Extractives, climate and health equity

Trends in extraction of mineral resources in east and southern Africa

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Background

This brief is produced as part of the scoping work in the Regional Network for Equity in Health in east and southern Africa (EQUINET). Co-ordinated by TARSC, SATUCC and SEATINI, the EQUINET work aims to use scenario planning to explore the distributional consequences for current and future wellbeing of projected trends in extraction of water, minerals, biodiversity and genetic materials and of climate change, to promote understanding and dialogue on how different choices made today can influence these different long-term outcomes. This paper focuses on trends in extraction of mineral resources and presents

- The current situation and projected trends related to extraction of mineral resources in east and southern Africa.
- The implications for the wellbeing of current and future generations of these trends.
- The policy choices and alternatives to respond to these trends and the factors that influence policy design and uptake of choices.

Key Messages

Mineral extraction in east and southern Africa (ESA) will undergo several changes in the coming decades: resurgent resource nationalism will continue to place demands on mining firms; emerging economies will become both important sources of consumption and investment; mineral price volatility and cost pressures will heighten, pushing mining investors to casualise their workforces and mechanise their operations. Tax avoidance and illicit financial flows (IFFs) will continue if left unchecked. Technology changes will increase demand for some 'strategic minerals', while lessening demand for others. Artisanal and small-scale mining (ASM) will expand and the availability of commercially viable mineral deposits will likely decrease. Environmental degradation will persist if unfettered mineral extraction continues.

These changes have numerous potential implications for health and wellbeing in ESA countries. Increased mining investment from emerging economies could push down health standards, fuel land displacement and with more precarious jobs in mines worsen health for workers and communities. The anticipated expansion of ASM, if left unregulated and unsupported, will have negative environmental and health effects. Tax avoidance and IFFs perpetrated by foreign mining investors deprive ESA governments of the revenue necessary to improve health services. Increased extraction of certain strategic minerals, like cobalt and tantalum, raises direct health risks for workers and fuels armed conflict over resources. Dependence on mineral extraction exposes many ESA economies to heightened economic turbulence, with negative effects on their health systems and social security. Mining in ESA contributes to environmental degradation and climate change, with negative health implications for future generations.

Accruing greater and wider health and developmental benefits from any current and future mineral extraction raises several options, in line with the demands of resurgent resource nationalism. They include strengthening the implementation of resource nationalism, as argued by the African Union; effectively projecting, monitoring and preventing the impacts of mineral extraction on health and environments; adopting financial transparency and accountability measures and employing strategies and responses that are built from bottom-up, based on broad-based local knowledge and consultation, including with ASM operators, communities, workers and the wider public.

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The current situation in mineral extraction

Table 1: Mining's contribution to ESA economies (2016)

	Metallic minerals, metals & coal export contribution (%)	Metallic minerals, metals & coal production value (% GDP)
Angola	2.3%	1.7%
Botswana	92.7%	31.8%
DRC	87.3%	22.6%
eSwatini	5.5%	-
Kenya	5.1%	3.5%
Lesotho	22.2%	1.1%
Madagascar	27.3%	41.6%
Malawi	1.5%	-
Mauritius	4.3%	-
Mozambique	47.5%	48.2%
Namibia	54.2%	8.8%
South Africa	35.2%	16.5%
Tanzania	44.7%	4.3%
Uganda	15.9%	0.03%
Zambia	75.0%	21.1%
Zimbabwe	41.5%	16.8%

Source: ICMM, 2018; DRC= Democratic Republic of Congo

Since the discovery of diamonds in Kimberley and in the Witwatersrand gold rush in the late nineteenth century, southern African economies have been highly dependent on mineral extraction. Currently, the mining and processing of metallic minerals, metals, and coal account for more than 20% of exports in 9 out of the 16 ESA countries and more than 10% of GDP in 7 of those 9 countries (*Table 1*). Throughout the 1900s some countries – such as Malawi, eSwatini, and Lesotho- with limited mineral production and exports have supplied migrant labour to mines in other countries, primarily to South Africa. Countries in the Southern African Development Community (SADC) account for more than half of the world's diamond, cobalt, chrome, and platinum production, as shown later in *Figures 6 and 7*.

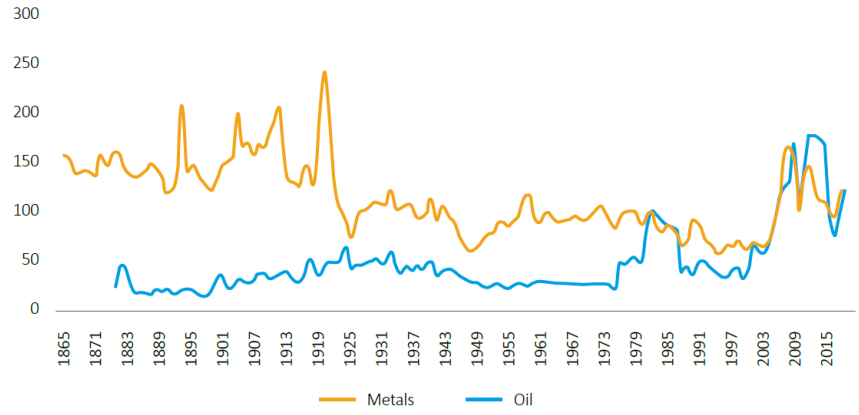
Mineral extraction has historically held less importance to the economies of East Africa. Yet over the last two decades, mining's economic contribution has increased, especially in the case of Tanzania after gold production surged in the late 1990s (SDI 2009).

Despite the centrality of mining for southern African economies, many governments have historically struggled to accrue substantive benefits and spillovers from their mineral resources. In the 1970s and 1980s, ESA governments secured partial state ownership of large-scale mines and/or established state-run mineral marketing agencies in an effort to harness mineral rents for developmental purposes. After the collapse of mineral prices in late 1970s, shown in *Figure 1*, mining productivity and the viability of these interventionist policies declined. With the onset of neoliberal structural adjustment policies in the 1990s, the World Bank and the International Monetary Fund (IMF) sought to liberalise African mining regimes and to revitalize African mining by encouraging foreign investment through economic and legal reforms. Regional governments were advised, or in some cases compelled through lending conditionalities, to privatize their mining assets, dismantle restrictions on mineral sales and on repatriation of profits such as through easing exchange controls, and revise laws to incentivise foreign investment. In Zambia, for example, the 1995 Mines and Minerals Act permitted the government to enter into overly concessionary 'development agreements' with foreign investors during privatization negotiations. Some of the conditions stipulated in these agreements included the following:

- reducing corporate taxation from 35% to 25% and providing sizeable tax deductions, including a 100% tax deduction allowance on capital expenditures;
- exempting mining companies from paying customs, excise duties, or any other duty or import tax levied on machinery and equipment;
- extending loss-carry forward provisions for up to 15-20 years;
- setting mineral royalties at a paltry 0.6% of the gross revenue of minerals produced;
- relieving some private investors from assuming financial liabilities and environmental legacies originally incurred by Zambia Consolidated Copper Mines (ZCCM); and
- providing a 'stability period' by stipulating that these agreements could not be amended for 15-20 years (Lungu, 2008).

Other ESA governments, except Botswana, offered similar agreements to secure foreign mining investment.

Figure 1: Real Commodity Price Index, 1865-2018 (1980 = 100)



Source: World Bank, 2019:14

Following a slump lasting more than two decades, mineral prices rose substantially from 2003 onwards (*Figure 1*), marking the beginning of what is known as the *commodities super cycle* (Humphreys, 2015). The super cycle, largely fueled by heightened demand from China (Table 2), raised investment levels and spurred economic growth across much of ESA. But it also called into question the overly concessionary terms afforded to foreign investors.

Table 2: China's Metal Consumption (%Total World Consumption)

	1998	2008	2013
Aluminum	11	36	48
Copper	11	28	47
Nickel	4	26	51
Zinc	14	36	46
Steel	16	37	47
Iron Ore	13	52	65

Source: Humphreys, 2015:47

Resurgent resource nationalism

The unbalanced nature of liberalised mining regimes sparked a resurgent *resource nationalism* in the DRC, Madagascar, Mozambique, South Africa, Tanzania, Zambia, and Zimbabwe. This imbalance often entailed low fiscal receipts from mineral taxation, contrasted with exorbitant profits for foreign investors, the almost complete absence of productive linkages to mining, and the deterioration of public services - such as for public health, sanitation, infrastructure maintenance - in many mining communities (Fraser and Lungu 2007; SID 2009; Saunders 2017). With the shift to resource nationalism, to varying degrees, governments have sought to revise or rescind aspects of these liberalised regimes.

