIVE IMPACTS	NEGATIVE IMPACTS	FORMALIZATION
<p><b>4</b> QUALITY EDUCATION</p> 	<p><b>Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all</b></p>	<p>ASM revenues are often used to pay for education, whether by parents or by mining children and youth themselves.</p> <p>ASM provides opportunities for on-the-job-learning and skills-based training, which are also transferrable to other economic activities.</p>	<p>The lucrative prospects of ASM causes school dropout among children and youth.</p> <p>Informal miners have limited access to mining education and scholarships, and tend to be excluded from TVET programs.</p>	<p>Addresses child labor issues through advocacy, affordable access to school-age education, and training in complementary and alternative livelihoods.</p> <p>Provides access to ASM-specific TVET, apprenticeship, scholarship and degree-level programs.</p>
<p><b>5</b> GENDER EQUALITY</p> 	<p><b>Achieve gender equality and empower all women and girls</b></p>	<p>Compared to most rural livelihoods, ASM enhances women's resilience, enabling them to cope with shocks.</p> <p>Relative to most rural livelihoods, ASM provides women with prospects for social and economic empowerment.</p>	<p>Female miners are typically confined to manual, low-paid, and secondary roles.</p> <p>Female miners have unequal access to ore deposits, mining groups, equipment, finance and fair markets.</p> <p>Female miners in conflict-affected areas may be exposed to SGBV (more evidence is needed though, and causality in relation to ASM is not clear).</p>	<p>Gender-sensitive formalization efforts can enhance women's access to mining titles and capital, and facilitate participation in decision-making.</p> <p>However, formalization processes that do not account for gender can also exclude women and perpetuate inequalities.</p>
<p><b>6</b> CLEAN WATER AND SANITATION</p> 	<p><b>Ensure availability and sustainable management of water and sanitation for all</b></p>	<p>By generating revenue and developing rural infrastructure, ASM can indirectly facilitate access to drinking water in rural areas, but there is limited empirical evidence to date.</p>	<p>ASM contaminates drinking water and water-related ecosystems by releasing hazardous chemicals and mine tailings.</p> <p>ASM communities have poor water and waste management systems and poor sanitation and hygiene conditions.</p>	<p>By supporting infrastructure development and better mining practices, formalization can indirectly improve water and sanitation management, reduce the release of hazardous chemicals and increase water-use efficiency.</p>

SDG	GOAL	POSITIVE IMPACTS	NEGATIVE IMPACTS	FORMALIZATION
<p><b>7</b> AFFORDABLE AND CLEAN ENERGY</p> 	<p><b>Ensure access to affordable, reliable, sustainable and modern energy for all</b></p>	<p>ASM produces many minerals critical for the transition to renewable, low-carbon and sustainable energy forms.</p> <p>Through infrastructure development, ASM supports the electrification of rural areas.</p>	<p>Due to its informality, ASM has little access to clean forms of energy, and relies upon 'dirty' forms such as diesel-powered generators.</p>	<p>Enhances the collection of license fees, taxes and royalties, which can be invested in renewable energy projects – including for use in ASM. Through better mining practices, it also facilitates a larger supply of minerals required for the transition to renewable energy technologies.</p>
<p><b>8</b> DECENT WORK AND ECONOMIC GROWTH</p> 	<p><b>Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all</b></p>	<p>ASM sparks local economic growth and has positive spill over effects on other economic sectors.</p> <p>(Informal) ASM contributes to national economic growth by buying VAT-taxed goods and by generating foreign exchange influx.</p> <p>ASM creates vast employment in rural areas, especially for otherwise unemployed youth.</p>	<p>ASM is associated with poor OHS conditions and poor access to healthcare.</p> <p>Informal ASM workers are unable to claim labor rights and have no access to social protection or grievance mechanisms.</p>	<p>Unlocks ASM's contributions to GDP and increases government revenue through fees, taxes and royalties.</p> <p>Reduces informal labor and child labor, and encourages the establishment of membership-based associations, small and medium enterprises, cooperatives, etc. – improving 'decent work'.</p>
<p><b>9</b> INDUSTRY, INNOVATION AND INFRASTRUCTURE</p> 	<p><b>Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation</b></p>	<p>ASM is helping developing countries to diversify their (largely) agricultural-based economies through gradual industrialization.</p> <p>ASM enhances local manufacturing, innovation, and technology transfer.</p> <p>ASM provides financing and minerals (e.g. construction materials) for local infrastructure development, including roads, villages and towns.</p>	<p>Not all infrastructure developed by ASM is resilient or sustainable, especially in rush-type scenarios.</p>	<p>Enables more sustainable industrialization by supporting miners' adoption of more efficient and environmentally-sound mining practices.</p> <p>Facilitates value addition of development minerals, gemstones and gold, and enables access to finance and integration into supply chains and markets.</p>

SDG	GOAL	POSITIVE IMPACTS	NEGATIVE IMPACTS	FORMALIZATION
 <p><b>10</b> REDUCED INEQUALITIES</p>	<p><b>Reduce inequality within and among countries</b></p>	<p>ASM reduces economic inequalities by enhancing income growth of the bottom 40% (and lower).</p> <p>ASM reduces social inequalities by empowering disadvantaged groups like widows, single mothers, poorly educated youth, orphans, former combatants, displaced people, refugees, and economic migrants.</p>	<p>Informal mineral supply chains are often associated with unequal power relations, which may result in economic exploitation of labor and exclusion of certain groups.</p>	<p>Top-down formalization processes can facilitate exclusion and exploitation.</p> <p>But by supporting access to justice, formalization can also facilitate social, economic and political inclusion and enable miners to combat exploitative practices.</p>
 <p><b>11</b> SUSTAINABLE CITIES AND COMMUNITIES</p>	<p><b>Make cities and human settlements inclusive, safe, resilient and sustainable</b></p>	<p>ASM provides critical minerals and materials for the construction of affordable houses for local populations.</p> <p>ASM establishes human settlements in rural areas, reducing the pressure on uncontrolled urbanization.</p> <p>ASM revenues are often reinvested in more resilient housing.</p>	<p>ASM communities often have poor housing conditions. Rush-type ASM tends to have overcrowded settlements where communicable diseases spread easily, while more permanent types of ASM have more resilient settlements.</p>	<p>Provides miners with the security of tenure and access to finance that incentivizes longer use of mine sites and investment into more resilient housing conditions.</p>
 <p><b>12</b> RESPONSIBLE CONSUMPTION AND PRODUCTION</p>	<p><b>Ensure sustainable consumption and production patterns</b></p>	<p>The quarrying of 'development minerals' – such as sands, clays, and dimension stones – travel much shorter distances than imported construction materials and reduce the amount of cement and concrete used, thus reducing carbon footprint.</p>	<p>ASM pollutes the environment with hazardous chemicals such as mercury and cyanide.</p> <p>ASM is characterized by inefficient processing methods, linear production models and poor waste management practices.</p>	<p>Facilitates the adoption of more responsible and sustainable mining practices which helps to improve 'materials stewardship', mitigating negative impacts on SDG12.</p>

SDG	GOAL	POSITIVE IMPACTS	NEGATIVE IMPACTS	FORMALIZATION
 <p><b>13</b> CLIMATE ACTION</p>	<p><b>Take urgent action to combat climate change and its impacts</b></p>	<p>ASM produces a large share of critical minerals and metals required for the transition to renewable, low-carbon and sustainable energy systems.</p> <p>ASM strengthens community resilience and adaptive capacity from a livelihoods perspective, enhancing the ability of the poor to cope with the effects of climate change and natural disasters.</p>	<p>While ASM is less carbon-intensive than LSM, it relies upon 'dirty' energy forms, contributing to greenhouse gas emissions.</p> <p>Mining-induced land degradation, habitat fragmentation, deforestation and biodiversity loss threatens the resilience and adaptive capacity of ecosystems and people.</p>	<p>Helps mitigate ASM's adverse impacts on the climate and increase the sustainable production of minerals critical for the transition to renewable, low-carbon and sustainable energy forms.</p>
 <p><b>14</b> LIFE BELOW WATER</p>	<p><b>Conserve and sustainably use the oceans, seas and marine resources for sustainable development</b></p>	<p><i>Positive impacts of ASM on SDG14 are limited. But in some coastal regions ancient coral rock mining used in construction provides a livelihood taking pressure off local (over)fishing and providing a positive contribution to cultural heritage preservation.</i></p>	<p>ASM degrades coastal ecosystems, including mangroves, estuaries, deltas and sand beaches.</p> <p>ASM miners dump mine waste, causing siltation and turbidity and threatening life under water.</p> <p>Dredging in small-scale mining disturbs the hydrologic flow and connectivity of inland and marine waters.</p>	<p>Facilitates monitoring and enforcement of heavy polluters and provides security of tenure and other incentives for mine rehabilitation efforts, thus mitigating negative impacts on marine and coastal ecosystems.</p>
 <p><b>15</b> LIFE ON LAND</p>	<p><b>Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and biodiversity loss</b></p>	<p><i>There are no clear documented positive impacts of ASM on SDG15.</i></p>	<p>ASM occurs in global protected areas, threatening terrestrial ecosystems, inland water and biodiversity.</p> <p>Informal ASM degrades and fragments habitat, increases illegal timber and wildlife harvest, while disturbing carbon sinks and native species.</p> <p>ASM releases large volumes of pollution and hazardous waste, degrading soil, air and water quality.</p>	<p>Can optimize land-use and promote the adoption of environmentally responsible mining, improve security of tenure and create incentives for mine rehabilitation, avoiding, reducing or reversing adverse impacts on terrestrial ecosystems, inland waters and their biodiversity.</p>

SDG	GOAL	POSITIVE IMPACTS	NEGATIVE IMPACTS	FORMALIZATION
 <p><b>16</b> PEACE, JUSTICE AND STRONG INSTITUTIONS</p>	<p><b>Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels</b></p>	<p>ASM often instils a 'culture of peace' as its working culture generally reflects solidarity and equality.</p> <p>ASM provides marginalized youth and ex-combatants in conflict-affected settings with an alternative to armed groups and criminal networks.</p> <p>ASM serves as a social safety net and may support the functioning of public institutions during crises.</p>	<p>ASM is associated with organized crime and the financing of armed conflict and terrorism.</p> <p>ASM is associated with poor respect for the rule of law, widespread human rights abuses, corruption, bribery, and illicit financial flows.</p> <p>ASM is associated with poor governance and low transparency and accountability.</p>	<p>Can support state-, peacebuilding and post-conflict reconstruction processes, and with it, SDG16's dimensions of peace, justice and strong and inclusive institutions. Human rights-based approaches are essential for realizing all this.</p>
 <p><b>17</b> PARTNERSHIPS FOR THE GOALS</p>	<p><b>Strengthen the means of implementation and revitalize the global partnership for sustainable development</b></p>	<p>ASM brings together stakeholders from civil society and the public and private sector.</p> <p>ASM elicits interest from bilateral, multilateral and private sector donors, helping to diversify sources of development assistance.</p> <p>ASM facilitates technology transfer and capacity building in developing countries.</p>	<p><i>There are no clear documented negative impacts of ASM on SDG17.</i></p>	<p>Helps to 're-risk' ASM, improve the investment climate for private and public partners, and enhances exports from developing countries, increasing government revenues from taxes and royalties.</p>



# 1. Introduction

Artisanal and small-scale mining (ASM) – low-tech, labor-intensive mineral processing and extraction (Hilson, 2009) – constitutes an essential livelihood for more than 40 million people living in rural and typically impoverished areas in lower-income countries across the developing world (World Bank, 2019).<sup>1</sup> ASM provides the world with a diverse array of minerals, metals, and mined materials. These include base metals, such as tin (cassiterite), tungsten (wolframite, scheelite), and tantalum (tantalum-columbite) (3T) ore minerals and their derivatives that are ubiquitous to modern electronic devices (Barume, Naeher, Ruppen & Schütte, 2016; World Bank, 2016), cobalt used in batteries fueling the electric vehicle revolution; alongside copper, rare earths, and other critical metals needed for the transition to a low(er) carbon economy (World Bank, 2017; 2020). ASM directly links impoverished miners in complex multi-layered networks to consumers of luxury goods such as jewelry made from precious metals, including gold and silver, as well as diamonds and gemstones (Hilson & McQuilken, 2016; McQuilken & Hilson, 2018). Meanwhile, development minerals<sup>2</sup> such as sands, clays, dimension stone and even coral rocks are quarried by hand and consumed locally to build housing, hospitals, roads, and other much-needed infrastructure, and could play a crucial role in propelling economic growth and development (Franks et al., 2016; IRP, 2019; Franks, in press). Similarly, ASM employs women, men, girls and boys from all walks of life who engage in activities for many reasons, ranging from poverty alleviation and livelihood diversification to financing education, agriculture and kickstarting businesses (Hilson, 2009; Cartier & Burge, 2011; Hilson & McQuilken, 2014; Franks, Pakoun & Ngonze, 2016; Stylo, de Haan & Davis, 2020).

Given this diversity, it makes intuitive sense that ASM cuts across the United Nation's Sustainable Development Goals (SDGs). Indeed, in the past two decades, scholarship has extensively described the importance of the sector for socio-economic development (Maconachie & Hilson, 2011a; Geenen, 2015; Barreto et al., 2018), its negative social, environmental and health outcomes (Gibb & O'Leary, 2014; O'Driscoll, 2017), and its multifaceted relationship with peace, security and human rights (Vogel & Raeymaekers, 2016; Massé & Le Billon, 2017; de Haan, 2021). Most recently, the global COVID-19 pandemic and its impacts on mineral supply chains and the rural economies that depend on them has made these myriad interlinkages and the cost of *not* having a thriving ASM sector even more apparent. However, to date, no comprehensive review on the ASM sector and its interlinkages with all 17 SDGs is available.

Operating on the margins of the global development agenda for the past 40 years (Hilson & McQuilken 2014), ASM was recognized but largely absent from the seminal report *Mapping Mining to the Sustainable Development Goals: A Preliminary Atlas* (see UNDP, 2016). The report provided analyses on the links between the SDGs and the mining sector for the first time but focused almost exclusively on large scale mining (LSM). This issue, as Hilson and Maconachie

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1 As of July 2020, the 'exact' estimate compiled from existing reports and publications was 42,240,796 people. For the latest estimates, see: <https://delvedatabase.org/>

2 Development minerals 'are minerals and materials that are mined, processed, manufactured, and used domestically in industries such as construction, manufacturing, and agriculture' (Franks et al., 2016). While often overlooked, ASM provides an important but poorly documented source of 'industrial minerals and construction materials', which account for nearly 85% of all global mineral production by volume annually (see Franks, 2020). Consequently, more attention is needed to these 'neglected' commodities in the global policy arena (IRP, 2019; Franks, in press).



(2019) rightly argue, is a critical oversight as the two sectors are intimately linked. Furthermore, while the authors of the report acknowledge that due to its scale, ASM deserves an SDG Atlas in its own right, its absence from such a key report has an (unintended) knock-on effect of perpetuating the blind spot and discouraging policymakers from integrating ASM into broader national and regional development frameworks. Following the lead from the United Nations Development Programme (UNDP) and World Economic Forum (WEF) and their LSM-focused Atlas, the same is true for much of the recent scholarship on the subject which has also missed the opportunity to analyze the importance of ASM to the SDGs head-on (de Mesquita, Xavier, Klein & Matos, 2017; Monteiro, da Silva & Neto, 2019). However, since the publication of the 2016 Atlas, there has, encouragingly, been some progress. Hilson and Maconachie (2019) were the first to make an academic contribution that evaluates the contribution of ASM to the SDGs, focusing on SDGs 1 (No Poverty), 2 (Zero Hunger), 5 (Gender Equality) and 8 (Decent Work and Economic Growth) in the African context. Meanwhile, the inaugural 2019 *State of the Artisanal and Small-Scale Mining Sector* published by Delve – a global initiative for ASM data led by the World Bank and the NGO Pact – makes clear links between ASM, the SDGs and the ‘need for better access to complete, accurate and reliable data’ (World Bank, 2019, p.1) to build the case for formalization and accurately charting the contribution of the sector to attaining the broader goals. Additionally, several chapters of the forthcoming book *Mining, Materials, and the Sustainable Development Goals (SDGs)* (Parra, Lewis & Ali, 2021) also analyze ASM against individual SDGs, including SDG8 on Decent Work and Economic Growth (Hilson, 2021); SDG13 on Climate Action (Levin-Nally & Racionero Gómez, 2021); SDG15 on Life on Land (Dales & Cordy, 2021); and SDG16 on Peace, Justice and Strong Institutions (de Haan, 2021).

## 1.1 No single review examines the interlinkages with all 17 SDGs

However, to date, no single review examines the interlinkages with all 17 SDGs simultaneously. Such a holistic overview and mapping exercise, as is undertaken in this Policy Assessment, is needed because the many relationships between the SDGs are multi-dimensional and complex. Their interlinked, integrated and ‘indivisible’ (p.1) nature means attaining all 17 is essential to realizing the UN 2030 Agenda for Sustainable Development.<sup>3,4</sup> This means that the impacts of ASM on one SDG also affect its ultimate or net impacts on the attainment of other SDGs. For example, the impacts of ASM on peace, justice and institutions (SDG16) indirectly affect poverty, human health, gender equality, and life on land (inter alia), thereby altering its net impacts on SDGs 1, 3, 5 and 15 respectively. While seemingly obvious, this becomes more difficult to appreciate when the relationships between ASM and the SDGs are discussed in isolation. This Assessment fills this gap by providing a detailed review of the positive and negative impacts of ASM on all 17 SDGs and their respective targets. In doing so, the authors recognize that in its largely *informal* state, the sector currently only realizes a fraction (yet impressive share) of its development potential. Therefore, the Assessment also considers the impacts that a fully formalized industry could have if governed and assisted

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3 The UN 2030 Agenda for Sustainable Development was universally adopted by UN member states in 2015. As a blueprint for peace, prosperity, people and planet, it builds upon the Millennium Development Goals (MDGs).

4 UN General Assembly, Transforming our world : the 2030 Agenda for Sustainable Development, 21 October 2015, A/RES/70/1, available at: <https://www.refworld.org/docid/57b6e3e44.html>

appropriately. In this sense, it provides a nuanced review of the *full extent* of the *current and potential* contributions of the ASM economy to the attainment of the SDGs. With this, the Assessment aims to support donors, policymakers and mining stakeholders (public and private) in their development and responsible business planning, and effectively provide the (first) ASM counterpart to UNDP and WEF's LSM-focused *Atlas*.

