Chapter 1

The Untapped Economic Potential of Sub-Saharan Africa’s Oil, Gas, and Mineral Resources

Introduction

Africa is blessed with significant natural resource wealth, spanning diamonds, gold, oil, natural gas, uranium, platinum, copper, cobalt, iron, bauxite, and silver, among others. In 2019, minerals and fossil fuels accounted for more than a third of all exports from at least 60 percent of African countries (Signé 2021). The majority of countries in Sub-Saharan Africa (26 out of 48) are now categorized as resource rich according to the International Monetary Fund definition (IMF 2012). This trend continues as a result of major new discoveries in recent years, with even more countries on the path to attaining resource-rich status.

Despite these large and growing reserves, success in converting subsoil wealth into above-ground sustainable prosperity and poverty reduction has so far been limited. For example, since the decline in commodity prices in 2014, resource-rich Sub-Saharan African countries have grown more slowly than the region’s average. In addition to slow growth, these same countries have performed worse in poverty alleviation. According to World Bank estimates, by 2030, more than 80 percent of the world’s poor will be found in Sub-Saharan Africa, and almost 75 percent of the world’s poor will be located in resource-rich countries (Cust, Rivera-Ballesteros, and Zeufack 2022).

Taken together, this implies a staggering 62 percent of the world’s poor could be found in Sub-Saharan Africa’s resource-rich economies by 2030 based on current trends. Poverty eradication is therefore becoming a disproportionately resource-rich country and Sub-Saharan African challenge. And because the management of natural resources plays such an outsized role in the performance of these economies, poverty eradication therefore relies crucially on governments harnessing the resource base effectively and avoiding the macroeconomic harm it can otherwise cause.
Exploiting natural resource wealth to drive economic transformation is central to Africa’s economic future. Subsoil assets such as metals, minerals, oil, and gas remain key sources of government revenues, export earnings, and development potential across the majority of countries in Africa (AfDB 2018). The post-2014 slowdown in commodity prices, however, has squeezed the sector and placed governments and the private sector under increased pressure, highlighting the need for diversification (Christensen 2016). As the continent emerged from a long commodity price boom during the 2004–14 period, Sub-Saharan African countries found it difficult to shift away from resource dependence. Leveraging resources for economic transformation will require new approaches to confront long-standing political economy pitfalls.

The legacy of the boom and bust was one of missed opportunity, where significant resource revenues were generally not successfully converted into sustainable, diversified prosperity. Since the decline in commodity prices in 2014, resource-rich Africa has grown more slowly than the region’s average growth rate. While the boom years saw a golden decade of rising revenues and economic growth, the prosperity proved to be short-lived and precariously dependent on high commodity prices.

The extractive sector is well placed to support the economic recovery phase that the Africa region now faces. COVID-19 (coronavirus) and the associated debt challenges in many African countries highlighted the need for increased domestic revenue mobilization. Many look to the extractive industries as a source of potential economic opportunity; however, the historical record has been disappointing. Rising Asian demand for commodities has deepened investment in, and hence reliance on, natural resources. Despite decarbonization and depletion, the amount of natural resource wealth available for development continues to increase, providing a potential engine for structural transformation.

Africa holds huge untapped and unrealized mineral and petroleum resource potential and remains relatively underexplored by global benchmarks. The continent also boasts a diverse basket of commodities. Therefore, there is an expectation that, under the right circumstances, significant untapped geologic potential remains across the region.

However, the mining sector’s contribution to employment has been declining amid mechanization; thus, new approaches and policies may be required to ensure a more equitable distribution of benefits from extractive industries to other parts of the economy.

Although decarbonization of the global economy has begun, demand for fossil fuels remains high, and geopolitical events create new opportunities for the export of African oil and gas. Taken alongside two decades of major petroleum
discoveries in Africa and several new producer countries entering the market, the role fossil fuels play in the economies of Sub-Saharan Africa has never been more significant. The challenge is how to harness this wealth amid uncertainty about the future and the potentially significant downside risk of a declining, rather than expanding, petroleum market in the decades to come.