Resource nationalism can be defined as a set of policies employed by governments to regulate and control extractive industries with the aim of improving the spillovers and benefits accrued. Resource nationalism has typically involved three distinct but overlapping kinds of policies:

1. *the maximization of public revenue from resource extraction*, through increased royalties, taxes, and duties on mining operations and the removal or limitation of tax exemptions and deductions;
2. *the regulation and ownership of extractive industries by the state*. through the creation or renovation of state regulatory bodies and the outright or partial nationalization of privately-owned assets;
3. and *the enhancement of developmental spillovers from resource extraction*, through the cultivation of backward and forward linkages to mining, such as the formation of local content or supplier development programmes or the construction of mineral processing and metal fabrication facilities (Haslam and Heidrich 2016:224-227).

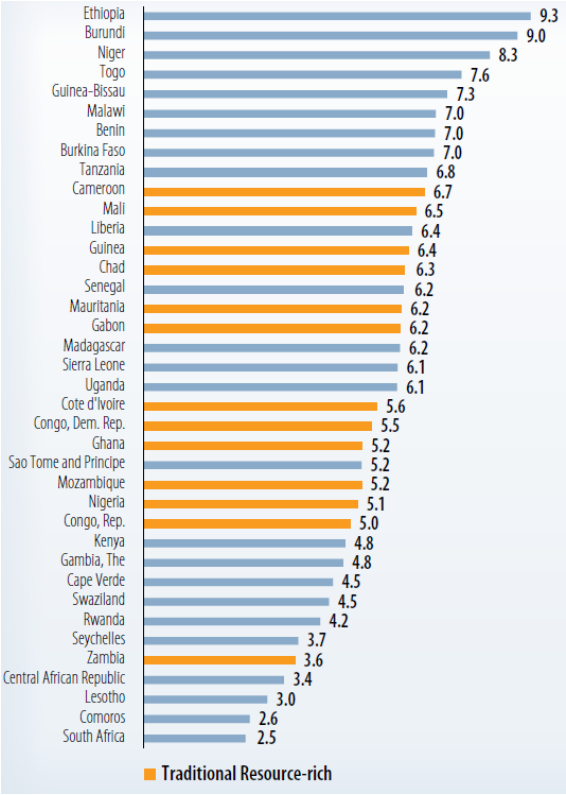
Two waves of resource nationalism have swept over the African sub-continent, the first in the 1960s and 1970s, following the attainment of independence and the second, which began in the late 2000s. The first wave involved policies that sought greater national ownership and control over mining assets. The second, current wave has not typically involved a significant effort to nationalise or indigenise mining assets. Instead, African governments have sought to increase mining taxation, improve regulatory oversight and cultivate backward and forward linkages to mining (Caramento and Saunders, 2019). At the continental level, the influence of resurgent resource nationalism was evident in the African Mining Vision (AMV), which was adopted by Heads of State at the African Union summit in 2009. The AMV called for improvements to the regulatory and contract negotiating capacities of African states, the expansion of mineral beneficiation (processing), the local procurement of goods and services, enhanced training and technology transfers and the empowerment of artisanal and small-scale miners (ASM). At the same time

civil society and communities in the region have not assumed the inevitability of mining and have resisted mines being established if they are seen as harmful for people or environments, proposing economic alternatives to mining, including investment in farming in these areas (TARSC et al., 2020).

Mining investors have typically responded to resource nationalism and heightened public hostility with a two-pronged approach. They have sought to 'secure a social license to operate.' In order to diffuse social conflicts and disruptions to their operations in surrounding communities, mining companies have funded "Corporate Social Responsibility" (CSR) initiatives. These initiatives include funding local infrastructure projects, sponsoring cultural events, or establishing vocational/training programmes. CSR spending sometimes includes health promotion, provision of medicines and other supplies or construction of health facilities. CSR initiatives are, however, voluntary and piecemeal, making them an inadequate alternative to public service provision. Foreign mining investors have also sought to directly counter resource nationalism through extensive lobbying and negotiation and, when this fails, pressure tactics and retaliatory measures that range from threatening to place mines under care and maintenance, to actively pursuing international arbitration. *Despite the end of the super cycle in 2012, many mining analysts, such as Humphreys (2019) anticipate that resource nationalist policies will persist into the next decade.*

Who has benefitted from heightened mineral prices?

Figure 2: Income Share of the poorest 20% of the population in select African countries (2012)



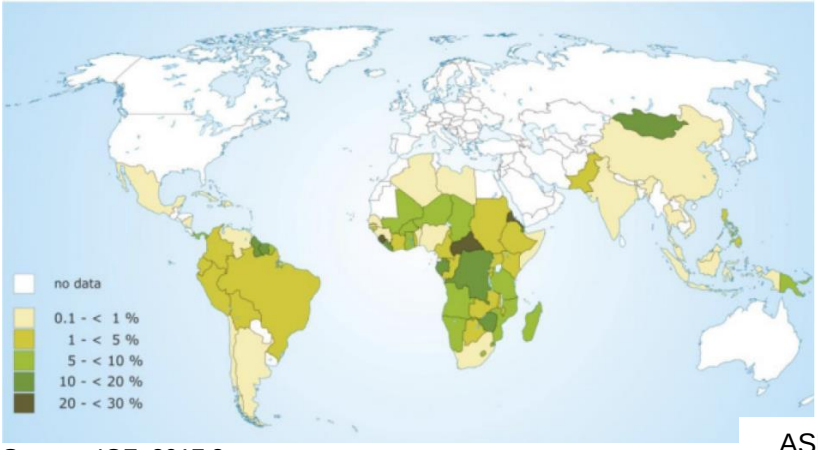
Source: World Bank , 2012 :16

While heightened mineral prices stimulated buoyant economic growth rates across most of ESA, the super cycle boom (2003-2012) did not translate into substantive poverty alleviation. Efforts to combat poverty and inequality in resource-rich countries generally lagged behind those in countries with less resources. The income share of the poorest 20% of the population in many ESA countries (with the exception of Tanzania and Malawi) at the end of the super cycle remained quite low (*Figure 2*). Resource nationalism, despite increasing public revenue from extractive industries, largely failed to stem the tide of capital flight unleashed by financial liberalisation in the 1990s (Ibi Ajayi and Ndikumana, 2015). Capital flight from extractives both legal (repatriation of profits and tax avoidance) and illegal (illicit financial flows - IFFs), deprived ESA of funds for infrastructure and social expenditure, discussed below. Efforts to nationalise or indigenise mining operations or establish productive linkages were often poorly implemented or enforced and actively subverted by foreign mining investors. *Despite mounting resistance from host governments and mining communities over the past decade, foreign mining investors continued to be the foremost beneficiaries from ESA's mineral resources. This trend will likely continue in the coming decades if certain actions are not taken.*

The proliferation of artisanal and small-scale mining (ASM)

The number of ASM operators globally has increased significantly over the last three decades, from an estimated 6 million in 1993 to 40.5 million in 2017. That is more than 5 times the estimated 7 million people who are employed globally by large-scale industrial mining. In sub-Saharan Africa, there are an estimated 9 million ASM operators and 54 million people whose livelihoods are dependent on the sector (IGF 2017). Moreover, African economies are more dependent on ASM than any other region (*Figure 3*).

Figure 3: Percentage of the Population Dependent on ASM (2012)



Source: IGF, 2017:3

Table 3: Estimates of ASM Employment in Select African Countries and Corresponding Minerals

COUNTRY	DIRECTLY WORKING IN ASM	ESTIMATED NUMBER OF DEPENDENTS	MAIN MINERALS MINED BY ASM
ANGOLA	150,000	900,000	Diamonds
BURKINA FASO	200,000	1,000,000	Gold
CENTRAL AFRICAN REPUBLIC	400,000	2,400,000	Gold, diamonds
CHAD	100,000	600,000	Gold
CÔTE D'IVOIRE	100,000	600,000	Gold, diamonds
DRC	200,000	1,200,000	Diamonds, gold, coltan
ERITREA	400,000	2,400,000	Gold
ETHIOPIA	500,000	3,000,000	Gold
GHANA	1,100,000	4,400,000	Gold, diamonds, sand
GUINEA	300,000	1,500,000	Gold, diamonds
LIBERIA	100,000	600,000	Gold, diamonds
MADAGASCAR	500,000	2,500,000	Coloured gemstones, gold
MALAWI	40,000	-	Coloured gemstones, gold
MALI	400,000	2,400,000	Gold
MOZAMBIQUE	100,000	1,200,000	Coloured gemstones, gold
NIGER	450,000	2,700,000	Gold
NIGERIA	500,000	2,500,000	Gold
SOUTH AFRICA	20,000	-	Gold
SIERRA LEONE	300,000	1,800,000	Gold, diamonds
SOUTH SUDAN	200,000	1,200,000	Gold
TANZANIA	1,500,000	9,000,000	Gold
UGANDA	150,000	900,000	Gold
ZIMBABWE	500,000	3,000,000	Gold, diamonds, coloured gemstones