The ASM-SDG Policy Assessment is structured as follows. First, the methods used to map ASM to the SDGs is outlined, including the definitions of ASM and the formalization process that were used. Next, in section three – the core of this document – the different SDGs and their interlinkages with ASM are discussed in seven clustered groups. Finally, the Assessment concludes with a summary and reflections on how policymakers can harness the full development potential of ASM by adopting an SDG lens to (re)formulate policy frameworks.

## 2. Methods

To conduct an *objective structured review* of the interlinkages between ASM and the 17 SDGs, an extensive 'ASM-SDG Matrix' was developed. This serves as the informational backbone for this Assessment.<sup>5</sup> The matrix summarizes the main positive and negative impacts of ASM on the 17 SDGs, including their respective objectives and targets (169 in total). The matrix was first developed in November 2019 during a collective mapping and discussion exercise with eleven ASM experts of Pact's Mines to Market (M2M) program.<sup>6</sup> Subsequently, the authors have further drawn upon the global ASM literature, their own experiences and field observations as development practitioners, and inputs provided by peer reviewers to complete the matrix.

In terms of concepts, this Assessment adopts the definition of ASM as "low-tech, labour-intensive mineral processing and extraction" (Hilson, 2009). The full spectra of ASM 'types' (traditional, seasonal, shock, etc.), scales (artisanal, small-scale, semi-mechanized, mechanized, etc.) and modes of organization (e.g. family-based, informal associations, cooperatives, SMEs) are all considered to fall under this definition, as are the various minerals that are produced in the sector including development minerals.

Regarding formalization, the authors adopt the comprehensive definition in the UNITAR and UNEP *Handbook for Developing National ASGM Formalization Strategies within National Action Plans* (hereafter: *Formalization Handbook*)<sup>7</sup>, which defines ASM formalization as:

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5 In view of space, the ASM-SDG Matrix is not included in this document, but the Summary Matrix summarizes its key findings.

6 The mapping workshop was held in-person in Kigali and led by J de Haan. Pact is an international development organization, and its M2M program is specialized in ASM. <https://www.pactworld.org/mines-markets>

7 For transparency, it must be noted that the *Formalization Handbook* was championed by J de Haan, and K Dales is a contributing author.

A process that ensures that [ASM] actors are licensed and organized in representative entities that represent their needs; policies are implemented, monitored, and enforced; and [ASM] actors receive technical, administrative, and financial support that empowers them to adhere to requirements prescribed by national regulations. [UNITAR & UNEP, 2018, p.17]

For a more detailed analysis of the formalization process, see de Haan (2021) and McQuilken and Hilson (2016). In essence, formalization can be understood as a long-term process of progressively building the capacity of government and ASM actors (understood as miners, traders, and all other participants along the mineral supply chain) to enable the latter to comply with applicable regulations, and ultimately access and equitably benefit from participation in formal local and global commodity markets. Six key components of the formalization process are outlined in the *Formalization Handbook*:<sup>8</sup>

**Figure 1. Key components of the ASM formalization process**



For the purposes of this Assessment, this conceptualization of formalization is used in order to meaningfully analyze the current *and potential* positive and negative impacts of ASM on the SDGs in relation to a comprehensive, 'ideal type' formalization strategy implemented by policymakers. A fully formalized ASM operation is therefore understood here as one that possesses the licenses and permits required by law; is organized in a legally-recognized entity that represents its members' needs; and is effectively enabled to comply with laws, regulations, and management practices – whereas an informal ASM operation is, regardless of its legal status, not enabled to achieve this level of organization and compliance.<sup>9</sup> But it must be noted that in reality, formality exists on a spectrum which sees many shades of grey between the black-white categorization of 'formal' and 'informal' ASM. Moreover, it can often be a zero-sum game with (un)intended impacts, and different winners and losers, including certain groups of artisanal and small-scale miners.

<sup>8</sup> Figure 1 is a slight adaptation (by J de Haan and Imran Ahmed Mohamed) of figure 4 of the *Formalization Handbook* (UNITAR & UNEP, 2018), which focused on ASGM rather than ASM. Used with permission.

<sup>9</sup> More detailed definitions of formal, informal, legal, illegal, extra-legal and illicit ASM are provided on page 17 of the *Formalization Handbook*.

### 3. Review of ASM (formalization)-SDG interlinkages

Against this background, the following section reviews the positive and negative, current and potential interlinkages between ASM, formalization, and all 17 SDGs. For clarity, and because many linkages between the SDGs and ASM are indivisible, our analysis is organized in seven thematic areas:

- **Economic development** (SDGs 1 (No Poverty); 8 (Decent Work and Economic Growth); 12 (Responsible Consumption and Production))
- **Social development** (SDGs 4 (Quality Education); 5 (Gender Equality); 10 (Reduced Inequalities))
- **Nutrition & health** (SDGs 2 (Zero Hunger); 3 (Good Health and Wellbeing); 6 (Clean Water and Sanitation));
- **Environmental Stewardship** (SDGs 13 (Climate Action); 14 (Life below Water); 15 (Life on Land))
- **Clean energy, infrastructure and sustainable cities** (SDGs 7 (Affordable and Clean Energy); 9 (Industry, Innovation and Infrastructure); 11 (Sustainable Cities and Communities))
- **Peace, justice and governance** (SDG16)
- **Partnerships** (SDG17)

The subsequent analysis, therefore, follows this order. While there is insufficient space to review all the impacts of ASM on the 169 SDG targets separately, for each of SDGs, the overall goal and three to five of the most relevant SDG targets are considered. These overall SDG goals are listed at the start of each subsection, and the respective SDG targets can be found online.<sup>10</sup>

In view of space, this Assessment does not examine the impacts of COVID-19 on ASM in communities and mineral supply chains in extensive detail – as for example the DELVE platform does.<sup>11</sup> Still, it must be acknowledged that the coronavirus has completely altered the world and its progress made towards the SDGs, effectively recalibrating the 2030 Agenda. This is clearly documented in the latest report of the UN Secretary-General on the progress made on achieving the SDGs, which describes how the coronavirus has reversed or at least decelerated progress made on virtually each of the 17 SDGs, describing it as “the worst human and economic crisis in the last century” (United Nations Economic and Social Council (ECOSOC), 2020, p. 2). The *Sustainable Development Report 2020* also presents thoughts and early findings on COVID's impacts on the SDGs and the future of sustainable development (Sachs et al., 2020). Therefore, brief reference is made to COVID-related impacts where it provides relevant perspectives for considering ASM-SDG interlinkages.

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<sup>10</sup> See: <https://www.undp.org/content/undp/en/home/sustainable-development-goals.html>

<sup>11</sup> The preliminary social, economic and environmental impacts of COVID-19 on ASM communities are being documented on an ongoing basis on a dedicated webpage on Delve: <https://delvedatabase.org/covid-19-impact-on-asm>

## 3.1 Economic development



### PROGRESS:

- Despite significant improvement in recent decades, progress on poverty reduction has been decelerating and in mid-2019, the world was not on track to achieve the target of less than three per cent of the world living in extreme poverty by 2030 (ECOSOC, 2019).
- The World Bank estimated in June 2020 that COVID-19 will push 71 to 100 million people back into extreme poverty, causing the first increase in global poverty in more than 20 years.<sup>12</sup>
- The pandemic is pushing the world into the worst global economic crisis since the Great Depression. Small and medium enterprises, workers in informal employment, the self-employed, daily wage earners, and workers in sectors at highest risk of disruption are hit the hardest (ECOSOC, 2020).
- It is critical to address employment opportunities for youth, reduce informal employment, enhance economic growth in LDCs, and promote safe and secure working environments (ECOSOC, 2019: 14) – especially after outbreaks of infectious disease where those in employment lack access to sick pay or other forms of social protection.
- The global material footprint rose from 73.2 billion metric tons in 2010 to 85.9 billion metric tons in 2017, a 17.4% increase since 2010 and a 66.5% increase from 2000. The world's reliance on natural resources has accelerated in the last two decades, endangering nature, biodiversity and the global climate (ECOSOC, 2020).



ASM plays an undisputedly important role in poverty reduction. In light of the overall goal of SDG1 and its specific targets, three central positive impacts will be briefly discussed, regarding the ability of ASM to i) provide (relatively) economically viable *direct* livelihoods for vast numbers of impoverished people in rural areas; ii) offer indirect livelihoods to even more people in such areas; and iii) improve the resilience of the poor to cope with shocks of varying nature.

First, as outlined, it is estimated that ASM provides direct livelihoods for more than 40 million people (World Bank, 2019) living in rural and typically impoverished areas in low and middle-income countries (Barreto et al., 2018). While likely an underestimate,<sup>13</sup> this value underscores the sector's importance in rural and impoverished areas where limited economic activity occurs. Indeed, in such areas, both poor and middle-class people are generally attracted to ASM because of the *higher wages* it offers vis-à-vis agriculture or other available livelihoods. For example, Perks (2011) observed that an individual Congolese artisanal 3T miner earns on average USD 80-150 a month compared to a farmer earning just USD 25; or 4-5 times as much (Perks, 2011, as cited in Iragi, McQuilken & Mitchell, 2019). Similar ratios have been reported for informal gold mining vs. farming in Northern Myanmar (Prescott et al., 2019), and slightly smaller ratios have been observed for miners quarrying clay bricks, sand, stone aggregate, dimension stone and other development minerals vs. smallholder farmers in Uganda (UNDP, 2018). Likewise, a recent study by the NGOs Pact and the Alliance for Responsible Mining (ARM) examining the economic impacts of ASM in East Africa found that the income of ASM miners (not to mention mineral traders) is generally higher than income from other available rural occupations and frequently above the Gross National Income per capita in those countries (Barreto et al., 2018).

Second, ASM helps to reduce poverty by providing *indirect* livelihoods for many more people in rural and impoverished areas through its 'multiplier effect' (World Bank, 2019). This includes, firstly, the income source that ASM provides for entire households. Indeed, ASM miners often use their earnings to pay for their children's food, clothes, medicines and school fees and regularly send remittances to family members (Tschakert, 2009; Environment Protection Agency (EPA), 2018). Furthermore, this includes ASM's many vertical and horizontal economic linkages. Namely, the majority of ASM revenues are spent *locally*,<sup>14</sup> creating a market for nearby producers and service providers. For example, ASM communities often attract merchants selling food, clothes and other items on ASM sites, mechanics providing machinery and maintenance, motorbike owners transporting people to extraction or processing sites, and so on (Geenen, 2015; Hilson & Maconachie, 2019). Indeed, as recently-reported COVID-19 impacts in countries like Kenya show, the slowdown in ASM activities has compounded the pandemic's effects on such economic activities fuelled by gold and gemstone mining, as people no longer have the cash to pay for food, products and

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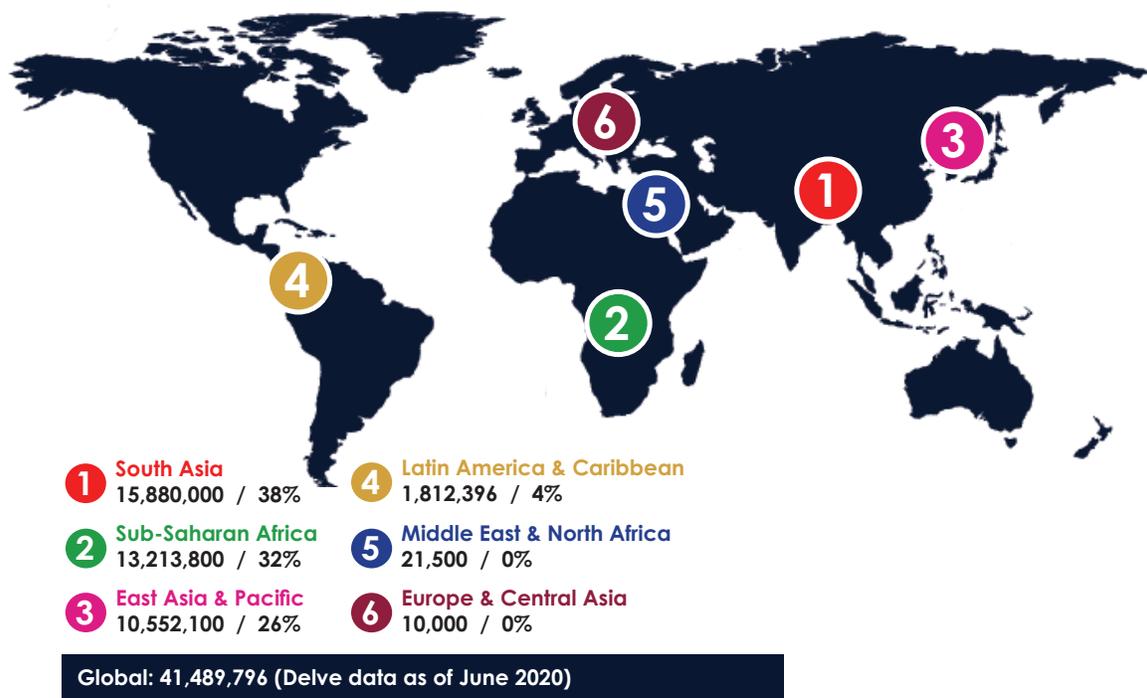
12 <https://blogs.worldbank.org/opendata/updated-estimates-impact-covid-19-global-poverty>

13 As recognized by Delve and outlined in the 2019 State of the Sector report (World Bank, 2019), the issue of data recycling and lack of comprehensive ASM baseline surveys means the estimate is based on a compilation of data that in some cases is over 20 years old, rarely explicitly details the methodology used, and does not routinely include other domestic ASM actors such as mineral traders or the quarrying of development minerals.

14 For example, as has been documented in East Africa, as much as 50% of the international value of gold is retained in the ASM communities where it is extracted (Barreto et al, 2018).

services.<sup>15</sup> Besides, as Hilson (2016) and Hilson & Maconachie (2019) explain in greater detail, ASM often serves as a 'platform for wealth creation' that spawns entrepreneurship. For example, Malagasy female gemstone miners have been reported to invest ASM revenues in housing and cattle (Walsh, 2003, as cited in Hilson & Maconachie, 2019); Sierra Leonian gold miners reinvest their ASM revenues in agricultural tools and groups (Maconachie & Hilson, 2011a); and Mozambiquan gold miners have been observed to buy cars that facilitated new opportunities in the transportation sector (Dondeyne & Ndunguru, 2014). Although scholars and development partners use different multipliers to estimate the sector's spillover effects, which typically do not encompass all the mechanisms described here – altogether, the >40 million miners could support up to *another* 280 million *indirect* livelihoods.<sup>16</sup>

**Figure 2. ASM workforce by region**



Third, and in direct relation with SDG target 1.5,<sup>17</sup> ASM enhances the resilience<sup>18</sup> of vulnerable and rural poor to cope with social, political, economic and environmental shocks. As the lead author has documented in Sierra Leone's artisanal and small-scale gold mining (ASGM)

15 See the COVID-19 webpage on Delve for more details: <https://delvedatabase.org/covid-19-impact-on-asm>

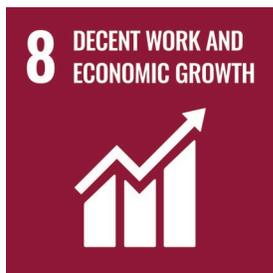
16 The '2019 State of Artisanal Mining' report enlists the various multiplier effects that have been documented for the sector, which range from 3 (lowest) to 7 (highest) (World Bank, 2019). To account for ASM's various multiplier 'mechanisms', the upper range of 7 is used here to illustrate the indirect livelihoods that the sector could be supporting in practice.

17 SDG target 1.5: "By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters".

18 'Resilience' or 'community resilience' includes local knowledge, community networks and relationships, communication, health, governance and leadership, resources, economic investment, preparedness, and mental outlook (sensu Patel, Rogers, Amlôt, & Rubin, 2017).

sector, the sector provides a safety net for many single mothers who have reported to be attracted to the sector's stable income after losing or being abandoned by their husband, as well as for youth who are unemployed or who have just lost their jobs and savings. Other miners have reported pursuing ASGM to cope with failed harvests as a result of climate-induced shifts in rainfall patterns, and seasonal farming is frequently combined with alluvial gold mining to maintain household resilience (EPA, 2019). Quantitative research in Tanzania's ASGM sector equally demonstrates the sector's capacity to reduce poverty and sustain resilience, while emphasizing that the full potential is undermined by the sector's informality (Fisher, Mwaipopo, Mutagwaba & Yaron, 2009).

At the same time, however, there is also cynicism over the ability of ASM to reduce poverty sustainably, and academics and policymakers regularly speak of the 'ASM poverty trap'. In short, the argument goes that (extreme) poverty drives unskilled people to informal ASM. With a lack of support and ability to invest, unskilled labour relies upon rudimentary practices, which results in low productivity, efficiency and income. Inefficient mining practices exacerbate environmental damage and deteriorate quality of life and health conditions, thereby increasing medical costs and poverty, thus preventing miners from improving their working conditions or pursuing other livelihoods, and perpetuating a vicious cycle of poverty (Barry, 1996; Hilson & Pardie, 2006). Still, despite this theory, which seems to apply to different degrees in different contexts of *informal* ASM, in many situations, ASM miners have reported a preference to remain in ASM because it is the most promising livelihood strategy available to escape rural poverty and hardship (Tschakert, 2009; Barreto et al., 2018; Prescott et al., 2019).



Concerning economic growth, Hilson & Maconachie (2019, p.9-10) already argued that even in its informal state, ASM is making sizeable financial contributions. Utilizing African data, the authors demonstrate that while it has long been assumed that ASM accounts for 15-20% of global nonfuel mineral output (Noetstaller, 1987; ILO, 1999), in reality (and especially in Africa), the growing ASM sector likely accounts for much more than that. But how does this affect the economy of low-income countries? As discussed, a large part of this production benefits *local* economies. Yet the more significant challenge is to ascertain the contribution of ASM to economic growth at the *national* level, given its predominantly informal state and exclusion from national statistics. It is this data that will help encourage policymakers to act (World Bank, 2019).

Nevertheless, recent fieldwork in East Africa provides an illustrative example. In Uganda, ASM's revenue generation has been estimated to constitute 5% of Gross Domestic Product (GDP), which, given that most activities are informal, effectively means that the inclusion of the sector in the formal economy would enhance real GDP by at least 5% (ARM, 2017b). Similarly, in Taita Taveta county, a primary colored gemstone-producing area of Kenya, income spent by miners on VAT-taxed goods contributes an estimated USD 1.6 million to the national budget annually (ARM, 2017a). Moreover, based on ASM production levels in Kenya, Rwanda and Uganda, the study estimates the region's cumulative income could generate a foreign exchange influx of nearly USD 1 billion per year (see Barreto et al., 2018).

Regarding employment, the ability of ASM to support hundreds of millions of people directly and indirectly in low and middle-income countries makes it an indisputably important activity.