In contrast, the demand forecasts for a range of Africa's metals and minerals predict significant growth. Deposits of cobalt, lithium, manganese, and other metals will play a critical role in the low-carbon transition. Meanwhile, Africa's significant domestic energy needs in the decades to come imply an important role for natural gas, even while the global economy decarbonizes.

Taken together, subsoil assets ranging across metals, minerals, oil, and gas are likely to remain key sources of government revenues, export earnings, and development potential across the majority of countries in Sub-Saharan Africa in the years to come. Indeed, the past two decades have been characterized by rising levels of resource dependence, despite the finite, depleting nature of these resources. Even with the decarbonization of the global economy that is beginning to occur, the extent to which global demand for petroleum is entrenched implies that African policy makers should proceed with caution but that they have an opportunity to react proactively to this megatrend.

Tapping into Africa's resource future and its significant economic potential is in the hands of policy makers. Meanwhile, managing risks on the horizon and building economic resilience to the range of possible futures can also be part of today's policy choices.

**The Significant Rise in Resource-Rich Countries across Africa in the Past Two Decades**

During the resource boom, the number of resource-rich countries and the overall degree of resource richness for the whole Sub-Saharan Africa region increased markedly. According to the IMF, a country is resource rich if it derives either 20 percent of exports or 20 percent of government revenues from natural resources. By this definition, the number of resource-rich countries in the region rose from 18 before the boom to 26 during and after the boom, representing a majority of Sub-Saharan Africa's 48 countries (IMF 2012). New discoveries, high prices, and more production caused this trend, increasing the levels of resource dependence and pulling more countries into this grouping. The IMF list in 2012 included five newly resource-rich countries and several that were prospectively resource rich due to major discoveries (see map 1.1).
African countries account for a large number of resource-rich countries globally. Measuring rents as a percentage of GDP offers an indication of the overall economic importance of natural resources, and is an indication of potential revenues available for taxation for a given resource-rich country. When assessed in this way, many African countries are some of the most resource-rich countries in the world—with a large concentration among oil and gas–producing countries (figure 1.1).

The degree of resource richness observed in the Africa region compared with other regions can also be examined. By using the same threshold criteria applied at the country level (20 percent of exports or 20 percent of government revenues from resources), figures 1.2 and 1.3 show that two world regions can be considered resource rich based on the IMF 20 percent threshold classification: the Middle East and North Africa region notably dominates this category,
Figure 1.1 Receipts from Natural Resources, by Country, 2004–14 Average

Note: The figure shows countries for which natural resource rents exceed 10 percent of GDP. Fossil fuel–rich Sub-Saharan African countries (in yellow) are those defined as resource rich by the International Monetary Fund (IMF 2012); oil is their main nonrenewable natural resource. Mauritania and Zambia (in red) are resource-rich Sub-Saharan African countries for which minerals are the main type of nonrenewable natural resource in this figure. A total of 20 countries in the world saw average resource rents that exceeded 20 percent of GDP. Timor-Leste is not shown, but its share of natural resource rents exceeded 100 percent of its GDP. SSA = Sub-Saharan Africa.

Figure 1.2 Nonrenewable Resource Exports as a Share of Total Merchandise Exports, by Region, 2004–14 Average

Source: Cust, Rivera-Ballesteros, and Zeufack 2022.
Note: The figure shows the 2004–14 average of fossil fuels, metals, and minerals exports as a share of each region’s total merchandise exports. The dashed blue line denotes the International Monetary Fund criteria for resource richness (natural resource revenue or exports at least 20 percent of total fiscal revenue or exports, respectively) applied to the boom period.
with almost 70 percent of total export value derived from natural resources—mostly petroleum—and more than 50 percent of government revenues. The Sub-Saharan Africa region also exceeds the 20 percent threshold for resource richness during this period but with a larger mineral component, exceeding 50 percent of export value and almost 30 percent of government revenues. Furthermore, in both of these regions, natural resource revenues in some individual countries surpassed 80 percent of total government revenues during the boom years.