Source: IGF, 2017:7

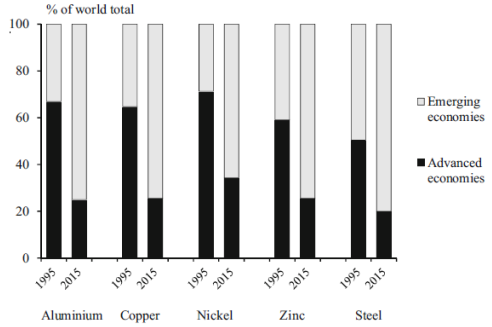
ASM activities play a significant role in many ESA economies. In terms of absolute numbers, Tanzania has the largest estimated number of people both working and dependant on ASM on the continent; 1.5 million and 9 million respectively (*Table 3*). In Zimbabwe, ASM miners were responsible for 65% of that country's national gold production in 2018 (Vinga, 2018). The number of ASM operators and people dependent on their activities has steadily increased over the last three decades in response to decreasing formal sector employment and the need to supplement subsistence agriculture (IGF, 2017). ASM is more labour intensive than LSM, so its potential for employment creation is much higher. However, the majority of ASM activities are conducted informally (i.e. illegally or unsanctioned) making it difficult for the African states to monitor and regulate such activities. *Over the next decade, the number of ASM operators and those dependant on ASM are likely to increase exponentially across sub-Saharan Africa.*

Projected trends in mineral extraction in the ESA region

Increasing role of emerging economies in mineral consumption and investment

(Humphreys (2019) maintains that mineral extraction in this century has been, and will continue to be, driven to a large extent by China and other emerging economies as both major consumers and producers. The "commodities super cycle", which lasted from 2004 to 2012, is largely attributable to heightened demand for minerals from an industrialising China. By the end of the super cycle in 2013, China accounted for nearly half of the world's total consumption of aluminum, copper, zinc and steel, and more than half of the world's total consumption of nickel and iron ore, as shown earlier in *Table 2.* Emerging economies, more generally, have far outpaced the metal consumption of advanced economies over the course of the last two decades (*Figure 4*). Even as China's economic growth began to slow from 2012 onwards, ending the commodities super cycle, emerging economies' metal consumption has continued to influence mineral prices.

Figure 4: Distribution of Global Metal Consumption



Source: Humphreys, 2019:146

Emerging economies have also become an important source of global mining investment and this trend will likely increase in the coming decades. According to annual mining industry surveys conducted by PricewaterhouseCoopers, the share of market capitalisation of the 40 largest companies accounted for by emerging market companies (or "emergers") rose from little more than 10% in 2003 to over 50% in 2013 (Humphreys 2015). A sizeable portion of this expansion, principally by Chinese mining firms, has involved increased investments into ESA.

Several state-owned Chinese mining firms (CNMC, Zijin Mining, China Minmetals, etc.) have made investments in the Congolese and Zambian Copperbelts and are expected to accumulate more assets in the future. Sinosteel acquired chrome mines in South Africa and Zimbabwe. China National Nuclear acquired uranium mines in Namibia. Various Chinese companies (with the assistance of the China-Africa Development Fund) have purchased stakes in South Africa's gold, copper and fluorspar mines (Ericsson and Lof 2017). Such investment could have both positive and negative outcomes for ESA. On the positive side, mining firms that are fully or partially state-owned tend to receive subsidised finance, state-guaranteed loans and other assistance from their home governments and typically outperform their wholly privately-owned competition. They thus tend to offer more stability and are less likely to shutter operations and withdraw their investment than those that are dependent on capital markets. On the negative side, some analysts argue that Chinese mining firms have worse safety records and pay lower wages than their non-Chinese counterparts (Fraser and Lungu, 2007; HRW, 2011). Many mining investors from emerging economies are not publicly listed on Australian, European, or North American stock exchanges and may thus be less transparent (Humphreys 2015). Conversely, the listing of mining multi-nationals on foreign stock exchanges is problematic, as financial transactions involving African assets are often not regulated and not subject to taxation of capital gains by African states.

Mineral price volatility and growing cost pressures

While mineral prices did not collapse following the end of the commodities super cycle in 2012, they have become more volatile. A major contributing factor to price volatility is the changing manner in which metals are purchased, with a shift away from long-term contracts towards dispersed, short-term spot orders. The latter arrangement is increasingly favoured by buyers in emerging economies. This raises price volatility and heightens macroeconomic turbulence for many of the mineral-dependant economies in ESA. It also complicates the efforts of mining investors to engage in long-term business planning. As a result, many expansion projects have been deferred or cancelled and spending on exploration has significantly decreased since 2012 (Humphreys 2015; 2019). In addition to mineral price volatility, mining operations are also contending with growing cost pressures: (1) declining ore grades, which means more ore must be processed in order to extract the same quantity of metal; (2) the need to dig deeper to access reserves, because shallower deposits have been exhausted; and (3) the need to secure intermediate inputs, like water and electricity, in jurisdictions where access is unreliable (World Bank 2019). *Price volatility and mounting cost pressures have been, and will continue to be, employed by mining investors to counter resource nationalist demands and justify the restructuring of their operations.*

The contribution of large-scale mining (LSM) to employment in the mineral dependent economies of ESA is already very low, ranging from 1.5% of total employment in Zimbabwe to 2.8% of total employment in South Africa for 2014 (ICMM 2016). *Over the past two decades, mining firms have sought to lower labour costs by (1) casualising their workforce and (2) mechanising their operations. The casualization of the mine workforce involves the replacement of a sizeable portion of directly employed, permanent employees, with indirectly employed, fixed-term/contractual employees.*

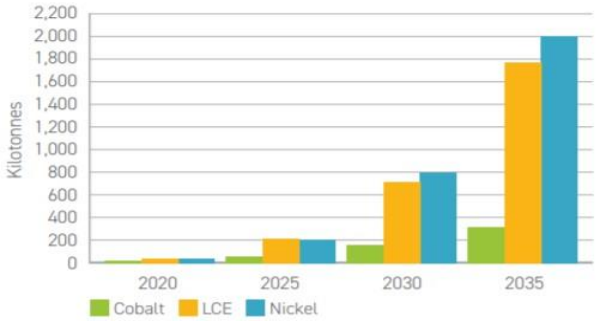
Fixed-term/contractual mineworkers are paid less and afforded fewer protections than permanent, unionised mineworkers. Mining is expected to undergo significant technological changes over the coming decades, including: increased mechanisation; adaptive planning and predicative maintenance (calculated

and updated in real time); and the digital integration of operational supervision and surveillance (Deliotte 2018). The mechanisation of mining operations, especially the automation of blasting and drilling, aims to increase productivity and reduce expenditure on labour (World Bank 2019). *The intensification of mechanisation over the coming decades will result in unemployment for a sizeable number of mineworkers in ESA. These two measures to reduce labour expenditure underline the need to secure more revenue and cultivate developmental spillovers from mining, in lieu of lost or precarious employment.*

Supplying strategic minerals for the technological revolution

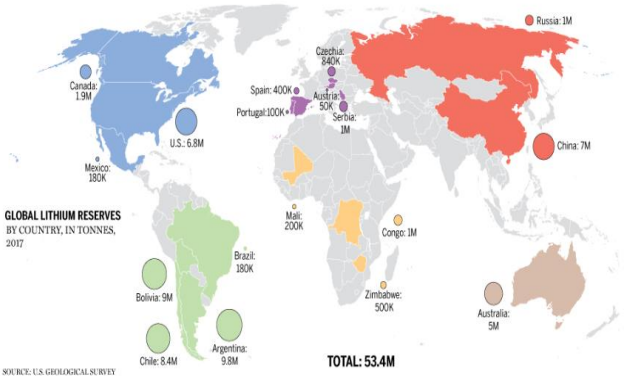
Over the next couple of decades, there will be increased demand for minerals used in new technologies, such as electric vehicles (EVs), renewable energy, and energy efficient electronic devices. Global demand for minerals necessary for the manufacture of EV batteries– principally nickel, lithium carbonate equivalent (LCE), and cobalt – are estimated to increase substantially over the next 15 years (*Figure 5*). The production of nickel in ESA is minimal, principally from South Africa and Madagascar, contributing to less than 5% of world production in 2018 (USGS 2020b). South Africa and Madagascar have nickel reserves of 3.7 million MT and 1.6 million MT respectively. The production of Lithium in ESA is also quite negligible, amounting to a little over 2% of global production (USGS 2020a). Yet both Zimbabwe and the DRC possess considerable reserves of these minerals (*Figure 6*). DRC produces more than 60% of the world's cobalt and holds almost half the world's viable cobalt reserves (*Figure 7*) and 40% of global tantalum production, both minerals used in electronics and demand for both likely to increase in coming decades, notwithstanding the damage reported from mining these minerals to environments and to the health of surrounding communities (Watts, 2019, Orr, 2018; Nest, 2011).