Still, in the context of SDG8, it is especially important to consider the sector's relative capacity to absorb unemployed youth. While little quantitative data is available on the participation of youth – and the issue is often conflated with and overshadowed by concerns over child labor, especially in contexts where adolescents aged 15-18 are formally still considered to be 'children'<sup>19</sup> – there is overwhelming (albeit mostly implicit) documentation of their dominant role in the sector. Some more dedicated scholarship on the issue includes Hilson & Osei (2014) who discuss youth in Africa's ASM sector, and Maconachie (2017) who reflects on the subject in Sierra Leone – both underscoring the critical livelihood and safety net the informal mining sector provides for what otherwise may become a 'lost generation'.

However, notwithstanding the amount of employment ASM may generate for typically-disadvantaged groups, an important question that remains is *to what degree can ASM be considered 'decent work'?* At present, the vast majority of ASM operations are associated with poor occupational health and safety (OHS) records. While exact OHS threats may depend on the specific type of ASM, almost all operators face issues such as ergonomic stresses, joint and muscle pains, hearing loss, exposure to dust containing hazardous chemicals; and a significant number faces the risk of accidents that could result in severe injury or even death (for a comprehensive overview of ASM-related OHS issues and hazards, see WHO, 2016; Smith, Ali, Bofinger & Collins, 2017: 47). And due to the sector's informality, availability of personal protective equipment, access to healthcare, formal oversight of working conditions, and reporting of incidents is typically inadequate or non-existent. Likewise, as discussed in de Haan (2021), informal ASM workers are typically not aware of (let alone able to claim) labor rights, have little to no access to social protection or grievance mechanisms and are sometimes exploited economically (de Haan, 2021).



In terms of sustainable consumption and production (SDG12), the ASM sector has obvious negative consequences, extending from inefficient, linear production models that generate large volumes of waste and chemical pollution. For the foreseeable future, mineral and metal commodities will play a central role in driving the global economy (Kesler, 2007; IRP, 2019), accelerating progress on Agenda 2030 and implementation of the Paris Agreement (Ali et al., 2017). Despite new strategies to decouple economies from resource use and promote circular economy principals in the extractive industries (IRP, 2019), daunting challenges remain for the ASM sector. Resource efficiency in mining has emerged as an international priority, where governments, industry, civil society and consumers are increasingly concerned about sourcing of raw materials from developing countries, fragile states and critical ecosystems. However, if the minerals and metals sector is to make a measurable contribution to sustainable development, it must adopt principles and practices that address impacts across the mine life cycle (Fleury & Davies, 2012; ICMM, 2016).

Perhaps one of the highest-profile production impacts of ASM operations relates to chemical

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<sup>19</sup> The UN defines 'youth' as those persons between the ages of 15-24 years (see A/36/215 and resolution 36/28, 1981), so by that definition, children are boy or girls under the age of 14. At the same time, Article 1 of the United Nations Convention on the Rights of the Child defines 'children' as persons up to the age of 18. In reality, these norms are determined by national law, cultural context and norms or traditional beliefs of what is 'expected' by men, women, boys and girls.

pollution. For example, the Minamata Convention on Mercury<sup>20</sup> is a significant advance in global environmental stewardship, targeting the ASGM sector directly, which not only relies on mercury but is the largest source of anthropogenic mercury emissions to air and releases to land and water globally (UNEP, 2019a). More recently, cyanide has increasingly been used to extract gold from valuable mine tailings (UNEP, 2019b). These hazardous chemicals are used by miners who receive limited guidance on their safe use, causing substantial threats to human health and the global environment (see section 3.4). ASM is characterized by poor waste management practices. Inefficient recovery and processing techniques yield vast amounts of waste rock, tailings and polluted wastewater, which are often left behind or discharged directly into the environment, including in inland waters, enhancing siltation and degrading aquatic habitat (Hinton, 2003).

The second area of concern, but also one that needs greater exploration, is 'materials stewardship' (ICMM, 2007) and thus, the sustainability of ASM operations versus their large-scale counterparts. Due to limited knowledge, skills, and access to tools and equipment, ASM operators often recover a fraction of the targeted minerals in a given ore deposit (Stocklin-Weinberg, Veiga & Marshall, 2019). For example, in various parts of the world, ASGM miners using basic gravimetric methods have been reported to recover no more than 30% of gold (Veiga, Maxson & Hylander, 2006; Veiga, et al., 2009). Consequently, ore waste (i.e., tailings) are repeatedly scavenged and reprocessed by miners, discouraging mine rehabilitation and closure, generating biological, chemical and physical hazards (Dales & Ramasamy, 2019; Dales & Cordy, 2021). Indeed, mineral processing must be improved, and yet across the mine life cycle, waste offers an opportunity for ASM to enter the circular economy. Drawing the maximum value from all materials and beginning with the end of mine life in mind, miners and their representative organizations can improve materials stewardship and reduce risks. If managed well, this can generate multiple benefits (Table 1).

**Table 1. Mine waste and applications for reuse or recycling (adapted from Dales & Ramasamy, 2019)**

MINE WASTE	DESCRIPTION	MINE REUSE OR RECYCLING APPLICATIONS
Mine waste	Coarse-grained rock with low metal concentration	Physical recontouring of degraded lands for rehabilitation and post-mining land-use
Tailings	Ore waste after extraction and processing	Recycling of discarded tailings for profit
Overburden	Soil, gravel, rock removed to access ore deposits	Recontouring of mined lands or construction
Water	Discharged mine effluent and tailings seepage	Dust suppression to improve OHS, reuse in mineral processing and metal recovery

<sup>20</sup> For more information on the Minamata Convention on Mercury, including access to its text and articles and updated list of Signatories and Parties, see: <http://www.mercuryconvention.org/>



Measuring gold in Nyabibwe, South Kivu, Eastern DRC

Yet, the carbon footprint and scale of the environmental impacts of ASM remains poorly understood globally. While mine-level impacts are minor in comparison to LSM operations, which rely on significant amounts of energy, water, and infrastructure, capable of destroying entire landscapes and communities in the process – ASM operates without the benefit of land-use planning. When considering the sector's scale and workforce, the *cumulative* impacts of ASM could be of similar magnitude to LSM (see also figure 3 for a more general comparison of different mine production scales). Another consideration regarding sustainable production and consumption

is the small-scale quarrying of development minerals (Franks et al., 2016; Franks, 2020). Locally dug and processed sands, clays, and dimension stones travel much shorter distances than imported building materials and reduce the amount of cement and concrete used in the construction sector, which has one of the highest material carbon footprints in the world (Grădinaru, 2017; Rodgers, 2018).

Figure 3. Comparing different mine production scales

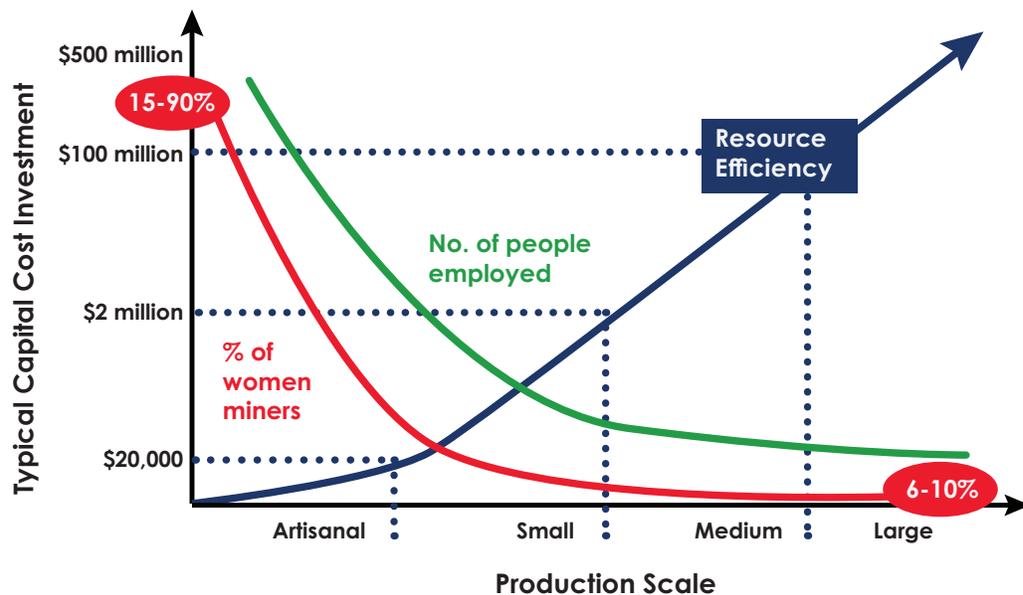


Figure adapted from Hinton, J. (2017). OECD Mineral Due Diligence Panel. Paris, France, used with permission.

### 3.1.1 ASM formalization and economic development

Many of the impacts on economic development can be enhanced by ASM formalization. Starting with SDG1, formalization can facilitate equal rights to and control over land and mineral resources, access to basic extension services, mining technology and microfinance – as indicated by SDG target 1.4, all key ingredients for reducing poverty and vulnerability. As

such, ASM formalization holds great potential in breaking the vicious poverty cycle, where it applies. Though it must be noted that certain formalization approaches and projects, often for practical reasons or in pursuit of other priorities, tend to prioritize 'small-scale' over 'artisanal' miners – leaving the poorest miners behind. A bottom-up approach incorporating an explicit 'pro-poor development' perspective accounting for the relational dimension of poverty can enable formalization to harness more of the sector's (extreme) poverty-reducing potential (de Haan & Geenen, 2016).

As for SDG8, ASM formalization can illuminate the sector's contributions to GDP (which only accounts for the formal economy) and augment government revenues through the collection of license fees, taxes and royalties. To illustrate the latter point with an example, between November 2018-October 2019, the International Tin Supply Chain Initiative (ITSCI) recorded the (taxed) export of over 22 million kg of 3T minerals from the African Great Lakes Region (ITSCI, 2020). Moreover, formalization can support the diversification of traditional agricultural-based economies and encourage positive sectoral linkages, thereby harnessing ASM's economic spillover effects. Regarding SDG target 8.3, which explicitly supports formalization, it can serve to reduce informal labor and encourage the establishment of SMEs, cooperatives and other types of organizational structures that facilitate production and representation.

Furthermore, as is echoed in approaches adopted by the International Labour Organization (ILO, 1999; ILO Recommendation 204)<sup>21</sup> and the Organisation for Economic Cooperation and Development (OECD, 2017), ASM formalization is used as an important tool for eliminating the 'worst forms of child labor' and for tackling forced labor in the ASM sector. The mentioned organizations also promote ASM formalization as a tool for promoting decent work, including the protection of labor rights and promotion of safe and secure working environments for all workers (ibid). Likewise, the emergence of ethical and fair trade certification schemes (McQuilken, 2016; Hilson & McQuilken, 2016) and industry traceability, transparency and due diligence standards and initiatives for responsible sourcing have demonstrated that more responsible production and consumption can be achieved in the sector, as part of broader formalization efforts (Levin, 2010; OECD, 2016; ITSCI, 2020; RMI, 2020).<sup>22</sup> Moreover, as is recognized in the Minamata Convention (Annex C, provision 1c) and by various international organizations (e.g. Swiss Agency for Development and Cooperation, 2011; UNEP, 2012; UNITAR & UNEP, 2018), ASM formalization is a crucial step for reducing mercury use and trade, as it facilitates (among many things) the adoption of more sustainable mining practices – which more broadly helps to improve materials stewardship.

**As such, formalization can go a long way in mitigating negative impacts on SDGs 8 and 12 and enhance the positive effects on all aspects of economic development and resource efficiency across the mine life cycle.**

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21 ILO, Recommendation 204 concerning the Transition from the Informal to the Formal Economy, adopted by the Conference at its 104th session, Geneva, 12 June 2015.

22 It must be noted that the vast majority of mineral supply chain due diligence measures to date focus on human rights, security and economic development issues rather than environmental stewardship – discussed further under section 3.4.

## 3.2 Social development



### PROGRESS:

- Education is an enabling human right. Despite encouraging trends towards achieving Quality Education (SDG4), 262 million children and youth aged 6-17 were still out of school in 2017, and less than half of primary and secondary schools in Sub-Saharan Africa had access to energy, internet, or basic drinking water (ECOSOC, 2019).
- School closures to reduce COVID-19 spread are adversely impacting learning and social and behavioral development, affecting 90% of the world's student population or 1.6 billion children and youth (ECOSOC, 2020).
- The digital divide is widening education equality gaps as many of those living in impoverished, fragile, and remote areas cannot access remote learning opportunities (ECOSOC, 2020).
- COVID-19 is exacerbating gender inequalities. Whereas women already spend three times as many hours on unpaid care work at home as men, school and daycare closure require parents, especially women, to care more for children and facilitate their learning at home. Moreover, domestic violence against women and children has risen during the global lockdown under social distancing protocols (ECOSOC, 2020).
- Although relative income inequality has reduced in some countries, inequality still persists in all forms (ECOSOC, 2020).
- As indicated, COVID-19 is perpetuating social and economic inequalities, as it disproportionately affects vulnerable and disadvantaged populations, including especially informal workers (Oxfam, 2020; OCHA, 2020).



ASM is most known for its *negative* impacts on education. Labelling ASM as one of the 'Worst Forms of Child Labor,' the ILO has widely documented how children and youth's participation in ASM causes school dropouts and impedes quality childhood development more broadly (ILO, 1999; ILO, 2005). Moreover, due to ASM's informal nature and negative public perceptions, artisanal miners often have limited access to mining education and scholarship opportunities. Informal miners also tend to be excluded from formal modes of education or accredited Technical and Vocational Education and Training (TVET)

programs, despite living in areas where mining dominates the majority of local employment opportunities.<sup>23</sup>

At the same time, there is mounting evidence that ASM *facilitates* school attendance and *enables* learning opportunities (Tschakert, 2009; Hilson, 2010; Maconachie & Hilson, 2016a; Potter & Lupilya, 2016). For example, parents often invest mine wages in their children's tuition fees (Barreto et al., 2018; Dales & Ramasamy 2019; Stylo et al., 2020; Zolnikov, 2020, others), while some industrious children and youth 'mine their path to education'. Indeed, children in Sierra Leone, Kenya and Mongolia<sup>24</sup> have been reported to combine ASM with education, participating in regular classes and using their lunch breaks or weekends to mine to pay for their school fees (EPA, 2019; UNESCO, 2018). Moreover, ASM provides opportunities for on-the-job-learning and skills-based training (e.g., accounting, equipment manufacturing, mineral



Children on a minesite in Dalakuru, Sierra Leone

<sup>23</sup> For example, in Nyatike Sub-county in Migori, Western Kenya, TVET centers mandated to enhance employable skills for youth fail to align skills training with local labour market demands despite broad recognition that informal small-scale and artisan gold and copper mining is the most important livelihood for local men, woman and youth. Personal observation, interviews and field work by K Dales throughout 2019.

<sup>24</sup> Personal observations and informal interviews by K Dales across 19 provinces (aimags) of Mongolia, July-August 2011, and June-Sept 2013.

prospecting, processing and engineering), some of which are transferrable to other sectors or economic activities (Hilson & Maconachie, 2011a; Hilson, & Osei, 2014; Ackah-Baidoo, 2016; UNESCO, 2018).

Unfortunately, many governments fail to recognize the nuanced situation in which miners and their families are placed, undervaluing ASM's role in enabling education and focus on negative impacts such as child labour. Accordingly, ill-conceived policies often have unintended, damaging consequences. For example, Zolnikov (2020) found that Ghanaian mothers reliant on galamsey (translated from the colloquialism to 'gather and sell' and meaning informal artisanal and small-scale mining) struggled financially after the 2017-18 regulatory ban on unlicensed mining. Without viable economic alternatives, their children's school tuition became a luxury they could no longer afford. As such, regulatory bans aimed at environmental protection or harm reduction can unintentionally diminish educational opportunities for children and youth.



Gender equality (SDG5) is intrinsically linked to sustainable development<sup>25</sup> and fundamental for transforming ASM into a vehicle for inclusive growth. As demonstrated in the growing literature, women play dynamic roles in artisanal mining and their communities (Labonne, 1996; Amutabi & Lutta-Mukhebi, 2001; Hinton et al., 2003; Hinton, 2011; Lahiri-Dutt, 2015; Bashwira et al., 2014), and constitute at least 30% of the ASM workforce.<sup>26</sup> Too often, however, women are confined to low paid (e.g., hauling, ore crushing, panning, mercury amalgamation) or secondary roles (e.g., cooking, selling clothes,

prostitution). Mining has historically been 'male-dominated' (Dallman & van Dyke, 2013), and while this is changing (Lahiri-Dutt, 2015), women continue to face implicit and explicit biases that are 'leaving them behind.' Gender<sup>27</sup> inequalities arise in part due to discriminatory beliefs that sustain broader inequalities, negatively affecting women's access to and control over resources, and hinder their participation in decision-making (Hinton et al., 2003; Hinton, 2011; Hinton et al., 2016; Huggins et al., 2017; Buss et al., 2019).

Indeed, female miners face disproportionate challenges in accessing lucrative ore deposits, mining groups, equipment, finance, and fair markets, with increased rates of sexual and gender-based violence (SGBV). In recent years, controversy on the role of 'conflict minerals' in driving conflict-related sexual violence raised global attention, especially in Central Africa (Buss and Rutherford, 2017; Buss et al., 2017; Buss, 2018). In fragile and conflict-affected settings in the Democratic Republic of Congo (DRC) for example, Rustad, Østby, and Norda's (2016) confirmed that women living in proximity to ASM sites experienced greater risk of sexual

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25 The future we want. (2012). General Assembly resolution 66/288, annex, paras. 31 and 45. Retrieved February 28th 2020 from: [https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A\\_RES\\_66\\_288.pdf](https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_66_288.pdf)

26 See <https://delvedatabase.org/>

27 Gender is a crosscutting socio-cultural variable, understood as an 'intersection' of different identity factors (i.e., sex, age, race, religion, refugee status, origin at birth, marital status). 'Leaving no one behind' is a recurrent theme of the 2030 Agenda, aiming to understand the 'intersection of identity factors' that contribute to marginalization and exclusion (UNDP, 2018). Understanding what it means to 'leave no one behind' in ASM offers a first step toward formulating effective policy responses to address gender inequalities and the worst forms of discrimination.



Woman panning for gold in Mikei, Kenya

violence, especially around mines with confirmed presence of armed actors. However, this research was not based on field studies in ASM areas or interviews, but rather on quantitative analysis of two externally-produced data sets. Consequently, while sexual violence and the number of human rights abuses plaguing women in ASM contexts are deeply disturbing, policy makers, civil society and development agencies must be critical of the (limited) available evidence on this topic (but see Buss, 2018).