The Untapped Resource Potential of Africa

Sub-Saharan Africa’s natural resource wealth, with the region’s deep reserves and untapped investment potential, can and should play an important role in its economic recovery. Approximately one-third of Sub-Saharan Africa’s stock of wealth in 2018 was held in various forms of natural capital, including non-renewable petroleum and mineral deposits (World Bank 2021). Between 2004 and 2014, natural resource revenues averaged 29.6 percent of total government revenues in Sub-Saharan Africa and 36 percent of government revenues...
in Sub-Saharan African resource-rich countries, based on UNU-WIDER data (2022).

However, revenues are falling short of capturing the economic potential of natural resources. Estimated rents from natural resources, which are the difference between the cost of extraction and the typical price of their sale (Cust and Rivera-Ballesteros 2021), are consistently far higher than the level of revenues collected by governments. Estimated annual resource rents in Sub-Saharan Africa account for the equivalent of 9 percent of resource-rich Africa’s GDP (World Bank 2021), but about 260 percent of their natural resource revenues, implying that a significant gap remains between the rents generated by resource extraction and the amount captured by governments as revenue.4

Leveraging these riches for sustainable development has never been more important, and governments must ensure these sectors remain productive and resilient. If governments across resource-rich Africa could capture just 10 percent of untapped rents, resource-rich Africa’s revenues would increase by US$2.4 billion per year.5 However, to close this gap, governments must find ways to more effectively tax the sector, including a move away from fiscal expenditures, especially for fossil fuels. Contract transparency, competitive bidding processes, and risk-based auditing are all tools governments can usefully deploy. Global efforts toward minimum taxation agreements can also serve to ensure countries capture a greater share of rents.

Regional Geology and Resources

Sub-Saharan Africa remains a heavily resource-driven regional economy drawing on its significant endowments of petroleum, minerals, and metals. The minerals sector is a major and growing component of the economic output and exports of many Sub-Saharan African nations, accounting for 10 percent of Sub-Saharan Africa’s overall economic output and 50 percent of exports excluding petroleum products (Albertin, Devlin, and Yontcheva 2021).

Although it is underexplored, the Sub-Saharan African region already hosts a large proportion of the world’s mineral resources, placing Sub-Saharan Africa at the potential center of the clean energy transition. These resources include, besides precious platinum group elements (59 percent of total world resources) and diamonds (48 percent), a dominant position in ferroalloy metals such as cobalt (75 percent) and manganese (68 percent) (Guj et al., forthcoming). Some of these metals, such as cobalt, manganese, graphite, and lithium, are important inputs for clean energy technology. Some countries are particularly well-endowed: two-thirds of the world’s cobalt is mined in the Democratic Republic of Congo; Rwanda accounts for a third of tantalum mining; and South Africa has the world’s largest reserves of platinum, palladium, and manganese. The continent is also home to resources with rapidly growing global demand. Specifically, lithium is a critical input for the electric vehicle (EV) battery
industry, and countries including the Democratic Republic of Congo, Ghana, Mali, Namibia, and Zimbabwe have reserves (see Guj et al., forthcoming). The continent also hosts the world’s largest resources of phosphate rock (67 percent) and bauxite (59 percent), as well as important deposits of iron ore, heavy mineral sands, salt, and potash, and energy minerals such as coal and uranium. Map 1.2 shows the distribution of main minerals on the African continent.

Current production levels still lag in a number of Sub-Saharan African countries, despite their having some of the world’s largest resource endowments. The picture is similar for petroleum wealth. For example, graphite, which is one of the most important components of lithium batteries, is relatively under-exploited in several Sub-Saharan African countries, particularly Tanzania. In 2018, despite having the fifth-largest reserves in the world, Tanzania is ranked 21st in global graphite production. In comparison, India (with half of Tanzania’s reserves) and Norway (with 30 times smaller reserves) are ranked 6th and 8th in production, respectively.