Figure 5: Projected Global Demand for EV Battery Minerals, 2020-2035



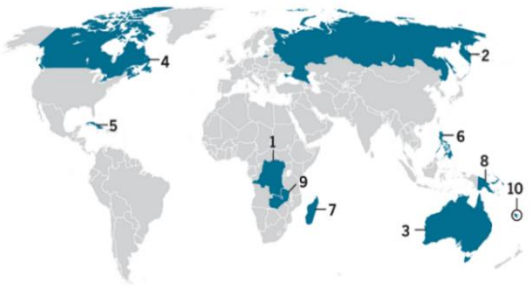
Source: Faraday Institution, 2020:3

Figure 6: Global Lithium Reserves, 2017



Source: USGS/Friedman , 2018: online

Figure 7: Global Cobalt Production and Reserves



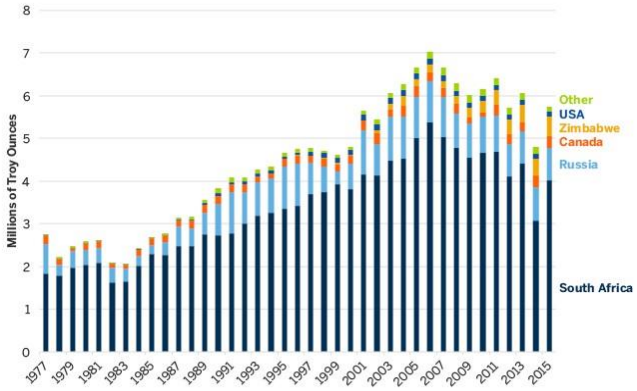
Cobalt mining and reserves (in metric tons)

Country	Mine production (2017)	Reserves (economically viable)
1. D.R. Congo	64,000	3.5 million
2. Russia	5,600	250,000
3. Australia	5,000	1.2 million
4. Canada	4,300	250,000
5. Cuba	4,200	500,000
6. Philippines	4,000	280,000
7. Madagascar	3,800	150,000
8. P. New Guinea	3,200	51,000
9. Zambia	2,900	270,000
10. New Caledonia	2,800	N/A
United States	650	23,000
Other	8,400	589,000

Source: Orr, 2018: online

At the same time, increasing efforts to utilise recycled minerals and a shift towards green technologies could hamper demand for other minerals produced in ESA. Over the last decade, the price of platinum has decreased, from a high of US$1,729 per ounce in 2011 to less than US$820 last year. This drop in price is attributable to an increase in the supply of recycled platinum and a decrease in global demand (World Bank, 2019). The demand for platinum will continue to decrease over the coming decades with the shift towards electronic vehicles, as automotive manufacturers will no longer require catalytic converters to reduce poisonous emissions. The South African mining industry, the world's largest producer of platinum, will be negatively affected as production levels decrease (*Figure 8*).

Figure 8: Global Platinum Production (1977-2015)



Source: Norland, 2015: online

Mineral Depletion and Environmental Degradation

Table 4: Life Expectancy of World Reserves, Selected Mineral Commodities

Mineral Commodity	Life Expectancy in Years, at Three Growth Rates for Primary Production*		
	0%	2%	5%
Coal	109	57	37
Aluminum	108	57	37
Copper	39	28	21
Iron	62	40	28
Nickel	34	25	19
Tin	17	14	12
Zinc	17	14	12

*Drawn from average annual production rates in 2012-14 and reserves in 2015
Source: Tilton and Guzman 2016

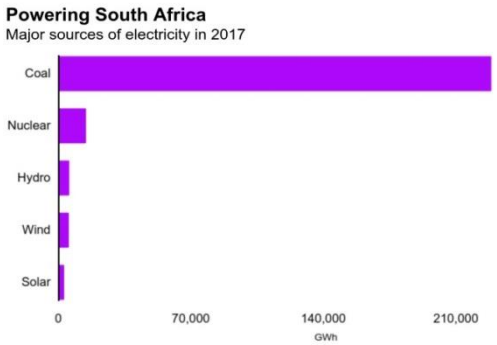
Whether or not the world is on the verge of depleting its mineral resources is widely debated. Many economists subscribe to the optimistic opportunity-cost paradigm; "mineral commodities may become more or less available, depending on whether the cost-reducing effects of new technology are greater or smaller than the cost-reducing effects of depletion" (Tilton and Guzman, 2016: 215). In other words, they argue that mineral depletion can be mitigated by technological innovation, such as by improvements to the processing of waste material in tailings that lessen the need for mining new deposits. In contrast, many geologists subscribe to the more pessimistic fixed-stock paradigm, which maintains that the global stock of minerals is finite and that demand will eventually outstrip supply (Meadows et al.,1972; Bardi, 2011). If we use current global reserves (2015) to calculate mineral depletion, employing varied production rate increases, some minerals like copper, iron, nickel, tin and zinc could potentially be depleted within the next thirty years, before 2050. There are several caveats to these estimates. Mineral reserve calculations are constantly expanding as more ore bodies are discovered. Many mineral commodities, especially metals can be recycled. Further, substitution may mitigate the effects of depletion (Tilton and Guzman, 2016). Nevertheless we are conceivably going to reach the limits of *economically feasible* extraction for several minerals in the coming decades. As minerals become scarcer, we will be forced to exploit them at progressively lower grades and concentrations, making mining operations increasingly less viable (Bardi 2014).

Mineral extraction contributes directly and indirectly to environmental degradation and enables "natural capital depletion." It directly causes pollution of water systems, contaminating drinking water and damaging fish stocks. It releases harmful emissions and dusts that negatively affect the air quality of nearby communities, and may contaminate soil and crops grown with polluted water or in contaminated soils. Such environmental degradation has done damage to the health and well-being of mineworkers, their families, nearby communities, and future generations, discussed later. Mining requires large

amounts of electricity and minerals must be transported significant distances from their point of production to their eventual point of consumption. For example, South Africa's energy-intensive mining industry is heavily dependent on coal burning (*Figure 9*), contributing to air pollution and climate change. According to Bond (2019), the extraction of exhaustible mineral resources, and the accompanying environmental degradation, has contributed to the depletion of sub-Saharan Africa's *natural capital* (which includes assets like forests, water, fish stocks, minerals, biodiversity and land) without sufficient replenishment or payment. Drawing upon the World Bank's Adjusted Net Savings calculations, Bond (2019) argues that sub-Saharan Africa has lost more than US$100 billion annually from natural capital depletion due to the extraction of minerals, oil, and natural gas. The depletion of natural capital, for Bond, represents both a spatial and temporal *unequal ecological exchange*; (1) between those foreign MNEs and African elites who benefit from the extraction of the continent's mineral wealth and those African communities who must live with its environmental consequences; and (2) between those who consume Africa's mineral resources today and those who must live with the environmental consequences of that consumption tomorrow.

Summary of Projected Trends

Figure 9



Source: IEA and Govender, 2020: online

Over the next three decades (to 2050), we can thus anticipate several trends in the extraction of ESA's mineral resources:

- The casualisation of mine labour and the mechanisation of mining operations will lead to increasingly precarious jobs and unemployment, highlighting the need for increased benefits from mining aside from employment opportunities.
- Increased mineral price volatility for at least the next decade will create heightened economic turbulence in many mineral dependent economies.

- Beginning in the late 2000s, resource nationalism emerged in response to the liberalisation of African mining regimes in the 1990s. Even with the end of the commodities super cycle, mining analysts anticipate the continuation of resource nationalism into the next decade. Despite this and mounting resistance from communities over the past decade as social unrest, foreign mining investors continued to secure substantial financial proceeds both licitly and illicitly from ESA's mineral resources. This trend will likely continue in the coming decades, if left unchecked.
- Emerging economies, especially China, are rising sources of mining investment for ESA. This could bolster operational stability, but could also hamper efforts toward the increased transparency of ESA's extractive sector, with falling occupational health standards and wage levels of mineworkers.
- Increased demand for minerals used in new technologies, such as EVs, renewable energy, and energy efficient electronic devices can be anticipated in the coming decades. This may increase mining investment and production for ESA countries with reserves of these minerals, including DRC, Madagascar, South Africa, Zambia and Zimbabwe, albeit with negative social, public health, and environmental consequences for communities. Other minerals- copper, tin, zinc, nickel and iron - could potentially reach the limits of economically feasible extraction in the coming decades, if no new commercially viable deposits discovered.
- The number of ASM operators and those dependent on ASM activities will likely increase exponentially over the coming decades, particularly in the DRC, Zimbabwe and East Africa.
- Mining activities have contributed to the environmental degradation and "natural capital depletion" of ESA and will continue to do so in the coming decades if corrective measures are not implemented.