Although women face numerous challenges in the sector, ASM can also provide an economic steppingstone (Labonne, 1996) that empowers them and enhances resilience (also discussed under SDG1). For example, female ASM miners in rural Mali invested their mining profits in freehold land purchases, enabling them to break free

from customary land relations, and thus providing disadvantaged rural women with greater autonomy, agency, and overcoming unjust gender norms (Brottem & Ba, 2019). Similarly, ASGM revenues in Maasai communities of Narok County in Western Kenya enabled the protection and education of adolescent Maasai girls (orphans) who fled their families to escape early, forced and child marriage, or Female Genital Mutilation (FGM). Consequently, mining revenues afforded Maasai women to financially sponsor disadvantaged girls at risk.<sup>28</sup> In Nyabibwe, a mining town in the Eastern DRC, the 'Shashulere', a group of female mineral traders, have registered an association and formed strategic political alliances to formalize their livelihoods (Bashwira et al., 2014) – exemplifying the voluntary nature of women's participation. Yet, while some women enter the ASM sector voluntarily, they can also become reliant upon mining, and despite the risks involved, be unable to exit the sector due to a lack of alternatives (UNESCO, 2018).



In terms of general equality (SDG10), ASM has important positive impacts on reducing economic inequalities, as is shown by the discussion on SDG1. Namely, it provides a relatively good income for many of the poor people it employs, and enhances the income of a large number of indirect beneficiaries in impoverished areas, thus enhancing income growth of the bottom 40%. Factors that underly the sector's capacity to employ the world's poorest include the fact that ASM requires little starting capital or education, and that ASM

28 Personal observation and interviews, K Dales in Maasai Lolgorian community, Narok County, Western Kenya. July 2019 & February 2020.

communities generally accept miners from varying cultural backgrounds, irrespective of race and socio-economic status (Bryceson & Fisher, 2014; Bryceson & Geenen, 2016; Nkuba et al., 2019). This leads to the capacity of ASM to reduce *social* inequalities. As outlined, ASM employs people from all walks of life, including a significant proportion of women (including widows and single mothers), poorly educated youth, orphans, former combatants, displaced people, refugees, and economic migrants. Challenges notwithstanding, ASM empowers many such people to improve their wellbeing by providing them with a relatively viable livelihood.

However, although ASM miners generally receive a relatively high revenue share (frequently 30-50% of international commodity prices) when compared to small-scale producers in other sectors, there is also documentation of the complex trading arrangements and unequal power relations between different supply chain actors and/or local authorities that can be exploitative. For example, through the highly unequal 'tributor-supporter' system that has been documented for diamond miners ('tributors') and investors/buyers ('supporters') in Sierra Leone (Maconachie & Hilson, 2011b); or through similarly unequal arrangements made between ASGM miners and processing centers in Colombia and Peru, where the latter pay the former marginal prices for their tailings that contain about two-thirds of the gold from the original ore (Veiga, in prep). It must be noted though that in Ghana, similar relationships have been shown to be far more equal and mutually beneficial than at first look (McQuilken and Hilson, 2018).



Woman crushing rocks in Kakamega county, Kenya

### 3.2.1 ASM formalization and social development

**Formalization can enhance the sector's positive net outcomes on social development by creating opportunities for historically-marginalized groups.** If formalization is indeed a process of integrating ASM into the 'mainstream' society, education should be understood as an integral part of that process, helping to 'legitimize, organize and professionalize' ASM actors just like other formal segments of society (Dales & Ramasamy, 2019). Formalization is already leveraging investments in learning infrastructure, facilitating miners' and traders' access to training programs, and facilitating the establishment of miners' entities that can serve to institutionalize knowledge and replicate trainings (UNITAR & UNEP, 2018). And as detailed elsewhere, ASM-specific TVET, apprenticeship and scholarship programs could be included in formalization strategies to empower marginalized groups, including women and youth, by increasing their employability (Dales & Ramasamy, 2019; Potter & Lupilya, 2016). Moreover, formalization can help to reduce child labor, by facilitating children's access to education.

With regards to (gender) inequalities, formalization can both help to perpetuate and reduce them. By opening space for 'renegotiating' social norms and power relations, gender-sensitive formalization efforts can enhance women's access to and control over natural resources through access to mining titles, land and other productive assets, and help to reduce discrimination and violence against women and girls (Bashwira et al., 2014; Brottem & Ba, 2019). Moreover, they can facilitate women's participation in decision-making and assumption of leadership positions, and facilitate more equitable benefit sharing. As an example, consider the 'Mutoshi' project, which has helped to formalize ASM cobalt miners in Kolwezi, South-Eastern DRC.<sup>29</sup> Female miners participating in the project now have greater diversity of roles (including digging, which is typically reserved for men), experience less workplace harassment, and earn about two and a half times more than their counterparts working in mines outside the project site (Trafigura Group, 2019). Thus, with an explicit commitment to gender equality, women's empowerment and upholding human rights across mineral supply chains, formalization can accelerate progress on SDG5 targets, especially 5.1, 5.2, 5.3, 5.5, 5.7 and 5.8.

However, evidence from the DRC, Uganda and Rwanda suggests that top-down formalization processes that do not account for gender dynamics can also exclude women (Hinton, 2016; Buss et al., 2019). Moreover, they can facilitate economic exploitation of labour. Indeed, scholars have documented how the creation of the Precious Minerals and Marketing Corporation in Ghana, and ASM cooperatives in the Eastern DRC, have effectively empowered such institutions to appropriate unequal revenue to the detriment of ASM miners (Hilson & Pardie, 2006; de Haan & Geenen, 2016). Nevertheless, as explained in de Haan (2021), by facilitating access to justice and grievance mechanisms, formalization can also empower informal miners to combat exploitative practices. Moreover, it can facilitate social, economic and political inclusion of previously-excluded citizens and advance their representation at the local and national levels (de Haan, 2021).

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<sup>29</sup> The Mutoshi project is financed by Trafigura Group and implemented by Pact. More information can be found in Trafigura Group, 2019. It must be noted that in response to the coronavirus and with a view to safeguarding human health, in March 2020, operations at the Mutoshi Pilot Project were suspended until further notice.

## 3.3 Nutrition & healthy lives



### PROGRESS:

- While hunger was already on the rise globally (ECOSOC, 2019), it is now exacerbated by COVID-19 which is disrupting food production and supply chains, causing increased prices and food shortages (OCHA, 2020), as well as by the Desert Locust upsurge (ECOSOC, 2020) which is taking 'Biblical proportions' in East Africa.<sup>30</sup>
- Although progress has been made in improving human health, progress is not happening fast enough in addressing major diseases, while at least half the global population does not have access to essential health services (ECOSOC, 2019; 2020).
- The COVID-19 pandemic is causing unprecedented human suffering, threatening the lives, health and wellbeing of millions of people, devastating health systems and reverting global progress made towards healthier lives (OCHA, 2020; ECOSOC, 2020).<sup>31</sup>
- ASM communities are particularly vulnerable to COVID's health impacts: they are remote communities with limited access to information and healthcare, characterized by poor, overcrowded living conditions where social distancing and other containment measures are often impossible (see section 3.5), pre-existing hygiene and sanitation conditions are poor, access to clean water is limited, where other infectious diseases tend to prevail, and so on.<sup>32</sup>
- In 2019, less than 71% of the global population used safely managed drinking water and 45% used safely managed sanitation services, leaving 2.2 billion people without safely managed drinking water, 785 million without basic drinking water; and 4.2 billion without sanitation (ECOSOC, 2020).



Understanding the relationships between ASM, agriculture, and the portfolio of livelihoods and land-uses the sector interlocks with, helps to explain the impacts on nutrition and health. Whereas OHS issues have been discussed in section 3.1, this section focuses instead on general population health in terms of quality and length of life as encapsulated in SDG2 (Zero Hunger), SDG3 (Good Health and Wellbeing) and SDG6 (Clean Water and Sanitation). Beginning with agriculture, as discussed, ASM provides a vital refuge during shock situations when farming becomes impossible due to adverse weather

events, economic downturn, or conflict resulting in the destruction and dispossession of land (Hentschel, Hruschka & Priester, 2003; Banchirigah, 2008, Hilson, 2009; Kamlongera, 2011). But under 'normal' circumstances in rural village settings across the developing world, ASM dovetails strongly with farm lifestyles (Hilson, 2016a, 2016b).



*Tin-tantalum miners walking to work through a banana plantation in Comikagi, Rwanda*

This complementarity often occurs in seasonal cycles, such as during dry-seasons and between planting and harvest and can create greater resilience (Labonne, 2002; Maconachie and Binns, 2007; Banchirigah and Hilson, 2010; Hilson, 2010). This is because of the dual income and additional capital from mining which can be used to pay for seeds, fertilizers, and equipment that, as well as being needed for subsistence agriculture, are especially important when growing cash crops for export such as cocoa, coffee, tea, sugar, and cotton. Thus, enhancing productivity and ensuring income to purchase sufficient food for the family and dependents and maintaining basic nutritional needs (SDG target 2.1). The other rural livelihoods that ASM

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30 Joint statement by QU Dongyu, Director-General of the Food and Agriculture Organization of the United Nations (FAO); Mark Lowcock, United Nations Under-Secretary-General for Humanitarian Affairs and Emergency Relief Coordinator; and David Beasley, Executive Director of the United Nations World Food Programme (WFP). <http://www.fao.org/news/story/en/item/1263547/icode/>

31 At the time of final writing in early August 2020, the number of global confirmed infections surpassed 20 million, and the death toll had passed 700,000. For the latest figures, see: <https://coronavirus.jhu.edu/map.html>

32 A deeper analysis of ASM's specific vulnerabilities to COVID-19 is provided in a blogpost by the Artisanal Gold Council. See: <https://www.artisanalgold.org/2020/04/health-responses-covid19-in-artisanal-gold-mining/>

supports also benefit from this interrelationship as the quicker and far greater financial returns from the sector can be used for investment in small businesses, education, and housing. Roads built for ASM also serve to enable farm produce to reach markets and improve access for rural communities, and enhances small farmers' incomes (Iragi, McQuilken & Mitchell, 2019). Ensuring ASM can enhance agriculture in a 'virtuous circle of investment and beneficial feedback' (McQuilken and Hilson, 2016, p.14) is therefore key to meeting SDG2 targets of achieving zero hunger through doubling agricultural productivity and incomes of small-scale food producers (2.3); ensuring sustainable and resilient food production systems and practices (2.4); and increasing investment including in rural infrastructure, agricultural research and extension services (2A).

Yet, it is this interaction that ASM has with land resources, communities and other rural livelihoods that can also create conflict and impact negatively on nutrition, food security and healthy lives. The most visually obvious is the destruction of farmland, the siltation of water bodies, and pollution which can put additional pressures on food security and the nutrition of communities at risk (see section 3.4). Indeed, through its impacts on local ecologies, ASM can also make other livelihoods, such as agriculture and fisheries, unviable (Ali, 2018). Besides this, ASM activity has also been reported to cause livestock to fall into mining pits, and to spur local food prices due to its increased demand, sometimes making it more difficult for residents to afford a healthy diet (EPA, 2019; Nkuba et al., 2019).



Regarding good health and wellbeing, major progress has been made in improving the health of millions of people but significant challenges remain (ECOSOC, 2019). All mining is an inherently dangerous activity that can have direct and indirect negative health impacts, and when it comes to ASM it is often its poor OHS record that is the main focus of media attention. But while raising awareness, what is not well-communicated is that these negative impacts are expressions of the sector's widespread informality which makes it a challenge for governments and agencies to directly reach and work

with miners. Instead, taking a 'health lens' to reframe the issues as an entry point to reach invisible and marginalized populations, could have significant benefits for these communities and contribute to wider formalization efforts (McQuilken and La Salvia, 2019).

By not addressing health issues in ASM populations, the SDG3 targets are under threat. Especially the aim to 'end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases' (3.3). Though significant resources have been mobilized to study and address the issue in large-scale mining, for ASM, the proliferation of these diseases has been completely overlooked. With ASM taking place in often poorly ventilated, dusty, under and above ground working conditions it creates the conditions for respiratory TB to thrive. As an infectious disease it is also easily transmitted to others living and working in ASM communities (Barwise et al., 2013; Rees and Murray, 2007; Stuckler et al., 2011). The dust from mining, processing and unpaved roads can also contain radioactive or heavy metals released into the local atmosphere. For instance, rural communities in the Witwatersrand Basin of South Africa have experienced adverse health outcomes where uranium-rich dusts from industrial gold mines wind-dispersed into residential and agricultural plots. While poorly documented, there is growing concern of ASM actors invading derelict and ownerless mines, reworking abandoned deposits and aggravating public health risks (Dales & Ramasamy, 2019). Contaminated mine dust that is

transported by wind and carried to nearby communities can pose additional health risks, where they may mix with other forms of air pollution or smog. In rural households reliant upon charcoal and fuelwood, contaminated dusts can also mix with high levels of smoke pollutants from stoves and fireplaces.

These health issues are complicated further by the high prevalence of HIV/AIDS in ASM communities, which makes them more susceptible to TB and other opportunistic coinfections. The link between ASGM, TB and HIV is particularly acute, creating a 'triple disease burden' (PHRU, 2015). Transient populations, higher-disposable incomes and 'fast lifestyles' in mining towns, and lack of healthcare access and education, as well as higher risks of SGBV increase incidence of Sexually Transmitted Disease (STD) and HIV/AIDS in ASM communities. For example, in Mali at an informal gold mining site with up to 6,000 miners, HIV prevalence was six times higher than the national infection rate (Sagagon-Teyssier et al., 2017); in Tanzania a baseline study of an ASM community found that one in 200 children working in mining were HIV positive (Pact, 2017); and a study including 393 male respondents at what is described as a 'traditional' mining site in Ethiopia found weak HIV preventative behavior, such as low condom use and multiple sexual partners, to be common (Abdissa, Leum & Niguissie, 2014). Similar trends in HIV/STD prevalence and associated risk factors have been observed in Myanmar (OHCHR 2019), and following mining booms in Latin America and the Caribbean (Wilches-Gutierrez & Documet, 2018).

In addition to the risky lifestyle hazards, broader characteristics of ASM communities can both help and hinder resilience to global health emergencies such as HIV/AIDS, malaria and infectious diseases, such as Ebola and COVID-19. For example, frontier exploration for mined materials into remote areas of the tropics bring humans in ever closer contact with wildlife and disease reservoirs. For instance, human-bat interactions are common in rural Africa (Leroy et al., 2005; Ali et al., 2015) where Ebola outbreaks in remote locations of West Africa have triggered infection chains that strained global public health and national health care systems (Kamins et al., 2011). While bushmeat harvest is often reported in ASM areas (Jenkins et al., 2011; Edwards et al., 2014; Spira et al., 2019) linkages between zoonotic disease transmission and bushmeat consumption in remote mining communities have not been adequately assessed.

These factors, coupled with the wider social and economic environment in and around ASM communities can lead to drug and alcohol abuse, exposure to violence, and poor living conditions. These issues are particularly acute in rush-type scenarios when camps are established quickly without functional water, sanitation and hygiene (WASH) facilities and when open pits fill with water and become breeding grounds for mosquitoes carrying malaria and other vectors for water-borne diseases (Hinton et al., 2003; McQuilken and La Salvia, 2019). Children working or simply living around ASM sites are most susceptible to such health risks, as their brains and bodies are still developing (ILO, 1999; ILO, 2005). Yet at the same time, even in its informal state, ASM also has positive impacts on human health. As documented in Sierra Leone, ASM directly and indirectly provides a regular source of income to spend on health care. Similarly, infrastructure development generated by ASM activity can facilitate better improved access to health clinics, pharmacies and hospitals (EPA, 2019).

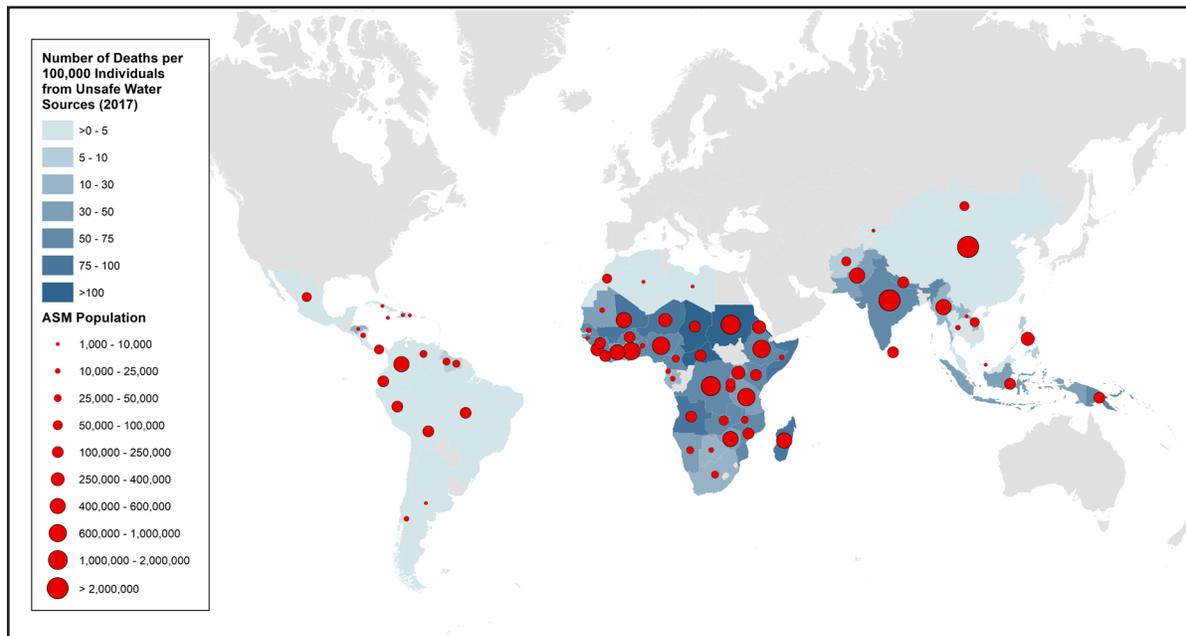


With reference to SDG6 (Clean Water and Sanitation), ASM, and especially informal ASM, poses a significant threat to water-related ecosystems and water resources, including to drinking water for human settlements, livestock and wildlife. Due to the absence of land-use planning and environmentally sound waste management practices ASM very often deteriorates WASH conditions in already vulnerable areas. Significant efforts are therefore needed to assess chemical, biological and physical hazards and vulnerabilities linked to water quality and quantity, locally and regionally. Within mining-affected watersheds and transboundary river basins, governments, civil society and affected communities must prioritize cooperation, especially in cases where local chemical pollution hazards (e.g., mercury) can become regional or global health risks.