Map 1.2 Selected Metals and Mineral Deposits Discovered in Africa, 1990–2019

Source: Based on MinEx Consulting Africa Minerals Database 2020.
Note: The map includes discoveries in North Africa. PGE = platinum group elements.
Another way to measure this discrepancy is to compare the gap between reserves and actual economic value from resources across different regions. The economic contribution from natural resources can be measured by using wealth accounting, as developed and published by the World Bank’s Changing Wealth of Nations program (World Bank 2021).

Although Sub-Saharan Africa has abundant natural resources—including minerals, metals, oil, natural gas, land, and forestry—its absolute level of resource wealth is one of the lowest among the world’s developing regions (figure 1.4). Measured in dollar terms using wealth accounting, Sub-Saharan Africa’s resource wealth is lagging both in aggregate and per capita levels, owing largely to less exploration and development in previous decades. Sub-Saharan Africa’s natural wealth could rise substantially in a generation if exploration and development of mining projects expand to levels seen in other regions. Evidence suggests that such a process may be under way (Arezki, van der Ploeg, and Toscani 2019), but that such investment decisions are influenced by institutional quality (Cust and Harding 2020).

Sub-Saharan Africa’s Exploration Opportunity
The natural resource sector has untapped potential to make larger contributions to economic activity, primarily via revenue generation, but much of the resource wealth likely remains undiscovered. Sub-Saharan African countries are still relatively unexplored compared with other regions of the world (McKinsey 2013).

Figure 1.4 Sub-Saharan Africa’s Aggregate and per Capita Natural Wealth, 1995–2018

Underexploration is seen in the fact that the region's resource wealth in per capita terms lags behind that of other regions, as just discussed and shown in figure 1.4. It can also be seen in the number of mine sites compared with other regions. Figure 1.5 shows the number of active mineral exploration sites worldwide by region. In 2017, African countries’ total number of active mineral exploration sites was estimated at 282, or about half of the number of sites in Australia or Canada, despite having more than triple the surface area.

A driving factor behind the disproportionately low number of active mines is the level of exploration expenditures in Sub-Saharan Africa. Despite being a highly profitable discovery region, where the estimated value of mineral discoveries exceeded exploration spending between 2005 and 2014, the amount of money spent on mineral exploration was relatively lower than in other places. Figure 1.6 shows that the expenditure on mineral exploration in Africa was lower than the estimated exploration spending in places where discoveries have accumulated less value, such as Latin America and Canada. The exploration-spending-to-discovery value in Sub-Saharan Africa is also higher than in other mineral-rich places, including Australia and the United States. Although Sub-Saharan Africa has rich endowments, between 2007 and 2016, it only attracted 14 percent of the world’s total exploration expenditure (US$20 billion). Such results are not surprising if investors attach greater perceived risk to operating in such jurisdictions. It is likely that the institutional environment influences investment location, as has been found for petroleum exploration decisions (Cust and Harding 2020).

Figure 1.5 Active Mineral Exploration Sites per Million Square Kilometers of Surface Area in Key Mining Jurisdictions, 2017

<table>
<thead>
<tr>
<th>Region</th>
<th>Active Mineral Exploration Sites per Million Square Kilometers</th>
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<tbody>
<tr>
<td>Australia</td>
<td>504a</td>
</tr>
<tr>
<td>Canada</td>
<td>532a</td>
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<tr>
<td>South America</td>
<td>451a</td>
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<tr>
<td>United States</td>
<td>225a</td>
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<tr>
<td>Africa</td>
<td>282a</td>
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Sources: Mining Engineering; Statista estimates; US Geological Survey; World Bank; S&P Global Market Intelligence.

a. The value on top of each bar indicates the number of active mineral exploration sites in each region.
Globally, exploration expenditures declined substantially after the last commodity boom. As figure 1.7 shows, exploration expenditure declined by 68 percent, from US$34.9 billion in 2012 to US$11.2 billion in 2016 (Schodde 2019). This decline was largely due to heightened uncertainty within the commodities sector as prices returned to more moderate levels. The outlook for exploration investment in the medium term is more positive because commodity prices have increased significantly as a result of new infrastructure programs in countries such as China the United States and coupled with momentum from the clean energy transition.