Health and wellbeing impacts of current and projected trends[2]

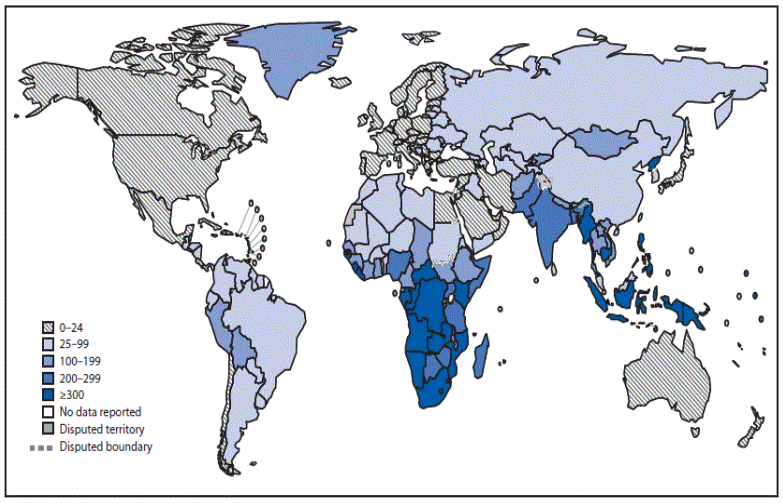
Land Displacement

Land displacement occurs during exploration of a new mining investment or in the expansion of an already operational mine. Displacement of people through land conversion – from communal, customary tenure to private, leasehold tenure – has a negative impact on rural livelihoods. Once mining investors secure the requisite licensing, acquire title and occupy the land, local inhabitants are typically deprived of access to lands they had previously farmed or used for ASM activities. The resettlement of these displaced communities is often haphazard and at the mercy of mining investors who, in many cases, lack resettlement action plans or fail to provide adequate compensation. Failure to properly resettle these communities and provide them with adequate compensation can result in social unrest and violence, food insecurity, and immiseration, negatively affecting health outcomes (Chanda-Kapata 2020).

Impacts of mineral extraction on mineworkers and their families

There are several hazards associated with large-scale industrial mining that can prove detrimental to the health of mineworkers and their families. Accidents caused by rockfalls, shaft or surface collapse, operating machinery, and explosive use, can severely injure or kill mineworkers. Noise from mine operations can cause noise-induced hearing loss. Working conditions can lead to chronic health conditions, mental stress, or provoke alcohol/drug dependencies. Failure to utilise appropriate PPE or employ physical distancing measures could potentially fuel the spread of the current COVID-19 pandemic from the mine-site to mineworkers' families and their communities. Mineworkers are exposed to harmful dusts, gasses, and chemicals with the adverse health effects dependent on the mineral being mined. Exposure to radiation during uranium mining can cause genetic damage. Exposure to sulphuric acid fumes through proximity to copper smelting can cause a variety of respiratory diseases. Exposure to arsenic/cyanide in gold, iron ore, and zinc mining can cause various cancers, respiratory illnesses, and neurological damage. Dust particles or silicates released during most types of mining can cause a variety of respiratory illnesses among mineworkers, including silicosis, TB, chronic obstructive pneumonia disease (COPD), pneumoconiosis, asthma, emphysema, lung cancer, and mesothelioma (Chanda-Kapata 2020).

Figure 10: TB incidence per 100,000 population (2017)



Source: MacNeil et al. 2019:266

Globally, TB occurs in 128 people for every 100,000. In sub-Saharan Africa, this figure is more than double at 350 people for every 100,000 (*Figure 10*). Aside from HIV, mining is the largest driver of the TB epidemic on the sub-continent, responsible for an estimated 760,000 cases annually (Dharmadijari et al 2013). Mineworkers in southern Africa — Lesotho, Mozambique, South Africa, and eSwatini — have among the highest TB incidence rates in the world, with 2,500–3,000 cases per 100,000 persons (Osewe and Kistnasamy 2018).

[2] For a detailed discussion of the health impacts of mineral extraction in ESA, see P. Chanda-Kapata (2020) *Public health and mining in East and Southern Africa: A desk review of the evidence*, EQUINET Discussion paper 121, EQUINET, Harare https://www.equinetafrica.org/sites/default/files/uploads/documents/EQ%20Diss121%20Mining%20and%20health%20April2020.pdf

Overexposure to silica dust can cause silicosis among mineworkers, a disease characterized by scarring of the lungs. People with silicosis are at an especially high risk of contracting TB (Lurie and Stuckler, 2010). HIV, which happens to be prevalent among mineworkers in southern Africa, also has a "synergistic effect" on TB acquisition and transmission; "[t]he combination of the two—infection with HIV and exposure to silica—increases the TB incidence rate 15 times higher than in HIV-negative miners not suffering from silicosis" (Dharmadijari et al., 2013: 652). In South Africa, approximately 71% of the country's HIV patients, many of them in mining communities, are coinfected with TB. Unsurprisingly, TB is the leading cause of death among people with HIV (Osewe and Kistnasamy, 2018).

A significant portion of mineworkers in South Africa's mines are migrant workers from neighbouring countries. They often live in overcrowded hostels, and TB spreads more easily in such settings. TB infected mineworkers, in turn, spread the disease to their families and communities when they return to their homes (Dharmadijari et al., 2013; Osewe and Kistnasamy, 2018). The risk of silicosis and TB rises where mines fail to provide early detection, mine ventilation, adequate housing and other preventive measures. Mineworkers are often dependent on their employers for medical services but these are often limited to active permanent mine employees, not contractual employees, former mineworkers, family or community members. Hence, for example, the recent retrenchment of mineworkers in South Africa, largely in response to production cutbacks and mechanisation, and the increasingly precarious conditions of mine employment have detrimental effects on their health (Page-Shipp, 2016). Many current and former mineworkers face difficulties in securing mandatory compensation from mines for occupational lung diseases, especially after returning home to neighbouring countries, such as in eSwatini, Mozambique, Malawi and Lesotho, where rural healthcare systems may not provide the relevant medical care. The absence of continuity in medical services is a contributing factor to the development of drug resistant TB (Osewe and Kistnasamy, 2018). The health risks are thus magnified for such vulnerable groups, including migrant workers, those in insecure contracts and those with conditions such as HIV.

Impacts of Mineral Extraction on Surrounding Communities

Mines also impact on the health of surrounding communities. Smelter emissions and dust from tailings/mine dumps can pollute the air quality of nearby communities, negatively affecting respiratory health. Mine effluents in water systems can harm the health of those who drink, or consume fish from, the contaminated water. Exposure to chemical effluents can lead to short and long-term health effects for nearby residents, including neurological damage, respiratory illnesses, and various cancers. Mine pollutants can pose intergenerational risks, negatively affecting neonatal and child development. The influx of economic migrants to mining communities can place strains upon water, sanitation and electrical infrastructure, ultimately jeopardising public health (Chanda-Kapata, 2020). Exposure to these harmful health effects is heavily influenced by socio-economic status. Impoverished residents of mining communities tend to have homesteads that are closer to mine sites or tailings dumps and cannot afford the means to mitigate exposure to mine-related environmental contamination such as purchasing safe drinking water (Loewenson, 2018). The carbon emissions caused by mineral extraction, which contribute to climate change, could also potentially have longer-term effects on the health of mining communities (e.g. desertification, water scarcity, food insecurity, etc.).