Water plays a crucial role in all aspects of ASM (Lynas et al., 2018), however, mine water management, pollution abatement and waste recovery systems are often insufficient in the sector, especially where mine operations are informal, unbanked, poorly resourced and miners are uneducated. While the adverse environmental and human health impacts of ASM on inland waters, including rivers, wetlands and lakes, have been well-documented (Pinedo-Hernández, et al., 2015; Ouoba, 2017; UNEP, 2019c; World Bank, 2019), water-related health, safety, and sanitation issues remain comparatively under-investigated. Recognizing water, sanitation and hygiene are a frontline defense against disease and vital for human well-being, more attention to WASH is needed in programs, projects and development interventions.

Figure 4 shows death rates from unsafe water, measured as the number of deaths per 100,000 individuals, compared with ASM workforce estimates globally. In this map, death rates from unsafe water sources and their mortality impacts are observed across the world. What becomes evident are sizable differences in death rates among countries, with highest rates in lower-income countries across Sub-Saharan Africa and parts of Asia (IHME, 2018). Compare this trend with death rates across high-income countries – for instance across Europe rates are below 0.1 deaths per 100,000, which equates to greater than a 1000-fold difference. The issue of unsafe sanitation is thus largely confined to low and lower-middle income countries – where the vast majority of ASM activity occurs worldwide. There is thus a clear correlation (not necessarily causation) between ASM activity and clean drinking water.

**Figure 4. Global Death rates due to unsafe water and ASM workforce in developing and middle-income countries.<sup>33</sup>**



Access to clean drinking water, sanitation and hygiene for ASM communities is often viewed as ‘outside’ conventional boundaries of public health and technical assistance, despite clear indications of water-related impacts. In Bolivia’s Lake Poopó Basin, one of the poorest regions on the Altiplano, limited access to safe drinking water and sanitation are compounded by mine pollution. Environmental degradation from mining, despite local economic benefits, further deteriorated human, animal and ecosystem health in a context where 78% of water samples are severely contaminated and unfit for human consumption (French et al., 2017). While levels of dependency on natural resources vary in different jurisdictions and socio-economic contexts, resource degradation can restrict access to clean drinking water or land, exacerbating livelihood vulnerability and poverty through a complex web of interactions (Smith, 2008; Musah-Surugu et al., 2017). Similarly, in the Tarkwa region of Ghana, the majority of illnesses in ASM communities are water-related, ranging from recurrent malaria, diarrhea, and various skin conditions (Lynas et al., 2018). At the same time, by generating revenue and developing rural infrastructure, ASM can indirectly facilitate access to drinking water in rural areas, but there is no empirical evidence on this to date, and this potential positive impact is not yet harnessed by existing programs.

<sup>33</sup> Figure developed using data from IHME, Global Burden of Disease (2017) and open source data from [www.artisanalmining.org](http://www.artisanalmining.org) by Marco Brambilla and Kirsten Dales. Death rates measure the number of deaths per 100,000 in a given country or geographic region.

### 3.3.1 ASM formalization and nutrition & healthy lives

ASM formalization, in synergy with integrated land-use planning and local environmental management, can leverage the existing positive synergies between ASM and agriculture, such as by facilitating and incentivizing investments of ASM revenues in agricultural tools and products. It can further help to ensure farmers and communities affected by ASM activity are properly compensated, and that land is reclaimed once activities cease, so that farming can continue. Moreover, by making ASM communities visible and accessible, formalization can facilitate their access to health services and training, helping to improve workers' OHS conditions (see picture below) and mitigate the sector's local health impacts, and enhancing community resilience in the face of existing and emerging health threats (e.g. epidemics, pandemics). Furthermore, as mentioned before, formalization can help to reduce child labor, thereby protecting children's health. Of particular relevance for the health of newborn babies and children under five years (SDG target 2.2), it can facilitate the establishment of childcare facilities in ASM areas as is indicated, for example, in Sierra Leone's ASGM formalization strategy (EPA, forthcoming).

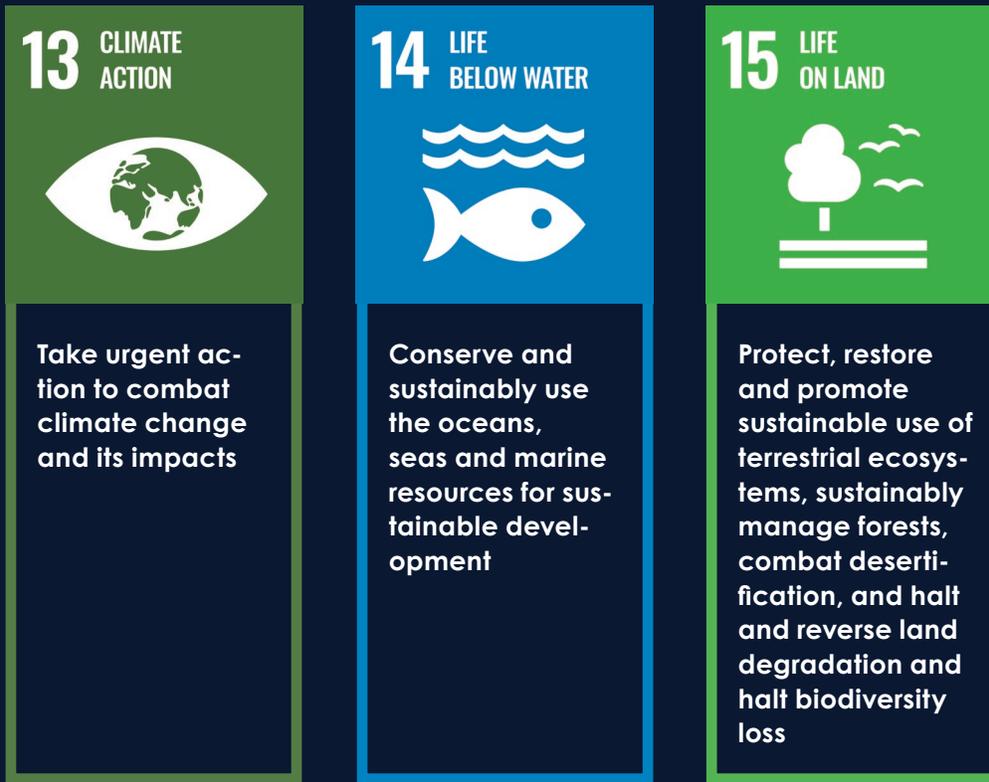
Finally, by facilitating the development of infrastructure and adoption of better mining practices, formalization provides opportunities to strengthen community participation in improving water and sanitation management (SDG target 6.B) and create awareness to improve sanitation and hygiene with the aim to reduce water-related disease (6.2), while reducing release of hazardous chemicals (6.3) and increasing water-use efficiency (6.4).

**Integrating nutrition, food security and health lenses into ASM formalization approaches can help to ensure that such outcomes are realized.**



*Formalized tin-tantalum miners equipped with PPE at a mine shaft in Comikagi, Rwanda*

## 3.4 Environmental Stewardship



### PROGRESS:

- With rising greenhouse gas (GHG) emissions, climate change is occurring at rates much faster than anticipated and its effects are clearly felt worldwide but especially in developing countries (ECOSOC, 2019).
- Despite a projected temporary drop in GHG emissions in 2020 due to COVID-related travel restrictions, the global community is way off track to meeting either the 1.5°C or 2°C targets called for in the Paris Agreement (ECOSOC, 2020).
- As of 31 March 2020, 186 Parties had communicated their first nationally determined contribution (NDC) and several had communicated updated NDC to the UNFCCC, yet mining remains poorly integrated in the context of climate change (ECOSOC, 2020).
- As of December 2019, over 24 million km<sup>2</sup> or 17% of waters under national jurisdiction (up to 200 nautical miles) were sheltered by protected areas, representing more than a double amount since 2010 (ECOSOC, 2020). But notwithstanding regulatory progress, overfishing and growing ocean CO<sub>2</sub> saturation and acidification are threatening life below water (ECOSOC, 2019, 2020).
- Despite progress in sustainable forest management, the expansion of protected areas and the implementation of programs, legislation and accounting principles to protect life on land, wilderness areas, critical ecosystems and biodiversity are being lost at rates that far exceed their conservation or sustainable use (ECOSOC, 2019, 2020).



Mining often transforms landscapes, discharging large volumes of waste and pollution that can pose serious threats to the environment and human health (Festin et al., 2019; Dales & Ramasamy, 2019). Environmental threats like climate change (SDG13) do not respect national borders, with nuanced global linkages to the minerals and metals sector. In general, mining is a key emitter of GHGs, and at the same time, provides an essential contribution to combating climate change and mitigating its impacts by provisioning critical resources needed for the transition to a low carbon economy (World Bank, 2017; Ali et al., 2017; World Bank, 2020; Levin et al., 2021). While ASM is much less carbon-intensive than industrial scale operations, more mechanized small-scale mines rely on 'dirty' forms of energy – such as diesel generators to power automated crushers – thereby contributing to GHG emissions. Commodity-driven deforestation, habitat fragmentation and biodiversity loss due to mining, remain poorly understood at regional and global scales (Web et al., 2017; IPBES, 2018) but threatens ecosystem resilience and the adaptive capacity of communities to withstand climate-related hazards and natural disasters (SDG target 13.1). Consequently, ASM has clear negative impacts on the climate system, and is an important driver of land and ecosystem degradation (IPBES, 2018). Recent evidence suggests mining is an emerging global threat to 'irrecoverable carbon stores'<sup>34</sup> found in tropical forests, peatlands and coastal mangroves (Goldstein et al., 2020), which may be partly caused by ASM activity, discussed under SDG15.

At the same time, however, ASM strengthens community resilience (discussed in section 3.1.) and adaptive capacity to climate-related hazards and natural disasters. The sector produces a large share of minerals that are critical for the transition to renewable, low-carbon and sustainable energy forms, such as wind, solar, hydrogen and electricity systems (World Bank, 2017, 2020). For example, cobalt is used to produce lithium-ion batteries that are used in electric vehicles, of which approximately 40-60% of world supply originates in the DRC, with 20-40% of this dug by 60,000-80,000 ASM operators (Darton Commodities, 2017; McQuilken, 2020). Likewise, copper is used to produce coil-driven generators that are used in most wind turbines, and rare earth minerals are important elements for producing magnets in wind turbines and electric vehicles and phosphors in energy-efficient lighting (World Bank, 2017, 2020). In addition, ASM helps people cope with the effects of climate change. For example, as outlined in section 3.2, it provides an alternative or a complimentary livelihood for farmers suffering diminishing returns from the land as a result of droughts. Moreover, as mentioned above, the sector produces construction materials such as clay, sand, aggregates (Franks, 2020) and pieces of dried coral used to build rural settlements and houses or other types of infrastructure – enhancing community resilience in rural post-disaster reconstruction.

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34 Ecosystems containing high amounts of 'irrecoverable carbon', occur where carbon can be influenced by direct and local human action, is vulnerable to loss during a land-use conversion and, if lost, cannot be recovered within a specified timeframe (t) relevant for climate action. Following a land-use conversion event, both biomass and soil carbon could recover to some extent, but a portion would remain 'irrecoverable'.



With regards to SDG14 (Life Below Water), the direct and indirect impacts of ASM on coastal ecosystems (e.g., mangroves, beaches) and marine resources (e.g. coral reefs) are underrepresented in the existing literature. Mining in coastal mangroves should be considered high priority for climate stability given their high soil carbon density (see Goldstein et al., 2020), not to mention their role in mitigating coastal flooding and extreme weather events. Among all anthropogenic and natural factors, conversion to fish and shrimp ponds has been regarded the greatest single historic driver of

mangrove degradation and decline, with the highest impact on their carbon stocks. However, mining also affects coastal ecosystems, estuaries and beaches, although its impacts are not well-documented. For example, sand and gravel are extracted from river channels for different purposes such as developing agricultural drainage systems, flood regulation and the production of aggregate materials (Padmalal, & Maya, 2014). These materials are one of the largest resources extracted and traded by volume yet tend to be the least regulated activities in most regions (UNEP, 2019c). Meanwhile, rivers, river deltas and coastlines are eroding, and global demand for sand and less recognized commodities, such as coral, continues to grow (Padmalal & Maya, 2014; UNEP, 2019c). But while ASM activities can threaten life below water, they can also be part of the solution. The ACP-EU Development Minerals Programme has, for example, worked alongside ASM communities in Cameroon, Fiji, and Uganda to more sustainably manage and monitor sand and gravel extraction, and resolve sand-mining conflicts (Franks, 2019).

In Eastern Africa and Madagascar for example, there are important links between poverty, coral reef ecosystems and informal mining.<sup>35</sup> Within the region, coral reefs border 35% of mainland coastlines and encircle many smaller barrier and offshore islands (Whittingham, et al., 2003). Such reefs are under threat from ASM coral mining, though it must be noted that miners target ancient coral reefs and rock. In the Lamu archipelago off the Kenyan coast, artisanal coral mining could create decent jobs for rural coastal peoples, if managed strategically, and by extension take pressure off local (over)fishing and provide a positive contribution to cultural heritage preservation at UNESCO world Heritage sites in Lamu old town.



*Young man extracting and polishing coral bricks on Manda island, Lamu, Kenya*

35 Personal observations by K Dales in Lamu and Kalifi, Kenya (2018-2019), Zanzibar, Tanzania (2015) and Nosy Be, Madagascar (2014).

As such, ASM can be seen as a driver of land-use change in coastal areas and 'irrecoverable carbon' hotspots (i.e. amphibious mangroves), while its local livelihood benefits, including cultural heritage preservation remain important considerations.



*Man sluicing ore to recover gold concentrate in the Teye river, Makong, Sierra Leone*

Besides this, as mentioned under section 3.1, ASM activity leads to the dumping of waste rock and mine tailings, causing siltation and turbidity, which threatens life under water (Hinton, 2003). In Sierra Leone, the use of dredges by foreign-owned small-scale mining companies is disturbing the flow of inland waters, which could possibly extend to transforming the landscape in coastal areas (EPA, 2019). Moreover, by releasing heavy metal pollution into transboundary river systems and deltas, which drain into oceans, ASGM activity endangers aquatic life and ecosystems, where inorganic mercury (Hg) used in ore processing can be transformed into methyl mercury (Me-Hg), a neurotoxin that concentrates along food chains. Indeed, once transformed, a chemical conversion which readily occurs in brackish waters of mangroves, mercury from poorly planned mine sites can bioaccumulate to harmful levels in fish and marine food chains, endangering local and global fish consumers (UNEP, 2019a).



SDG15 sets forth an unprecedented global agenda to sustain 'life on land.' Growing demand for productive land and raw materials, especially minerals and metals, requires appropriate regulation, planning, and management (IRP, 2019) but are not without political blind spots. While the magnitude of impacts from mining can be profound, evidenced by catastrophic tailings dam bursts (Fernandes et al., 2016) and legacies of mine abandonment (Veiga & Hinton, 2002; Mhlongo & Amponsah-Dacosta, 2016; Dales & Ramasamy, 2019; Getty & Morrison-Sanders, 2020), the capacity of LSM actors to

mitigate and redress these impacts far exceeds that of ASM miners (Marshall & Veiga, 2017; Dales & Cordy, 2021).

As mining occurs in nearly all terrestrial biomes on earth (Sonter et al., 2018), it affects a variety of ecosystems – including tropical forests, peatlands, wetlands, mountains, savannas, drylands – and their biodiversity. Most policy actions prioritize the protection of tropical forest ecosystems, such as the World Bank’s focus on forest-smart mining (World Bank, 2019). Within forested systems however, tropical peatlands (or forested wetlands) in Indonesia, the Amazon and Congo Basin contain vast quantities of irrecoverable carbon where land-use decisions can expand protection and avoid their loss. Similarly, mangroves store soil carbon and biomass but receive less attention than their terrestrial counterparts. While ASM occurs in montane grasslands with significant soil carbon, grasslands are more resilient to land-use change as their recovery times and climate mitigation benefits can be realized on rapid time scales. Consequently, while commodity-driven deforestation is a critical issue in improving the sustainability of mineral supply chains, it is important to recognize that ASM widely occurs in *non-forested* ecosystems, such as tropical savannas, that offer biodiversity, carbon, water, albedo<sup>36</sup> and cultural benefits (Temperton et al., 2019; Goldstein et al., 2020). A major concern is the lack of adequate revegetation and rehabilitation after mining activities end, which threatens the achievement of SDG targets 15.2, 15.3 and 15.5, which respectively aim to sustainably manage forests and land and halt biodiversity loss (Dales & Cordy, 2021).

A growing body of evidence shows that the cost of inaction far outweighs the benefits of restoring degraded land and ecosystems (Bullock et al. 2011; IPBES, 2018). Land restoration can deliver synergetic benefits toward achievement of virtually all SDGs (IRP, 2019), especially SDG15, alongside the Convention on Biological Diversity (CBD) 2020 Strategic Plan and post-2020 Aichi targets; the Paris Agreement on Climate Change; the UN Strategic Plan for Forests (2017-2030) and UN Decade on Ecosystem Restoration (2021-2030) as well as other multilateral agreements on international waters and sound chemicals (i.e., Minamata Convention on Mercury) (Dales & Cordy, 2021). Key challenges include insufficient knowledge about species roles and functions, underlying mechanisms of biological invasions, and how to monitor restoration success in biologically diverse ecosystems. In the case of ASM, the challenge is compounded by the informal and ephemeral nature of many ASM operations, which creates a disincentive to invest in land rehabilitation. Another important concern, as outlined, are releases of heavy metals to land and water (UNEP, 2019a). And finally, ASM also threatens life on land indirectly through the secondary industries it supports and migration it causes

in remote areas. For example, underground mine shafts often require significant amounts of hardwood driving deforestation, while workers also harvest timber for fuel wood and construction needs.



*Land degraded and deforested by gold mining around Mafai mine site, Makong, Sierra Leone*

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36 Albedo refers to surface reflectance of a landscape that is influenced by land cover.

### 3.4.1 ASM formalization and environmental stewardship

Evidence suggests that the cumulative impacts of ASM on the environment are worse where resource governance is weak and mining is informal, unskilled, and disorganized, leading to 'death by a thousand cuts'. It thus follows that formalization is a key (though not necessarily sufficient) condition for mitigating these impacts. Indeed, by facilitating access to the finance and assistance required for the adoption of better mining practices, formalization can help to reduce the sector's pollution of various ecosystems, river systems, and their biodiversity. Moreover, it can facilitate monitoring and regulatory enforcement of heavy polluters (e.g. dredges), and provide security of tenure and additional incentives for rehabilitation efforts such as 'turning mining pits into fish farms' (Otchere et al., 2004), thus mitigating negative impacts on marine (SDG14) and terrestrial ecosystems (SDG15). Furthermore, it can facilitate miners' education on climate change and sustainable development issues, and help to integrate climate issues into mining regulations. Finally, it can help to increase the sustainable production of minerals critical for the transition to renewable, low-carbon and sustainable energy forms – thus harnessing the sector's positive impacts on resilience and adaptive capacity to climate-related hazards (SDG13).

**Figure 5. Multifunctional mining landscape\***



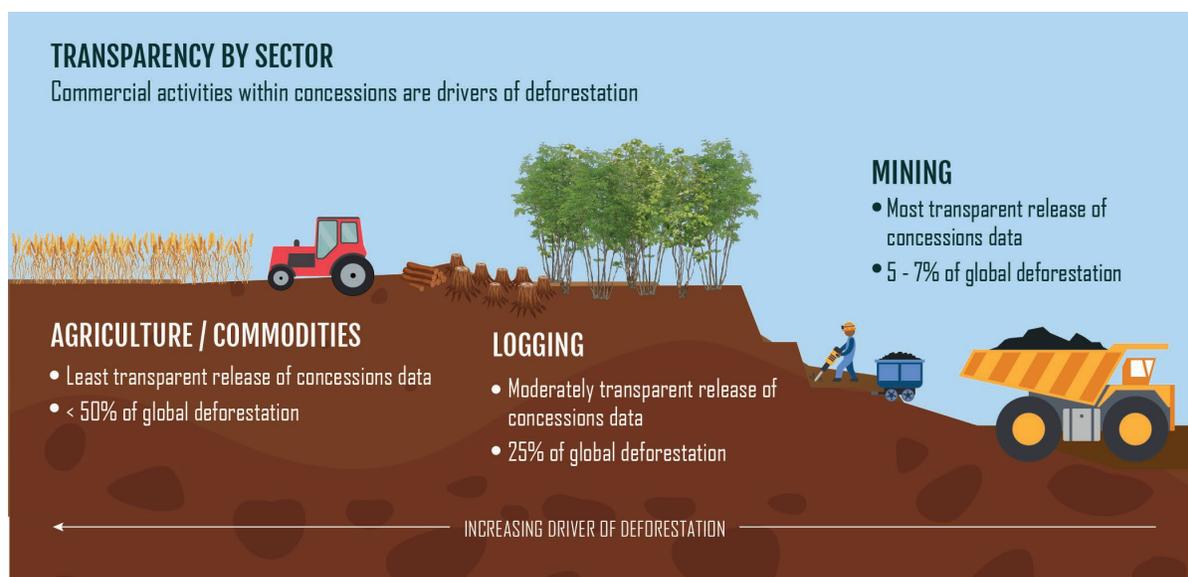
*\*Figure depicts an informal rural economy in the Global South where agriculture, logging and mining coexist near rural settlements, inland waters, and wildlife, such as bats. Source: Dales & Cordy, 2021.*

Globally, ASM represents the most important non-farm livelihood (World Bank, 2019). Driven by necessity, subsistence mining, agriculture and forestry often coexist in multifunctional working landscapes, as depicted below. Without the benefit of formal concessions or land-use planning, ASM miners operate on the margins of, or directly on, agricultural, logging or commercial mining concessions. In many cases, such issues are at the heart of land-use conflicts due to informality and the persistent lack of land allocated for ASM activities. Accordingly, access to land and multi-sectoral landscape approaches are necessary to optimize formalization processes (Davidson, 1993; Hentschel et al., 2003; Hilson & Maponga, 2004; Mutemeri et al., 2016; Steinmüller, 2017; Dales & Cordy, 2021).

The legal nature of land concessions<sup>37</sup> varies by country and administrative jurisdiction often with wide discrepancies between concession size, terms of use, lease details, and options for renewal (Webb et al., 2017). The terms are dictated by the commodity of interest. For instance, point source non-renewable resources (i.e., minerals, metals) are often enshrined in law as state-owned resources or deemed as strategic assets. Mining concessions are particularly complex due to the legal division between surface and subsurface rights, where a landowner may own surface rights but not the minerals beneath (i.e., subsurface mineral rights). Indeed, for this reason security of tenure and allocation of mineral rights are heavily regulated in industrial operations and often a root cause of land-use conflicts in and with ASM communities.

Webb et al. (2017) found that commercial mining had the most transparent release of concession data followed by moderately transparent logging data, while agricultural concessions were the least transparent. Although mining is a driver of tree cover losses within concessions, impacts also regularly occur off mine concessions due to influxes of mine workers and secondary industries (Sonter et al., 2017). In commercial sectors, evidence suggests that less transparent concession data at a minimum correlates with, and potentially drives land-use changes leading to higher rates of deforestation, depicted in Figure 6.

**Figure 6. Transparency by commercial sector\***



\*Figure compares concession data of shifting commodities, logging and mining linked against their relative impact on tree cover losses between 2001 to 2015. Graphic design of imagine was inspired by Webb et al. (2017) with additional data trends from Curtis et al. (2018) and Hosonuma et al. (2012).

37 Land rights are granted through concessions that enable an individual, small enterprise or company to grow crops, log timber or extract minerals on a given concession for a period of time.

Until recently, commodity-driven deforestation<sup>38</sup> has been lumped with agriculture, together accounting for at least half of tree cover losses, when in fact certain commodities, such as palm oil in Southeast Asia or beef in the Amazon, are disproportionate drivers of forest loss (Curtis et al., 2018). Accordingly, data on forest-related SDG indicators 15.1.1 (forest area as a proportion of total land area in 2015) and 15.2.1 (progress towards sustainable forest management) must be judiciously assessed by policymakers, planners, the private sector, and donors who intervene in multifunctional mining landscapes, especially at tropical latitudes (Dales & Cordy, 2021). Moreover, the number of non-forest patch types (e.g., savannas, wetlands, deserts) represented on a landscape and their relative abundance are equally important to assess impacts, yet are less obvious compared to areas of dense forest canopy where impacts are more visible. Consequently, greater scrutiny of mining as a driver of ecosystem degradation is needed to accurately attribute drivers of habitat fragmentation, degradation and change, and inform ASM formalization policies.



*Orkhon Valley, Mongolia at risk of degradation due to ASM*

**To unlock the ASM sector’s potential, formalization should be approached as a part of integrated land-use and sustainable development planning** where mining titles are allocated and managed in broader consideration of sustainability issues. For instance, differentiating land-uses such as row crops in South America, or tree plantations from disturbed natural forests in Southeast Asia, could allow for deeper supply chain analyses in rural areas. To this end, governments can consider piloting commodity-specific Jurisdictional Approaches<sup>39</sup> to optimize formalization efforts by managing ‘spaces’ (i.e. ‘ASM zones’) rather than people (Mutemeri et al., 2016). At scale, Strategic Environmental Assessments (SEAs) can help to establish regional priorities in ASM zones and promote localized environmental management by miners (Dales & Ramasamy, 2019). They could also align mine rehabilitation and closure policies with national land degradation neutrality targets (SDG 15.3) ensuring measures to conserve, sustainably manage and restore land; halt biodiversity loss (SDG 15.1.) and end illegal poaching (SDG 15.8.). Irrespective of the approach taken, with appropriate strategies, incentives and assistance, miners and their communities can be progressively empowered to self-manage mine sites and become champions for environmental stewardship.

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38 A recent classification of global drivers of deforestation between 2001 to 2015 indicates that 27% of annual tree cover losses were attributed to commodity-specific deforestation, followed by forestry (26%), shifting agriculture (24%) and wildfire (23%) (see Curtis et al., 2018).

39 Jurisdictional Approaches (JAs) are a type of multi-stakeholder collaboration process aimed towards enhancing landscape sustainability, improving local livelihoods and managing natural resources through coordinated strategies to achieve specific sustainable development goals in supply chains of a given commodity, and originated in REDD+ programs (see Godar, 2014; Godar et al., 2016; Buchanan, et al. 2019).

## 3.5 Clean energy, infrastructure and sustainable cities



### PROGRESS:

- Although the world is making good progress on increasing access to electricity and improving energy efficiency, millions of people around the world still lack access to electricity and billions still rely on polluting cooking systems (ECOSOC, 2020).
- Faster uptake of renewable energy sources is required to meet long-term climate goals (ECOSOC, 2020).
- The COVID-19 pandemic is hitting manufacturing industries hard and causing disruptions in global value chains and the supply of products (ECOSOC, 2020).
- While Sub-Saharan Africa already has the world's smallest share of manufacturing employment and intra-regional trade, the pandemic has caused the postponement of the operationalization of the Africa Continental Free Trade Area Agreement (AfCFTA), which had been touted as a catalyst for industrial development through the configuration of an integrated African market (UNECA, 2018).
- COVID-19 has exposed the vulnerability of poorly-planned, informal and overcrowded cities, towns and villages, underscoring the importance fostering safe, resilient and sustainable human settlements.



In terms of SDG7 (Affordable and Clean Energy), anecdotally ASM requires much less energy for extracting a given amount of minerals than LSM, because it relies heavily on manual labor. Still, accumulatively, the sector – and especially small-scale mines – requires considerable energy for powering crushing and grinding machines, water pumps, lighting and ventilation in underground mines, etc., and this is expected to increase as the sector further mechanizes. As outlined in the previous section, in most cases, ‘dirty’ forms of energy are used. Since most ASM mines are informal, are

located in remote areas, and enjoy low levels of investment, they do not have access to clean forms of energy, as recently documented in South Africa (Ledwaba, 2014).

At the same time, as was outlined in section 3.4, ASM produces vast numbers of minerals that are critical for the transition to renewable, low-carbon and sustainable energy forms (World Bank, 2017; Ali et al., 2017; World Bank, 2020). As the demand for such minerals is expected to rise dramatically, the production of renewable energy technologies will increasingly rely on ASM for a sufficient supply. Besides this, in some cases, ASM also supports the electrification of rural areas. For example, at one of the mine sites of Coopérative Minière Kaba-bara-Gikingo (COMIKAGI), a Rwandan tin-tantalum ASM cooperative, an electricity mast was established using mining revenues, providing electricity for the local community.<sup>40</sup> Similarly, small-scale alluvial gold mining operations in Suriname that extended infrastructure into the dense forested interior not only extended energy access to indigenous communities, but integrated photovoltaic arrays into their district energy systems.<sup>41</sup>



In terms of industry, innovation and infrastructure (SDG9), ASM is helping developing countries to diversify their (largely) agricultural-based economies through gradual industrialization that includes the rural poor, women and youth. The sector brings a lot of innovation in rural areas. Once a new technology or new way of mining is introduced that is affordable, trusted locally and proven to have economic returns on investment (which naturally takes some time), it can be taken-up quite rapidly and diffused locally among different communities. For example, in Migori, Western Kenya, local miners

have introduced and (after a long period of sensitization) eventually adopted the ‘Tanzanian ball mill’ in their community, enhancing gold recovery in ASM mines. Moreover, the US-based mining equipment manufacturer, Mount Baker Mining and Metals (MBMM), has donated a shaker table, an advanced sluice box technology<sup>42</sup> and retorts to one of the community groups, reducing their dependence on and exposure to mercury. Local engineers are currently replicating the sluice box and retort, while making slight adjustments to enhance

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40 Personal observations by J McQuilken and J de Haan during a site visit at one of Comikagi’s mines in October 2019.

41 Personal communication and informal electronic (WhatsApp) interviews with local mining stakeholders, K Dales, February 2020.

42 MBMM open source and free technical plans for advanced sluice box technology are available online: <https://mbmmlc.com/stop-mercury/improved-sluicing-technology/>



Local engineers in Mikei community, Kenya, with their reproduced MBMM sluice

recovery and comfortable use by local miners (see picture).<sup>43</sup> Notwithstanding cultural, social and economic challenges in facilitating ASM's transition to new methods, this example demonstrates how ASM can enhance local manufacturing opportunities, promote local innovation and encourage technology transfer.

The sector also supports local infrastructure development. For example, in Mambasa territory, Ituri province in the Eastern DRC, village 'PK25' has been established by local miners and mineral traders thanks to mining revenues, providing shelter for local people from all walks of life, including women and youth (Agence Congolaise de l'Environnement, forthcoming). In many countries, local roads have also been

established around ASM sites, making such rural areas more accessible and conducive to trade, benefiting local merchants and farmers (for example, see EPA, 2019; Nkuba et al., 2019). Development minerals, and especially its category of construction materials, such as sands, clays, dimension stones, are directly used for the construction of roads, houses and other types of infrastructure (Franks et al., 2016). For example, as mentioned under the preceding section, artisanal coral miners in East Africa have been observed to use the extracted and polished coral stones, a light but relatively resilient construction material, to construct local houses, thereby generating significant added value at community level. Moreover, on the African continent, the supply of development minerals will be critical for realizing the infrastructure development required for AfCFTA's effective operationalization. In turn, AfCFTA can (along with formalization efforts) be expected to help optimize the efficiency of regional ASM supply chains, and encourage value addition to raw mineral outputs.



In terms of sustainable cities and human settlements (SDG11), it was just highlighted how ASM enables the establishment of human settlements in rural areas that can absorb a large number of poor and disadvantaged people. This helps to take some of the pressure off urbanization and the many negative aspects associated with it. However, given the informal and often short-term nature of ASM activities, one could ask how *resilient* and *sustainable* those settlements are. Particularly in rush-type ASM activities, the established villages tend to be characterized by poor housing conditions. For in

example, in Kono district, Sierra Leone, an ASM village named 'Komahun' was established after local miners found several gold-rich ore deposits in the area in 2017, and attracted more than 2,000 inhabitants in a matter of months. Yet most inhabitants only stayed there for one to three years in view of gradually depleting ore deposits and conflict with a foreign-owned mine. The houses in the overcrowded village are built close to each other, are covered with

43 These observations are based on personal and professional experiences from K Dales and J de Haan in Migori, Kenya, 2018-2020.

thin, porous plastic sheets or clothes, have simple and improvised toilets and poor waste management practices. Moreover, in one of the mine sites on the mountain overlooking the village, excavators have left large holes in mountain slopes which may cause landslides that could potentially kill nearby miners and damage the village and its inhabitants.<sup>44</sup> Although such an example must be considered in a context of deep-seated poverty and poor housing conditions in general, it underscores the housing risks that tend to be associated with temporary ASM settlements, and the threats they pose to public health.



*Living conditions in Komahun community, Sierra Leone*

In contrast, Dalakuru, an ASM community that was established around more permanent-type and better organized goldmines in Sierra Leone's Makong district, has much better housing conditions and poses less risks to its inhabitants. Moreover, as outlined above with the examples from Manda Island and Zanzibar, the extraction of development minerals such as coral facilitates the construction of very affordable local houses locally (see picture below), which is often done by the miners and local inhabitants in a participatory manner. Moreover, ASM revenues are often reinvested in housing. For example, in Mikei village, Migori county in Kenya, the intensification of gold mining activities has enabled the transformation of porous roofs made from plastic or grass to more solid, water-proof tin roofs that most houses in the village are now equipped with.<sup>45</sup> Finally, and with reference to SDG targets 11.1 and 11.7, ASM promotes rural access to transport and social and economic links between urban, peri-urban and rural areas, by enabling the development of local roads (albeit not always safe ones) and promoting local transport services.

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<sup>44</sup> Based on field observations and interviews by J de Haan, undertaken with EPA-SL in Komahun, Dalakuru and other ASM communities during January and February 2018. For more detailed contextual information, readers can refer to EPA, 2019.

<sup>45</sup> Personal observations and informal stakeholder interviews conducted by K Dales and J Opiyo in Migori County, Western Kenya, 2015-2019.

### 3.5.1 ASM formalization and clean energy, infrastructure and sustainable cities

Formalization can enhance the sector's positive net outcomes on energy, infrastructure and sustainable cities. Regarding all SDGs discussed here, formalization can facilitate governments' collection of license fees, taxes and royalties, which can in turn be invested in renewable energy projects, safe and resilient infrastructure, technological innovations and improvement of local housing conditions. Regarding SDG7, formalization can help to make ASM more visible, attract the necessary investment and advocate for its inclusion in renewable energy projects, while facilitating a safer, more sustainable and larger supply of minerals critical for the transition to renewable energy technologies. Regarding SDG9, it can facilitate more sustainable industrialization, by facilitating the sector's adoption of more efficient and environmentally-sound mining practices and processing equipment. Specifically with regards to SDG targets 9.3 and 9.7, formalization can facilitate access to finance and integration into value chains and markets (9.3); and more indirectly, enable value addition (9.7) to raw mineral outputs such as through cutting and polishing of gemstones, smelting and refining of gold and jewelry-making. Finally, regarding SDG11, formalization provides miners with the security of tenure and access to finance that can extend mine life and encourage investment into safe, more resilient housing.