Health impacts of ASM

ASM, much like LSM, have harmful effects on the health of miners and their communities. Approximately 20% of the DRC's cobalt production is conducted informally by artisanal miners (Schwartz, 2018). Direct exposure to cobalt affects heart-, lung- and thyroid-function (Leyssens et al., 2017). An increased demand for cobalt in the coming decades could thus have negative implications for the health of ASM operators. The mining processes in ASM can also have negative health outcomes. Mercury is used by artisanal and small-scale gold mining operators because it offers a relatively cheap and effective technique to capture fine gold from ore (IGF, 2017). According to the United Nations Environment Programme (UNEP) (2013a; 2013b) ASM activities in goldmining are the largest source of man-made mercury emissions worldwide, accounting for an estimated 727 tonnes annually. People working in these mines using mercury are exposed to occupational mercury poisoning and methylmercury poisoning through consumption of fish, with consequent nervous, respiratory, digestive,

and immune system problems (IGF, 2017). Women miners are particularly vulnerable to mercury poisoning as they are typically responsible for amalgamation tasks in ASM gold mines in Tanzania and Zimbabwe, whereas men are largely responsible for the tunneling, mining and transportation of gold ore (Spiegel et al., 2015). Communities surrounding ASM gold mining operations, like those in northwestern Tanzania, are also negatively impacted through mercury and arsenic contamination of their drinking water and soils (Nyanza et al., 2014). ASM activities can also harm the environment, including through deforestation, soil erosion, contamination of water systems and depletion of fish stocks, harming the livelihoods of those dependent on these natural resources.

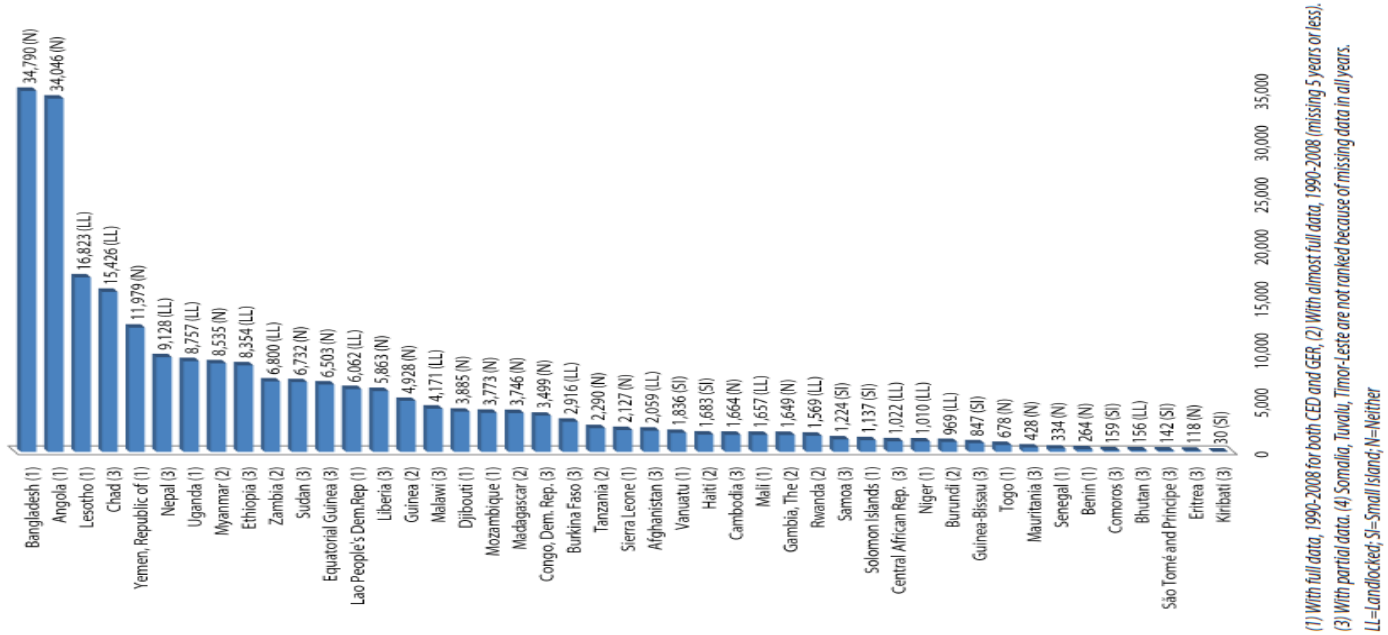
Mine Abandonment and Post-Closure Challenges

Lands previously utilised for mining are often polluted and unusable for agriculture and abandoned mines and tailings dumps in ESA may be occupied by ASM operators, with report of major accidents, fatalities and injuries. The 2018 shaft implosion at 'Black Mountain' in Kitwe, Zambia and the 2019 flooding of Cricket and Silver Moon gold mines in Battlefields, Zimbabwe are two recent examples. Closed mines have other negative environmental legacies. Lead poisoning from Broken Hill Mine's tailings and smelter dust continues to affect the children of Kabwe, Zambia more than twenty years after its closure, with risk of brain, liver, and hearing damage (Yabe et al. 2015). A recent Human Rights Watch (2019) report on the legacies of lead mining in Kabwe found that lead contamination disproportionately affected poor people as they tended to be undernourished, increasing the amount of lead their bodies absorbed; as lead dust particularly affected the informal settlements where they lived; and they did not access adequate water to maintain grass and dampen lead dust. As often is the case with such pollution, those with the least resources to mitigate exposure are most exposed and affected.

Mining's economic impact on the health systems of ESA

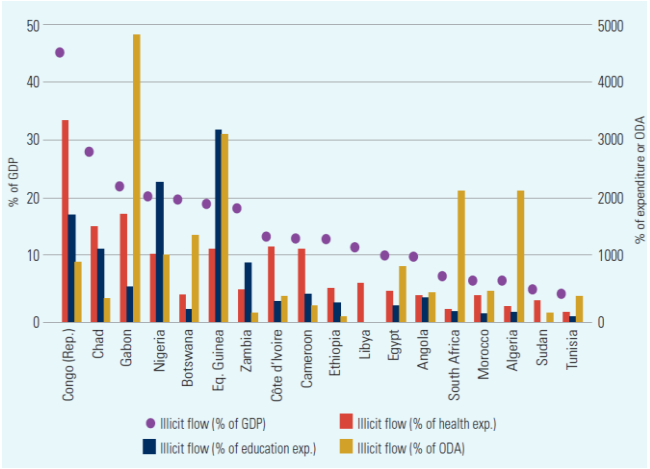
Health expenditure per capita and health expenditure as a % of GDP in sub-Saharan Africa has remained far below the global average over the past two decades. Arguably, efforts to increase mining's fiscal contribution could increase public revenues and, in turn, health expenditures. However, collecting such revenue from foreign mining firms has proven quite difficult. This difficulty was in large part due, initially, to financial liberalisation and the tax concessions offered to mining investors under liberalised mining regimes, described earlier, and now stems from difficulties with curbing tax avoidance and illicit financial flows (IFFs).

Figure 11: Cumulative IFFs from LDCs by country 1990-2008 (USD million)



Source: Kar 2011:13

Figure 12: Illicit flows in Selected African Countries, 2000-2009

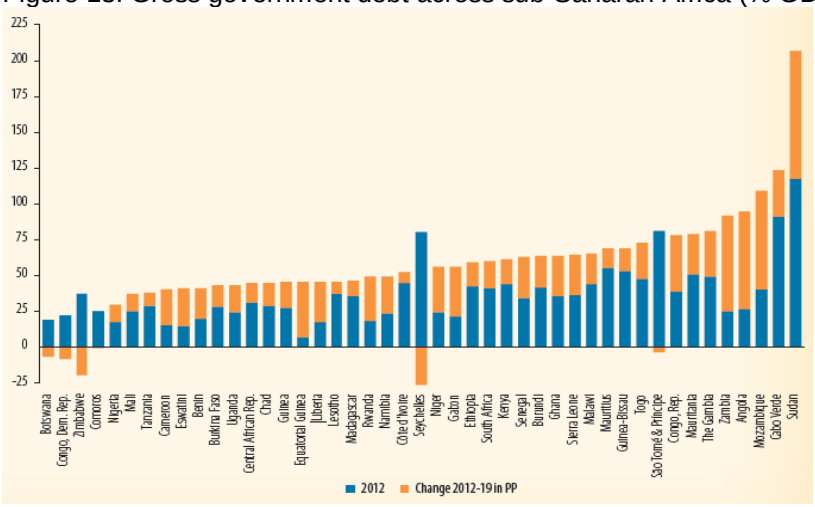


Source: Bharat et al., 2017;141

The tax concessions offered to incentivise foreign investment in the 1990s severely hampered the ability to secure sufficient taxation from the mining sector in most ESA countries. With the resurgence of resource nationalism, many of these concessions were either revised or revoked in the late 2000s and early 2010s. However, elements of financial liberalisation that enable capital flight such as exchange control measures, were not reversed. Increasing tax collection is not simply a policy issue. It also demands implementation and monitoring. Revenue collection from mining sector has been hampered by evasive tactics employed by foreign investors to avoid paying taxes, and by the weaknesses of African tax authorities.

Using strategies like *thin capitalisation* (shifting debt-to-equity ratios) or *transactions in intangibles* (i.e. charging exorbitant management or licensing fees), foreign mining investors can legally avoid paying taxes by shifting profits to low tax jurisdictions (Arezki et al., 2015; Moore et al., 2019). Foreign mining investors have also employed illicit methods. Many ESA countries rank highly for cumulative illicit financial flows (IFFs), shown in *Figure 11*. Aside from elite pilfering, a significant share of these IFFs have been attributed to the actions of foreign mining investors. For example, the Zambian Revenue Authority, together with an international audit team, audited Mopani Copper Mines (MCM) in 2010. They found that MCM was selling copper to Glencore (Switzerland), its parent company, at prices far below the international price for copper, or what is known as *transfer mispricing*. From 2003 to 2008, the cumulative difference between the international price and the price offered by MCM to Glencore for the quantities of copper supplied amounted to approximately US$700 million (Bharat et al. 2017). *The public revenue lost to tax avoidance and IFFs by several ESA countries, shown in Figure 12 could have been be channeled towards social and environmental needs.*.

Figure 13: Gross government debt across sub-Saharan Africa (% GDP)



*PP = Percentage Points
Source: World Bank 2020:88

Dependence on mineral extraction exposes ESA economies to export commodity price shocks due to mineral price volatility (World Bank 2019). *Such macroeconomic instability can have negative effects on financing healthcare systems*. A depreciating currency, for example, increases the cost of imported medical supplies, upon which many ESA health systems depend. The failure to capture tax revenue, macro-economic instability due to mineral price volatility, and increased borrowing to remedy infrastructure deficits has heightened debt in the region (*Figure 13)*.

The failure to capture ample taxation revenue from extractive industries and the macroeconomic instability caused by mineral price volatility, together with increased external lending to remedy infrastructure deficits has heightened debt levels. Since the end of the commodities super cycle in 2012, several ESA countries– particularly Mozambique, Angola, and Zambia– accumulated sizeable debts (*Figure 13*). Debt servicing will in the coming decades divert public revenue from social services and lead to a more short-term outlook in addressing resource nationalism, dictated by the need to overcome successive fiscal crises (Caramento and Saunders 2019).

Implications of Projected Trends in Mineral Extraction on Health Outcomes

The projected trends discussed in this brief have several implications for health outcomes in ESA, that will continue to be, felt most acutely by vulnerable groups including: artisanal miners, especially women; precariously employed mine contractors, poor residents of mining communities; migrant workers and their families and rural and peri-urban people who lack secure land tenure. The casualisation of mining labour and the increased unemployment associated with the mechanisation of mining operations will serve to deny mining contractors and terminated mineworkers access to health services that they would have previously been afforded.

Increased mining investment from emerging economies could negatively impact health outcomes in two ways: their health standards and wage levels are comparatively low, which could negatively impact the health and wellbeing of mineworkers and their families; and new mining ventures or the expansion of current operations could lead to displacement. The anticipated expansion of ASM, if left unregulated, will also have negative environmental and health effects.

Strategic minerals required for the manufacture of EVs and consumer electronics, like cobalt and tantalum, have negative health effects on workers extracting these minerals and those living close to extraction sites. As this expands these harms may also expand. There is potential for increased public revenue from the mining of these strategic minerals that could be employed to boost social expenditures. Dependence on mineral extraction exposes many ESA economies to export commodity price shocks. The heightened economic turbulence caused by mineral price volatility will have negative effects on ESA country health systems, as exchange rate fluctuations make it costlier to import medical supplies. Mining operations contribute to environmental degradation and climate change, with negative health implications for future generations.

Choices, responses, and policies

There are constitutional provisions on the right to health in many ESA countries, legal provisions covering mineworkers and contractors health, safety and workers compensation in most ESA countries, and environmental laws generally protect against harm to environments. However, few ESA countries legally guarantee healthcare provision to mineworkers, former mineworkers, and their families. There are limited health and social protections related to the resettlement and relocation caused by mining operations in many ESA countries. Post-mine closure obligations center largely on environmental rehabilitation and safety issues, are often poorly enforced and make no specific reference to, or financial provisions for, chronic health conditions (Loewenson et al., 2016). All countries have included some level of consultation in the negotiation of prospecting /mining rights and require applicants to conduct Environmental Impact Assessments (EIAs), but these EIAs do not necessarily include health impacts of nearby communities or ex-mineworkers, nor does the law require the health sector to approve EIAs (Loewenson et al., 2016). The legislation across ESA countries largely focuses on large-scale mining. Artisanal mining is often not legally recognised and may be criminalised, as happened in Zimbabwe's *Operation Chikorokoza Chapera* between 2006 and 2009, inhibiting the possibilities for environmental management and the mitigation of negative health effects associated with their activities (Spiegel et al. 2015).

Resource nationalism in ESA has sought to increase fiscal contributions from mining, through a combination of revenue- and profit-based taxation measures. However, many regional tax administrations still struggle to curb tax avoidance and IFFs from the extractive industries. Some ESA governments have also included provisions for mandatory fiscal contributions towards health services like Zimbabwe's *National AIDS Trust Fund Act* or for direct fiscal contributions to municipalities impacted by mining activities like Mozambique's *Mining Code*, Article 20 (Loewenson et al. 2016).

Despite these gaps, the law is arguably not the main constraint to regulating extractive industries in ESA. As Shelton and Kabemba (2012:197) point out: "Legislative and policy shortcomings are not the most important constraint… the most serious problem is the gap between what the law or policy says

should happen and what does happen." Government regulators in ESA often do not possess the requisite capacity to monitor mining operations and rollout/enforce existent legislation.

For example, South Africa's Department of Mineral Resources (DMR) did not fully enforce the Social and Labour Plans (SLPs) that like EIAs must be completed by prospective investors prior to the granting of mining rights in South Africa. Included in the SLP is a Housing and Living Conditions Plan that includes the housing conditions of mineworkers living in hostels, a factor in their TB risk, as noted earlier. A recent South African Human Rights Commission report (2016) found that SLP commitments were not being met, as shown in Table 5, nor was compliance adequately enforced.

Table 5: Social and Labour Plan Compliance, South African DMR Inspections (2013-2016)

Province	SLP compliance level 2013/14	SLP compliance level 2014/15	SLP compliance level 2015/16	Average
Eastern Cape	12/28	12/30	7/27	31/85 (36%)
Free State	2/21	4/26	6/28	12/75 (16%)
Gauteng	3/19	0/11	0/31	3/61 (4%)
KwaZulu-Natal	1/12	2/8	5/19	8/39 (21%)
Limpopo	16/27	18/25	11/18	45/70 (34%)
TOTAL	**34/107 (32%)**	**36/100 (36%)**	**29/123 (24%)**	**99/330 (30%)**

Source: SAHRC 2016

ESA governments thus confront a set of choices on how best to address the policy and regulatory challenges and shortcomings to advance policies on mineral extraction that have wider socio-economic benefit for the country and their populations in the coming decades. They can either maintain the status quo or take can proactive measures:

Maintain the Status Quo	Take Proactive Measures
Continue adopting a short-term outlook, by maintaining current levels of regulatory oversight, continuing to criminalise/marginalise ASM, and increase/adjust mining taxation to cover debt servicing payments.	Embrace a long-term outlook and adopt the recommendations of the AMV: 1. Increase Regulatory Oversight 2. Empower ASM 3. Facilitate developmental spillovers and encourage industrialisation
Indirectly regulate the health impacts of mineral extraction (employing current environmental legislation)	Regulate and prevent the externalising of health impacts of mineral extraction, including through Health Impact Assessments and in regional standards
Selective policing of mining operations by environmental management agencies	Actively enforce environmental legislation and broaden efforts to mitigate environmental degradation
Continue attempting to curb tax avoidance and IFFs by bolstering the regulatory capacity of tax authorities and employing selective taxation measures	Curb tax avoidance and IFFs by addressing the causes for capital flight, increasing financial transparency in the extractive industries, and empowering civil society
Continue employing top-down approach to the governance of mineral extraction	Embrace a bottom-up approach to the governance of mining, including communities in prior information and decision-making

Deepen and implement sustained proactive measures for resource nationalism

Following the end of the commodities super cycle in 2012, many ESA countries adopted a short-term resource nationalist outlook, principally concerned with increasing fiscal receipts from mining to relieve successive fiscal crises. Leveraging development outcomes from exhaustible mineral resources in ESA countries calls for *a longer-term, sustained outlook on resource nationalism.* The African Union (AU) *African Mining Vision* identifies three potential areas for this (AU 2009): increasing regulatory oversight of mining; empowering ASM; and facilitating developmental spillovers from mining.