*Coral house on Manda Island, Kenya*

## 3.6 Peace, justice and governance

### 16 PEACE, JUSTICE AND STRONG INSTITUTIONS



Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

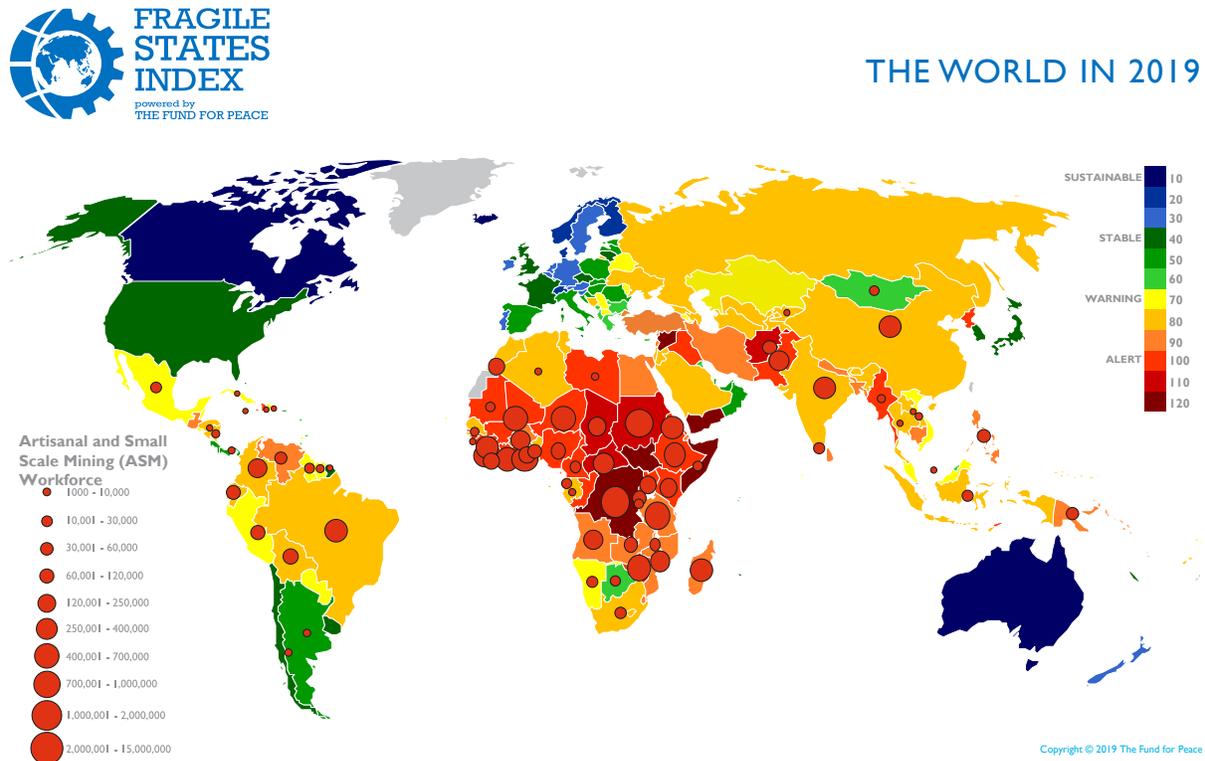
#### PROGRESS:

- "There can be no sustainable development without peace, and no peace without sustainable development." (UN 2030 Agenda for Sustainable Development).
- Conflict, insecurity, weak institutions and limited access to justice remain a great threat to sustainable development. In 2018, the number of people fleeing war, persecution and conflict exceeded 70 million, the highest level recorded by UNHCR in almost 70 years (ECOSOC, 2020).
- As the UN Secretary-General recently remarked to the Security Council, the severe socio-economic fallout of the pandemic is causing tensions and accentuating pre-existing grievances and vulnerabilities, increasing "the potential for instability and violence". Moreover, "fragile peace processes could be derailed by the crisis", and terrorist and violent extremist groups could "see the uncertainty created by the pandemic as a tactical advantage".<sup>46</sup>
- On the same occasion, the UN Secretary-General has identified "growing manifestations of authoritarianism, including limits on the media, civic space and freedom of expression".

46 Statement by UN Secretary-General Antonio Guterres on 2 July 2020 to the Security Council Open Video-Teleconference on the Maintenance of International Peace and Security: Implications of COVID-19. <https://www.un.org/sg/en/content/sg/speeches/2020-07-02/remarks-security-council-maintenance-of-international-peace-and-security-implications-of-covid-19>

This subsection briefly recaps the key points of de Haan (2021), which analyzes the relationships between ASM formalization and peace, justice and strong and inclusive institutions as the three key domains of SDG16 (de Haan, 2021). As can be observed from figure 7, which overlays the 2019 State Fragility Index with ASM workforce estimates, ASM thrives in areas that have been affected by conflict, are considered as high-risk, and/or are characterized by poor governance.<sup>47,48</sup> ASM and ASM formalization are therefore inextricably related to the three domains of SDG16, discussed below.

**Figure 7. 2019 Fragile States Index vs. estimated ASM workforce**



Given ASM's informal nature, and its capacity to thrive in fragile and conflict-affected areas, the sector is strongly associated with issues such as violence, the financing of armed conflict and terrorism, and organized crime – notwithstanding differences among minerals.<sup>49</sup> At the same time, ASM also instils a 'culture of peace', as its working culture generally reflects solidarity and promotes equality. Moreover, formalization efforts are helping to delink ASM

47 Figure adopted from de Haan (2021), and inspired by ASM Program Strategy, Canadian International Resources and Development Institute (CIRDI), developed by Kirsten Dales et al. Used with permission.

48 The full range of security, economic, political and social indicators of the Fragile States Index can be found here: <https://fragilestatesindex.org/indicators/>

49 Certain minerals such as 3T, gold, diamonds and other high-value gemstones are more strongly related to conflict, corruption and human rights abuses (and often labelled 'conflict minerals'), while other minerals – and especially development minerals – are significantly less related to such issues.

from issues of insecurity. For example, the Pact-implemented ITSCI mineral traceability and due diligence program in the African Great Lakes Region helps to create 'conflict-free' 3T mineral supply chains that avoid contributing to armed conflict, human rights abuses, child labor and corruption, thereby contributing to peace and security in insecure parts of the region. Furthermore, ASM formalization can help to address the root causes of the outbreak of violent conflicts by providing marginalized youth with more meaningful prospects for the future and an alternative to joining armed groups or criminal organizations.



ASM is also plagued by poor respect for the rule of law, widespread human rights abuses, corruption and bribery, limited access to justice, and illicit financial flows. However, by providing miners with mining titles that serve as a form of legal identity, formalization provides miners and traders with a means to access justice. More broadly, formalization facilitates land tenure and labor rights, and protection of fundamental freedoms. Moreover, by bringing more transparency and checks and balances into the sector, formalization can help to curb illicit financial flows, and facilitate action against corruption and bribery. At the same time, however, mining revenues collected as part of formalization processes can also be subject to corruption in the absence of adequate checks and balances.



Finally, the sector is characterized by poor governance and low levels of transparency and accountability. At the same time, however, ASM has been reported to support the functioning of public institutions in times of crisis, such as in Mali, where ASM gold helped to fund local governments, schools and medical providers during the 2012 *coup d'état* (Teschner, 2014). Formalization can leverage this potential and support long-term processes of state-building and state-reconstruction. For example, by enhancing monitoring and enforcement of national regulations (thus strengthening the rule of law), or by decentralizing the issuance of mining licenses and related tasks to provincial and district governments and building their capacity for regulating the ASM sector. Moreover, formalization can provide a space for dialogue and participation, and help to restore trust and state legitimacy in areas where trust has been eroded. For example, by organizing regional workshops where miners, traders and community members can voice their concerns about the governance of the sector and suggest new policy measures to shape sectoral plans.

**As such, ASM formalization needs to be understood and prioritized as an integral part of state- and peacebuilding processes, and correspondingly be integrated in national, regional and global frameworks of peace and security (de Haan, 2021).**

## 3.7 Partnerships

### 17 PARTNERSHIPS FOR THE GOALS



Strengthen the means of implementation and revitalize the global partnership for sustainable development

#### PROGRESS:

- With global financial markets experiencing great losses and volatility, and world trade being expected to plunge between 13% and 32% in 2020, the pandemic is adding more hardships in the already-challenging implementation of the SDGs (ECOSOC, 2020).
- Yet in the current context, strengthening multilateralism and global partnership are more important than ever before (ECOSOC, 2020).
- SDG17 contains four domains: finance, technology, capacity building and trade.



As a result of its crosscutting nature, ASM brings together a diversity of stakeholders from civil society and the public and private sectors, at the local, national, regional and international levels. Multi-stakeholder initiatives such as the European Partnership for Responsible Minerals (EPRM) which brings together governments, international mineral traders and civil society organizations exemplify the convening nature of the sector.<sup>50</sup> It also elicits great interest from bilateral and multilateral donors, enhancing resource mobilization for developing countries. Increasingly so, this includes private donors, including tech giants such as Apple, Google and Microsoft who need a sustainable supply of responsibly-produced minerals, as well as industrial mining companies, industry associations such as London Metal Exchange (LME) and London Bullion Market Association (LBMA) and international commodity traders, refiners and jewelry makers. ASM thus helps in diversifying the global sources of development assistance, rather than relying only on more 'traditional' donors. Formalization efforts, and especially supply chain due diligence initiatives, have helped many such stakeholders to realize their connection to (or dependence on) ASM.

At the same time, various private and public stakeholders, including donors, financial institutions, international mineral buyers and LSM companies, are regularly observed to stay away or even disengage from ASM in view of reputational risks, especially in instances where ASM gets extensive negative media attention, as the sector often does (see for example Sofala Partners & BetterChain, 2019). Nevertheless, formalization efforts, and in particular industry traceability, transparency and due diligence standards and initiatives for responsible sourcing such as the Code of Risk-mitigation for Artisanal and small-scale mining engaging in Formal Trade (CRAFT)<sup>51</sup> and the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas (OECD, 2016), can help to 'de-risk' ASM and facilitate the (re)engagement of such partners. Of particular relevance to SDG targets 17.1, 17.5, 17.10 and 17.11, formalization further helps to improve the investment climate for private partners (17.5), and – as discussed in section 3.1 – enhances exports from developing countries (17.10 and 17.11), increasing government revenues from taxes and royalties (17.1).

Finally, as section 3.5 already demonstrated, ASM activity also facilitates technology transfer and capacity building in developing countries, including through North-South and South-South cooperation. Moreover, the sector sparks great interest in the scientific community and facilitates partnerships between researchers. For example, the establishment of ASM expertise centers – such as the Bukavu-based CEGEMI (Centre d'Expertise en Gestion Minière),<sup>52</sup> which was established in collaboration with Flemish and Congolese Universities – underscores the sector's catalyst role in promoting scientific research, collaboration and global knowledge sharing on development issues.

**ASM thus already plays an important role in revitalizing the global partnership for sustainable development, a role which can further unfurl through global partnerships for formalization.**

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50 For more information about the EPRM, see: <https://europeanpartnership-responsibleminerals.eu/>

51 For more about CRAFT, see: <https://www.craftmines.org/>

52 For more about CEGEMI, an expertise center on mining governance in the DRC, see: <http://cegemi.com/>

## Conclusion and policy recommendations

This ASM-SDG Policy Assessment complements earlier work that explores the relationship of ASM with certain SDGs (World Bank, 2019; Hilson & Maconachie, 2019; Hilson, 2021; Levin-Nally & Racionero Gómez, 2021; Dales, 2021; de Haan, 2021), to provide a first complete and structured review of the interlinkages between ASM, formalization and all 17 SDGs. As such, it has provided the ASM counterpart to the LSM-focused UNDP and WEF mining-SDG *Atlas*. Still, the authors acknowledge that given the diversity of the sector and certain ASM-SDG interlinkages that require further exploration, this mapping exercise can and should be updated or complemented in the future.

It has been demonstrated how even in its informal state, the sector makes positive contributions to almost all SDGs, and particularly those concerned with social (SDGs 4, 5 and 10) and economic development (1 and 8), nutrition (2), clean energy, infrastructure, sustainable cities (7, 9 and 11), adaptation to climate change (13), peace, justice and governance (16), and partnerships (17). At the same time, without intervention ASM has negative impacts on the majority of the SDGs, and particularly those concerned with human health (SDGs 3 and 6), environment (13, 14 and 15), nutrition (SDG2), social development (4, 5, and to some degree, 10), decent work (8), sustainable cities (11), responsible production (12) and peace, justice and governance (16). When considering the respective SDGs' domains and targets, there are in fact very few aspects that are not directly or indirectly affected by ASM, whether positively or negatively.

The SDG wheel on the top in Figure 8 illustrates these links between the *current*, largely *informal* ASM sector and the various SDGs, reflecting the *mainly positive* (blue arrows), *mainly negative* (red arrows) and – most commonly – *multi-sided* (green arrows) directions of these relationships.<sup>53</sup>

The Assessment has also highlighted how ASM's informality is often an important cause of the sector's negative impacts, and how formalization, for each SDG, can help in mitigating any negative impacts and unlocking or amplifying the positive impacts (though as indicated, formalization can also perpetuate negative impacts). The SDG wheel below in Figure 8 illustrates how some of the relationships can be altered through a comprehensive formalization process. While a comparison between the top and bottom ASM-SDG wheels shows that formalization can help to unlock positive impacts (i.e. turning red arrows into green), it is difficult – and indeed seems excessive to the point of redundancy – to portray the full and exact impacts formalization can have in altering positive and negative impacts. It is equally challenging to determine whether formalization can go beyond mitigation to fully eliminate existing negative impacts – even as it has become clear that formalization processes have great potential in mitigating the majority of negative impacts, and can effectuate an *overall much more positive relationship between ASM and the SDGs*.

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<sup>53</sup> The figure highlights mainly positive and mainly negative impacts so as to indicate differences among SDGs and illustrate how formalization can alter the main direction of these impacts, but it must be noted that technically speaking, ASM has both positive and negative impacts on virtually all 17 SDGs.

Figure 8. 'ASM-SDG wheels': interlinkages between 'informal' ASM and the SDGs, and 'formal' ASM and the SDGs

BOTH POSITIVE & NEGATIVE IMPACTS



MAINLY NEGATIVE IMPACTS



MAINLY POSITIVE IMPACTS



This ambiguity reflects the complexity of the ASM-SDG relationships – which, as formality itself, are best understood as a spectrum – as well as the fact that it all depends on the way that formalization is approached. Indeed, when considering most efforts undertaken to date, large parts of the positive potential are not yet realized. Moreover, as documented, top-down approaches to ASM formalization can also have negative impacts, in particular by perpetuating inequalities (SDGs 5 and 10) and facilitating corruption (SDG16), thereby undermining the sector's pro-poor development potential (i.e. positive impacts on SDGs 1 and 8) and possibly causing social unrest, which threatens peace and security (SDG16). This raises some (initial) important questions:

- *Is it possible and even appropriate to develop formalization strategies that cover all SDGs at once?*
- *Is it possible for such strategies to attain their desired positive impacts while avoiding (unintended) negative impacts?*
- *How can such holistic strategies be best designed?*

The below policy recommendations provide initial reflections to these questions.

## **Developing SDG-sensitive ASM formalization strategies**

The various analyses presented in Section 3 have underscored the importance of approaching formalization with the respective (cluster of) SDGs in mind. For example, taking pro-poor and gender-sensitive approaches; adopting nutrition and health lenses; approaching formalization as a part of integrated land-use and sustainable development planning, and as a part of peace- and state-building processes. But given the myriad interlinkages identified in this Assessment, the selection of only one such approach risks not effectively harnessing the complex interlinkages between ASM, formalization and other SDGs. Arguably, formalization therefore needs to be planned with all the SDGs in mind, or at least with those prioritized in the local and regional context.

For a large part, this boils down to the need to approach formalization in a comprehensive and an inclusive manner. The comprehensive conceptualization of formalization that was presented here, the more bottom-up *human rights-based approach* that is discussed in de Haan (2021), and the more detailed guidance provided in the *Formalization Handbook* – can serve as tools for designing such comprehensive and inclusive ASM formalization strategies, reflective of the 17 SDGs. While all components of the formalization process are important, technical assistance and education are critical for individual, institutional, national capacity building toward legal and regulatory compliance, transparency and broader sustainability.

As advocated by DELVE and much of the ASM scholarship (World Bank, 2019), a key starting point for ensuring that formalization strategies are comprehensive is ensuring that they are evidence-based by conducting comprehensive baseline assessments of the ASM sector, covering socio-economic, regulatory, institutional, health, environmental and technical aspects of all minerals produced. As part of this, a nuanced analysis of *local governance structures* (formal and informal), *power dynamics* and *gender considerations* in mineral



supply chains can be conducted.<sup>54,55,56</sup> Adopting a *human rights-based approach* can then help to avoid unintended consequences by preventing, for example, the perpetuation of unequal power relations, or the exclusion of identified vulnerable groups. Next, ensuring Inter-Ministerial coordination around ASM formalization and inclusive stakeholder mapping and engagement at the national, provincial and local levels can facilitate the buy-in of key stakeholders. Engaging these stakeholders for mapping and prioritizing the sector's positive and negative impacts on sustainable development issues can also help to ensure that their respective needs and interests are identified and considered.

Ultimately, this stakeholder engagement and mapping exercise can lead to the development of a *National Vision* for the ASM sector, which can guide the national formalization strategy and related policies, regulations and programming. Such a *National Vision* can be based on international, regional and national development frameworks. Key frameworks include the *African Mining Vision (AMV)*, which incorporates ASM,<sup>57</sup> and the Mosi-oa-Tunya Declaration, a multi-stakeholder global call to action on small-scale mining and quarrying (ASM18, 2018), and can be used to ensure the alignment of a National Vision with (among other things) the SDGs.

Finally, based on this, the contents of the formalization strategy can be developed, which needs to be comprehensive in scope but also realistic. For example, based on the assessed government capacity and barriers to formalization, it may in many cases not be feasible to formalize the entire ASM sector, and be more pragmatic to prioritize the formalization of specific parts. For all such steps and considerations, step-by-step guidance is provided in the *Formalization Handbook* (UNITAR & UNEP, 2018), and broader guidance for managing ASM can be found in *IGF Guidance for Governments: Managing Artisanal and Small-scale Mining* (Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development, 2017). A concrete example of this entire process is given in the accompanying case study at the end of this Assessment, which describes the development of Sierra Leone's ASGM formalization strategy.

But although the SDGs serve as an entry point for understanding and harnessing ASM's multifaceted development outcomes, their 'use' in formalization strategies is only as meaningful as the extent to which countries ascribe to and 'domesticate' the SDGs in national and regional development frameworks – and include ASM in that process. Additionally, before and beyond the SDGs, it is essential to align ASM formalization strategies with local, national and regional development priorities, to ensure local ownership and alignment with existing development planning. Thus another key question to consider is:

- *How can ASM and ASM formalization strategies be integrated in national and regional policy/development frameworks?*

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54 UNITAR's Socio-economic ASGM Research Methodology provides step-by-step guidance for investigating such issues in the ASGM sector. [https://unitar.org/sites/default/files/media/file/final\\_socio-economic\\_methodology.pdf](https://unitar.org/sites/default/files/media/file/final_socio-economic_methodology.pdf)

55 World Bank's Rapid Assessment Toolkit for gender in the ASM sector can be used for assessing gender dynamics in ASM. See: Eftimie, A.; Heller, K.; Strongman, J.; Hinton, J.; Lahiri-Dutt, K.; Mutemeri, N., 2012. Gender Dimensions of Artisanal and Small-Scale Mining: A Rapid Assessment Toolkit (World Bank). <https://openknowledge.worldbank.org/handle/10986/2731>

56 See McQuilken and Hilson (2018) for a novel framework to map governance and power structures at all levels in the ASM production network.

57 See [www.africaminingvision.org](http://www.africaminingvision.org)

## Integrating ASM and the SDGs in (sub)national and (sub)regional policy frameworks

National frameworks may take the form of national vision documents and national development strategies, often named 'National Sustainable Development Strategies', 'National Development Plans', 'Poverty Reduction Strategy Papers', or similar. While sub-national frameworks include (among others) local government and sub-national development plans. Regional development frameworks include, for example, *AU Agenda 2063: The Africa We Want*, while sub-regional frameworks include for example the *G5's Strategy for the Development and Security of the G5 Sahel Countries*<sup>58</sup>. And as this Assessment makes clear, it is equally important to integrate ASM into topic-specific frameworks, such as gender equality policies, climate actions plans, peace and security, financial inclusion and youth employment strategies. Moreover, ASM may be integrated in post-COVID recovery plans, which provide a unique opportunity to reverse current trends and change our consumption and production patterns towards a more sustainable future (ECOSOC, 2020). And as indicated in section 3.2, beyond policy frameworks, ASM could be integrated in the education system through inclusion in school and university curricula and/or TVET, apprenticeship and scholarship programs.

Different processes and tools can be used for integrating ASM in such frameworks. As most UN Member States are still in the process of domesticating the SDGs into their development frameworks, there is an opportune moment for also integrating ASM during the process. A useful start point may be Voluntary National Reviews (VNRs), which are a critical component for the review and implementation of UN Agenda 2030. VNRs serve to track progress on the SDGs and their targets at the national level, and are presented at the High-Level Political Forum on Sustainable Development. They analyze the extent to which national frameworks are aligned with the SDGs and determine whether there are critical gaps – for example, the inadequate integration of relevant economic sectors relevant for achieving the SDGs. Based on this, the VNRs can propose and kickstart the development or amendment of existing national frameworks to address these gaps.

Another useful tool, already identified by the World Bank (2019), concerns the *Roadmap for Localizing the SDGs: Implementation and Monitoring at Subnational Level* (Global Taskforce of Local and Regional Governments, UNDP & UN Habitat, 2016). This roadmap provides guidance for incorporating local priorities, perspectives and identified sectors into provincial and national development frameworks that are intended to implement the SDGs. The local mapping and prioritization exercises prescribed in this document can have obvious synergies with the exercises described above for drafting a national vision and formalization strategy for the ASM sector.

African countries specifically can also use the African Minerals Development Centre's *A country mining vision guidebook: Domesticating the African Mining Vision* (AMDC, 2014) as a starting point for integrating ASM in national frameworks. This guidebook provides guidance

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58 G5 Sahel, *Stratégie pour le Développement et la Sécurité des Pays du G5 Sahel*, September 2016. [https://admin.g5sahel.org/wp-content/uploads/2020/06/SDS\\_G5S\\_VF.pdf](https://admin.g5sahel.org/wp-content/uploads/2020/06/SDS_G5S_VF.pdf)

on how to incorporate the AMV at the national level, including through the articulation of *Country Mining Visions* – which can be developed in conjunction with or as a larger part of national visions for the ASM sector. The development of ASM formalization strategies, as



*Artisanally-mined bricks for construction in Rwanda*

prescribed in the *Formalization Handbook* and as discussed above, follows the same fundamental processes and principles as those described in AMDC's guidebook. So the development of ASM formalization strategies and national domestication of ASM (formalization strategies) can go hand-in-hand with the national domestication of the AMV and its related tools and frameworks.

Finally, to ensure integration, it is essential to map ASM against national and regional development frameworks, which

can be undertaken alongside the SDGs as they typically overlap (such frameworks typically prioritize a dozen or so of the SDGs). Global inspiration can be drawn from the *National Action Plans* (NAPs) for reducing mercury use in ASGM that have recently been developed

by Sierra Leone (EPA, forthcoming), the DRC (Agence Congolaise de l'Environnement, forthcoming) and other countries under the auspices of the Minamata Convention.<sup>59</sup> Both NAPs include a national vision for ASGM, in which the sector's positive and negative impacts have been identified and related to thematic clusters of the respective *Medium-term National Development Plan 2019-2023* and *Plan National Stratégique de Développement 2019-2023* – which in turn domesticate the SDGs, AU Agenda 2063 and other frameworks. The ASGM formalization strategies and other implementation plans that have been included in those NAPs, have consequently been designed to address the identified national and regional development priorities that are related to ASGM, besides addressing mercury use. To illustrate this process in greater detail, the subsequent section provides a brief case study for Sierra Leone.



*Small-scale gold miners in Colombia's Chocó Department (photo by Mikhaela Mezmaric)*

59 Both mentioned NAP documents have been validated at the national level and are currently pending endorsement and submission to the Minamata Secretariat. Once accepted by the Secretariat, they will be available online: <http://www.mercuryconvention.org/Countries/Parties/NationalActionPlans/tabid/7966/language/en-US/Default.aspx>

## To conclude: global support for SDG-sensitive ASM formalization

A final question is: *What can global stakeholders do to support the design and implementation of SDG-sensitive ASM formalization strategies?* Key recommendations for policymakers and private actors are provided here.

**Multi-lateral institutions and inter-governmental platforms** such as the World Bank, the Global Environmental Facility (GEF), the IGF, the OECD, the International Monetary Fund, relevant UN Programs, Funds and Agencies; **regional policy platforms** such as the African, Caribbean Pacific (ACP) Group of States, Asia-Pacific Economic Cooperation (APEC), the African Union, the Sahel Alliance and **bilateral and private donors and civil society organizations** should:

- Recognize and acknowledge the multitude of ASM-SDG interlinkages, and champion the explicit integration of ASM into national, regional and global development, environment and peace & security frameworks including the (post-2030) successors to the SDGs, periodic Implementation Plans of AU Agenda 2063, and so on;
- Ramp up ongoing efforts in formalizing and developing ASM, taking a more comprehensive approach to ensure that both existing and new ASM programmes address all components of the formalization process and that all (locally-prioritized) interlinkages with the SDGs are effectively harnessed. Governments should be provided with the required technical and financial assistance that enables them to develop ASM formalization strategies adopting holistic and human rights-based approaches, as well as to integrate ASM in national and regional development frameworks as part of the SDG domestication process. More initiative to coordinate and encourage such processes among their members and Member States also needs to be taken;
- Assemble global financial resources to dedicate to such formalization processes, and earmark a larger share of such resources for education, technical assistance and financing for ASM operators, mineral traders and their communities as this is often inadequate;
- Encourage and incentivize downstream supply chain actors and LSM companies to engage constructively with ASM actors in line with the OECD Due Diligence Guidance (OECD, 2016), and coordinate with governments for the removal of fiscal and administrative barriers to ASM's integration in global supply chains with gender-responsive measures (see OECD, 2019);
- Incorporate ASM in their support to developing countries in recovering from the social and economic devastation caused by COVID-19, in line with the OECD civil society group's Call to Action for Responsible Mineral Supply Chains.<sup>60</sup>



**International mineral buyers, smelter, refiners, jewelers, LSM companies and industry associations** should:

- Engage constructively with ASM actors and develop business partnerships in search of win-win situations, such as directly buying ASM minerals or supporting local traders to do so on more equitable terms, granting or leasing access to mining concessions, providing administrative, technical and financial support in formalization and professionalization processes;
- Map and align business strategies and Corporate Social Responsibility (CSR) programming to the SDGs following the UNDP and WEF *Atlas* and tools and guidance provided by UN Global Compact and SDG Compass.<sup>61</sup> In doing so, use the established ASM-SDG interlinkages to inform (or develop) ASM engagement, CSR and broader business strategies as a pathway to corporate sustainability and moral leadership in the extractive's sector.

**Thus, if approached strategically, ASM formalization can indeed serve to mitigate many of the sector's negative consequences and amplify its numerous positive contributions toward each of the 17 SDGs. By prioritizing a comprehensive and inclusive formalization of (specific parts of) the ASM sector in tandem with all 17 SDGs and local priorities, policymakers, donors, private sector partners and rural economies can recalibrate strategies and 'build back better' by blazing a new path toward Agenda 2030, while ensuring that no woman, man, girl, boy, mineral or SDG is 'left behind'.**

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See: <https://www.unglobalcompact.org/> and <https://sdgcompass.org/business-indicators/>

CASE STUDY:

# Developing Sierra Leone's SDG-Sensitive ASGM Formalization Strategy and Integrating it with National Development Frameworks

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As a Party to the Minamata Convention, Sierra Leone has recently developed a NAP for reducing mercury use in ASGM. Under the leadership from EPA, with technical support from UNITAR and UNEP, and funds from the Global Environment Facility (GEF), the country has first developed a comprehensive national overview of the ASGM sector. Following a country-wide field study, it was estimated that the sector provides direct livelihoods for some 80,000 miners – including many young men and single mothers – producing close to three tonnes of gold on an annual basis and supporting rural economies. However, the sector is largely informal and is associated with a number of environmental and health issues (EPA, 2019).

Subsequently, two stakeholder engagement workshops were organized in collaboration with the National Minerals Agency (NMA) in March 2019. One workshop was held in Makeni, a city close to ASM communities, where stakeholders at the local level were engaged (including miners, traders, community leaders, chiefdom authorities, local administrators, and so on); and another workshop was held in Freetown, where relevant government departments, donors, NGOs and academia were engaged. In both workshops, stakeholders mapped ASGM's positive and negative impacts on a range of development indicators related to Sierra Leone's *Medium-term National Development Plan (MTNDP/NDP) 2019-2023* – which domesticates all 17 SDG – and subsequently ranked them in order of importance. Stakeholders were asked to articulate where they would like to see the sector in 10-15 years from now, and what needs to happen to get there. Moreover, they were engaged in discussions about barriers and capacity gaps to formalization, and the selection of realistic approaches to formalizing parts of the ASGM sector (as it was agreed that it is not feasible to formalize the entire sector).

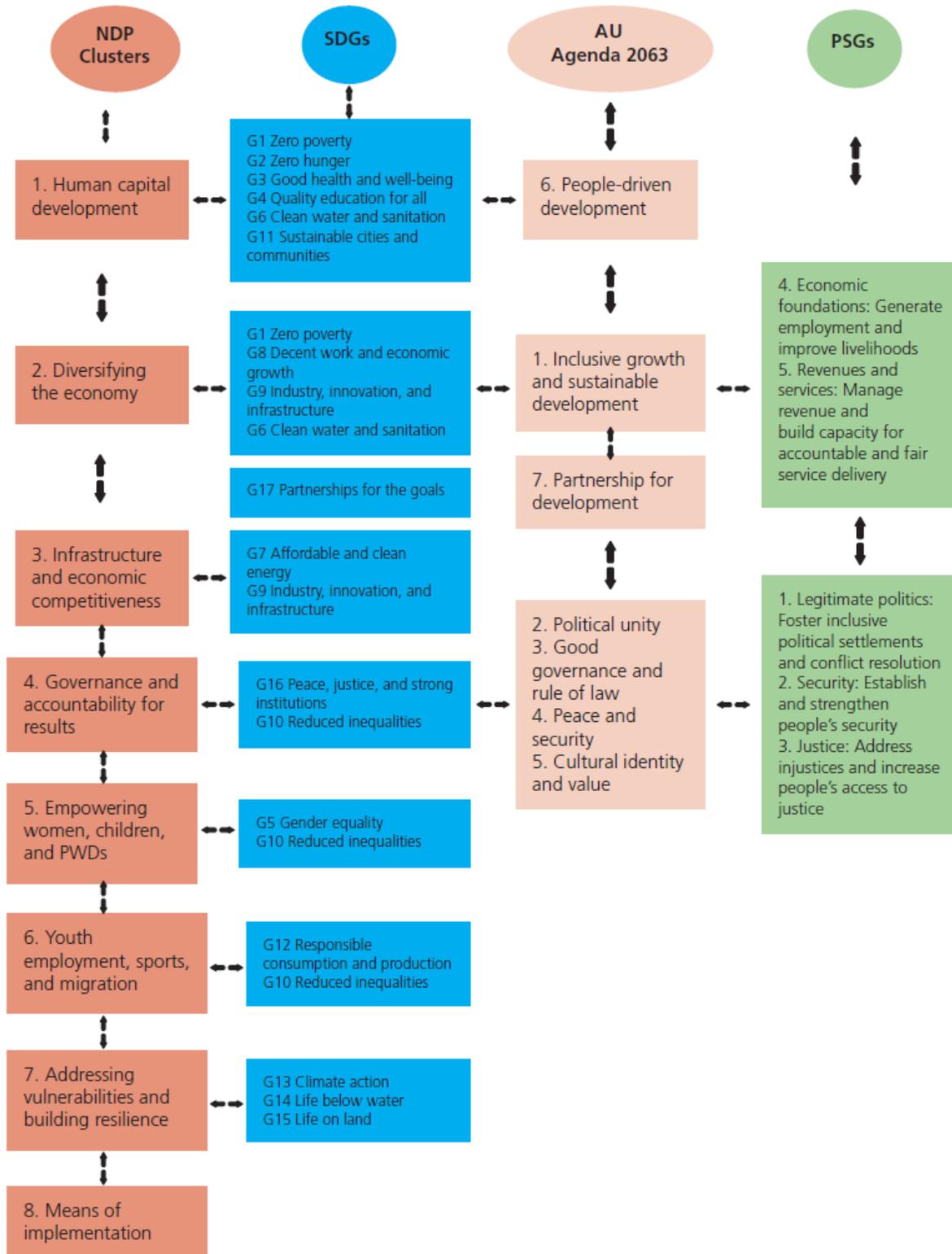
Based on stakeholders' inputs, research findings and relevant frameworks including Sierra Leone's MTNDP, *Vision 2035* and *Artisanal Mining Policy 2018*, the *African Mining Vision*, AU Agenda 2063 and UN Agenda 2030, a *National Vision* for responsible ASGM in Sierra Leone was articulated and included as a roadmap for Sierra Leone's NAP and its formalization strategy. This vision includes an appreciation of the sector's current status by identifying the 10 most important positive and negative impacts of ASGM, which have been sorted under the MTNDP's eight 'policy clusters' that domesticate the 17 SDGs as well as the 7 Aspirations of AU Agenda 2063. Table 2 illustrates this. Based on this understanding, a vision statement was developed which articulates how Sierra Leone would like to see the ASGM sector in the future. The NAP's ASGM formalization strategy and other implementation plans have consequently been designed with the aim to realize this vision and address the identified national development priorities related to ASGM (besides addressing mercury use).

The formalization strategy includes a set of mutually-reinforcing approaches for formalizing different segments of the country's ASGM sector, taking into account the unique characteristics and development impacts of each segment or sub-sector. In short, it was decided to formalize *specific parts of the alluvial artisanal gold mining sector* and *all of the hard rock artisanal gold mining sector* in 'ASM zones'; to pursue the formalization of small-scale gold mining in all parts of the country; and to promote best practices among alluvial artisanal gold miners operating in areas not prioritized for formalization. Subsequently, for each approach, the six key components of formalization were planned by selecting specific implementation steps and allocating roles, responsibilities, timelines and expected budgets for each step. While the full details of the formalization strategy can be found in EPA's forthcoming NAP document, the overall strategy including components and associated steps for formalizing artisanal gold mining is illustrated in Figure 10 – which highlights linkages with the SDGs.

**Table 2. Categorizing impacts of Sierra Leone’s ASGM sector**

POSITIVE IMPACTS	NDP CLUSTER	SDGS	NEGATIVE IMPACTS	NDP CLUSTER	SDGS
1. Direct livelihoods (economically viable and readily available)	1, 2, 6	1, 8	1. Deforestation, biodiversity loss and soil erosion	7	13,15
2. Indirect livelihoods and local economic growth	1, 2, 3	1, 8, 9, 17	2. Contamination of water resources	2, 7	6, 14
3. Financing rural education	1, 5	4	3. Mercury and acid poisoning	1, 7	3, 6, 12, 15
4. Empowering women and youth	1, 5, 6	5, 10	4. Occupational health and safety threats	1	3, 8
5. Income stability, resilience and economic diversification	2	8, 9	5. Child labor and gender inequality	5	3, 8
6. Potential exchange earnings and government revenues	2	8, 16, 17	6. Increased spread of malaria	1	3
7. Local revenue generation and infrastructure development	1, 3, 6	8, 9	7. School dropout	1, 5	4
8. Peace, security, decriminalization and social and political stability	4	16, 10	8. Social disorder	1, 6	10, 16
9. Cultural diversification and cohesiveness	4, 5	10, 16, 4	9. Diminished agricultural production	1, 2	2
10. Deurbanization	3, 6	11	10. Bribery and exploitation	4	10, 16

Figure 9. Policy clusters of Sierra Leone's MTNDP and alignment with intl. frameworks



**Figure 10. Overview of Sierra Leone's strategy for formalizing artisanal gold mining, and related SDGs**





- Conduct a financial needs assessment
- Engage and educate financial institutions about artisanal mining, and identify interested institutions
- Train miners on financial literacy and the process of accessing available financial products
- Provide ongoing assistance on opening bank accounts, developing savings and loans schemes and accessing microcredit
- Reserve a dedicated budget to assist AGM miners and small traders
- Include AM in Sierra Leone's National Strategy for Financial Inclusion

- Conduct a needs assessment among AGM miners and small gold traders
- Institutionalize expertise and strengthen relevant NGOs and university departments working with AGM
- Develop an educational programme on AM and include it in the regular curriculum of relevant disciplines
- Establish specialized training and research centers

- Train NMA officers on gold valuation and value addition
- Train AGM miners and small gold traders on gold trade, valuation and value addition
- Develop and implement a Green Gold marketing strategy and branding campaign for Sierra Leone's AGM sector
- Facilitate workshops to explore viable business relations between AGM miners and LSM companies

- Task compliance officers with inspection and assistance provision
- Establish multi-stakeholder local oversight committees, designate responsibilities
- Train local oversight committees and provide monitoring infrastructure
- Decentralize financial resources to district-level NMA and EPA offices and local oversight committees
- Adopt a new monitoring system including drones
- Liaise with MRU for strengthening border controls
- Train customs officers on curtailing gold smuggling and increase their wages
- Enforce penalties among traders and customs officers and establish new mechanisms to incentivize disclosure of illegal activity
- Enforce compliance with 'soft' coercive measures combined with technical guidance, and gradually tougher measures



Currently, Sierra Leone's NAP and its formalization strategy are pending national endorsement and submission to the Minamata Secretariat. Funding of its implementation has not yet been allocated and the strategy may still be slightly amended as part of the ongoing revision of Mines and Minerals Act 2009. Nevertheless, it has been validated by key stakeholders and integration processes have started. Importantly, this includes the integration of ASM formalization as a policy priority in MTNDP.

Although significant work lays ahead, and any strategy is only as good as its implementation, this case study has illustrated the process of developing SDG-sensitive formalization strategies and integrating ASM in national development frameworks.



A 'gang' of 'diggers' mining and sluicing ore in Kathantha, Sierra Leone



Mapping ASGM impacts during a workshop in Makeni, Sierra Leone (photo left by Paul Dumbuya and right by Jorden de Haan)

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