Regulatory oversight can be improved in key areas: Revenue authorities can be strengthened to curb tax evasion and secure much needed revenues for more equitable development, including for health and environment, building on efforts to date. Environmental management agencies, labour and public health authorities must be funded to effectively monitor mining operations and their health and environment consequences and to be accountable to communities in this, within the framework of a 'developmental state' (Kanyenze et al., 2017; Saunders and Caramento, 2018).

The AMV also calls for the empowerment of ASM to create employment and facilitate economic multipliers in communities. Instead of criminalising ASM and persecuting their operators, the AU maintains that "[t]he critical challenge for those working in and with the ASM sub-sector is to mitigate its negative consequences and enhance its positive benefits to transform it and maximise its contribution to poverty reduction and creation of resilient communities" (AU 2009: 27). Meeting this challenge requires a comprehensive strategy that includes training initiatives, legal reforms to recognise the sector, loans and financial assistance and appropriate technology development and transfer, such as for equipment hire for ASM operations and measures to curb the negative environmental and health effects of mercury use. Formal ASM recognition would enable ESA governments to better regulate activities and mitigate negative environmental and health impacts, and the labour-intensive nature of ASM provides an employment alternative to capital intensive large-scale mining.

Cultivating wider development returns from mining calls for strengthened backward and forward linkages. This can be achieved through the supply of goods and services for mining operations, as well as by processing minerals in ESA countries. Some economists maintain that African policymakers can industrialise their economies by developing manufacturing industries to supply the mines (Morris et al., 2012). Such industrialisation could potentially fuel a larger economic structural transformation in the coming decades and enable the ESA economies to diversify and reduce their dependence on mineral extraction, mitigating the negative effects of mineral price volatility and future mineral depletion.

Project, prevent and monitor the health impacts of mineral extraction

In addition to EIAs, Loewenson (2018) recommends that when applicants apply for mining licenses, public authorities should conduct *Health Impact Assessments* (HIAs), such as in the processes indicated in *Box 1* with the involvement of all stakeholders, that must be approved by Ministries of Health before licenses are granted.

Box 1: Implementing a health impact assessment

A HIA involves key steps:

1. **Screening:** Collecting available evidence to identify the situation, what could impact on health positively and negatively and the key stakeholders to be involved.
2. **Scoping:** Identifying the areas for information gathering to investigate the potential health impacts, with what should be collected, from whom and how.
3. **Appraisal / Impact identification:** Collection of information locally and through key informants and analysis of information on the current situation and current and potential health impacts.
4. **Reporting and recommendations:** Compiling and discussing the findings with key local stakeholders to find out what they recommend to be done in the short, medium and longer term to prepare a report with costed plans and intervention strategies.
5. **Evaluation and monitoring:** Follow up to assess the implementation of agreed recommendations.

Source: Loewenson 2018: 21

HIAs would compel applicants to develop strategies to mitigate any negative health effects that their proposed projects might have at the outset and provide public authorities and communities with evidence and a plan that they can use to monitor and prevent the health and social burdens of mining being externalised onto vulnerable communities before, during and after mine operations.
Doing this calls for strengthened recognition of the full spectrum of mine-related public health impacts, beyond HIV, TB and occupational health. For example, the SADC Mining Protocol (1997) committed member states, among other proposals, to cooperatively improve the practices and standards of health in mining, and in 2006 SADC resolved further to harmonise these standards in the region. While the SADC has signed the *SADC Declaration on TB in the Mining Sector* in 2012 and the *Framework for the*

Harmonized Management of TB in the Mining Sector in 2014, there continue to be challenges in reaching and providing care to and social security for many of ex-mineworkers who have contracted silicosis and other chronic conditions from their employment in the mines (World Bank, 2019). As Lurie and Stuckler (2010:1206) note *[b]y failing to compensate miners who are eligible according to the law, mining companies externalize a major cost of production so that a large proportion of the costs of mining-related occupational disease are being borne by the rural labor-supplying communities, families and overburdened healthcare systems. This effectively leads to the costs of mining-related diseases being borne by rural communities that supply labour to the mines, instead of the mines themselves*. Uneven levels of healthcare across ESA countries and absence of a regional social security system makes it difficult to care for retired mineworkers. With many mining multinationals operating across ESA countries, securing health calls for improved regional coordination on legal liabilities, including for cross border health and social security for migrant and other workers and their families, to ensure that the externalities of mining that may affect communities and future generations are identified and managed across all ESA countries.

Enforce environmental rights and broaden efforts to stop environmental degradation

Environmental protections are broadly enshrined in relevant ESA laws but not always actively enforced (Loewenson et al. 2016). For example, the pollution of the Kafue River and its tributaries in Zambia by Konkola Copper Mines, the former subsidiary of mining conglomerate Vedanta contaminated drinking water and fish stocks. Dozens of people fell ill upon consuming the contaminated water and fish, experiencing digestive problems, miscarriages and birth defects. The Zambia Environmental Management Agency's failure to prosecute KCM pushed some of those affected to pursue private litigation against Vedanta, in a case still to be resolved (Das and Rose, 2014). While this means that even the 'polluter pays principle' set in law was not enforced, there is a question of whether 'polluter pays' is sufficient for the intergenerational habitat, biodiversity and health consequences that such environmental contamination causes. Mining operations should be held financially responsible for any environmental damage, but the priority is to predict, monitor and prevent them, by assessing, planning for and being accountable for prevention of these risks, by increasing the use of green technology and processes in mining and by considering the option of not mining and investing in alternative economic activities where the risks demand it.

Curtail capital flight and ensure transparency and public accountability

While bolstering the capacity of revenue authorities will help to monitor and audit mining investors, the resources from mining need to be made more transparent in the public domain. This implies curtailing capital flight by foreign mining investors, revising or revoking financial liberalisation measures that enable capital flight, such as the lifting of foreign exchange controls and promoting financial transparency in the sector. The Extractive Industry Transparency Initiative (EITI) requires member countries to publish annual reports disclosing information on production and employment statistics, mining contracts and licenses, and tax payments, all in an effort to improve governance of resource extraction. Only 6 ESA countries (DRC, Madagascar, Malawi, Mozambique, Tanzania, and Zambia) out of the 16 are members, and only Tanzania explicitly mandates EITI transparency and accountability measures in its extractive industries by law (Loewenson, 2018).

EITI provides useful information to civil society organisations and networks like Publish What You Pay to assist African governments in their efforts to improve the governance of and public accountability in mineral extraction. Such efforts are complemented by extractive industry transparency measures implemented in some of the jurisdictions where mining investors are headquartered and publicly listed on stock exchanges. For example, Canada's Extractive Sector Transparency Act of 2015, Section 1502 of the American Dodd-Frank Act of 2010, subsequently revoked by the Trump Administration in 2017, and the European Union's Accounting and Transparency Directives of 2013 compel extractive companies registered in their respective countries to make annual disclosure of payments they make to governments. Mining investors from emerging economies, while increasing in prominence, are not required to disclose such information as they are not governed by similar measures. This underlines the importance of ESA countries joining and using the EITI for financial transparency and accountability.

Embrace bottom-up approaches, engaging local communities and the wider public

ESA governments can improve the governance of mineral extraction by embracing bottom-up approaches and empowering local communities in the process. An example of this is in the implementation of the *Minamata Convention on Mercury* as it relates to ASM in gold mining. The Convention calls upon signatories "to reduce, and where feasible eliminate, the use of mercury" by ASGM by implementing national action plans. Spiegel et al., (2015) maintain that rather than criminalising ASM which may hide the use of mercury rather than curb its use, a more effective approach to implementing the Minamata Convention and reducing mercury usage by ASM is to actively consult the ASM operators and adequately fund reduction efforts, providing improved mining technologies, awareness campaigns and training in ways that engage with local knowledge (Spiegel et al. 2015). A consultative, bottom-up approach by policymakers and regulators is argued to be more likely to achieve compliance with mercury reduction efforts than imposing restrictions that will be evaded.

Engaging those who live in and have roots in local communities would be fundamental for a more sustainable long term approach to land tenure conversion and any granting of minerals rights, especially where this implies any relinquishing of communal land rights. Instead of simply seeking the approval of traditional authorities for this, prospective investors should be legally obligated to hold open, broad-based public consultations with all affected communities and to implement the principal of free, prior and informed consent.

At the same time, the future trends and longer term potential positive and negative impacts of mining activities for current and future generations demand also a much wider public engagement with and debate on the decisions and choices on how these resources are used in the coming decades.

Effluents from a mine, South Africa, P Botes, 2016

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