There are four tiers of mineral deposits. Tier 1 deposits are large, long-life, and low-cost deposits. Tier 2 deposits are significant deposits, but not quite as large, long life, or profitable as tier 1 deposits (they only meet some of the tier 1 criteria). Tier 3 deposits are small or marginal deposits. Tier 4 are uneconomic deposits and are unlikely to be developed. Most deposits found in Africa are tier 3 deposits. They can be profitable, but only meet one of the criteria for tier 1 deposits. Deposits can also be classified into four size categories: giant, major, moderate, and minor. These categories depend on the amount and type of contained minerals. For example, giant deposits of gold
contain more than 6 million ounces of this metal, and giant nickel deposits hold more than 1 metric ton of this resource (see Guj et al. [forthcoming] for the size categories’ threshold for different types of metals and minerals). Most deposits that are categorized as tier 1, 2, and 3 are considered major or giant in size, while tier 4 deposits correspond mostly to minor and moderately sized deposits. However, moderately sized deposits can qualify for the tier 1, 2, or 3 categories if they are considered valuable because of their sufficiently high grade.

Although Southern Africa has the highest total value of undeveloped resources, West Africa has the vast majority of tier 1 value (see figure 1.8 and table 1.1). In West Africa, 34.4 percent of gross mine-site value is in tier 1 deposits, compared with 0.2 percent in Southern Africa and 0 percent in North, East, and Central Africa. On the other hand, Southern Africa has more than twice the total value of the rest of the African continent combined.

**New Discoveries in Petroleum and Minerals**
The average size of newly discovered deposits is decreasing. Schodde (2019) estimates that over the decade 2009–18, 846 mineral discoveries of moderate size or larger were made in the world. However, within that size range, the proportion of moderate-size discoveries has increased from 48 percent to
61 percent, indicating that, on average, the size of deposits being discovered is decreasing. On the other hand, over the past century, the number of discoveries on the continent has increased markedly (figure 1.9).

Gold still remains a major focus for exploration. Globally, gold accounted for 34 percent of expenditures over the past decade and 40 percent of all discoveries made. Gold also accounted for 25 percent of all tier 1 and 2 discoveries, most of which were in developing countries (figure 1.10).

Smaller mining companies recently began playing a larger role in exploration (figure 1.11). Until the 1990s, large mining companies made most
**Figure 1.9** Number of African Mineral Discoveries, by Size of Deposit, 1900–2019

Source: Guj et al., forthcoming.
Figure 1.10 Number of African Mineral Discoveries, by Commodity, 1900–2019

Source: Guj et al. 2022, forthcoming.
Figure 1.11  Number of African Mineral Discoveries, by Type of Exploration Company, 1900–2019

Source: Guj et al., forthcoming.

Note: State-owned companies = mines owned and managed by the national government. Industrial companies = companies engaged in mineral production. Oil companies = companies with the main activity of oil and gas exploration and production. Prospectors = companies that identify potential sites for mining. Junior explorers = companies that have limited or no revenue streams to finance their exploration activities. Small producers = companies with annual sales revenues of less than US$50 million per year. Moderate producers = companies with annual sales revenues between US$50 million and US$500 million per year. Major producers = companies with annual sales revenues greater than US$500 million per year. Major—singles = companies that tend to be focused on only one or two commodities. Major—multiples = companies with a spread of mining operations and expertise across a broad range of three or more different commodities.
new discoveries. Junior explorers first entered the scene in the 1990s, but they have grown substantially over the period 2009–18, during which time they made 63 percent of all discoveries. Sub-Saharan African policymakers need to take this into account when developing mining regulations and fiscal regimes to ensure they do not provide disincentives for junior exploration companies.

Petroleum Remains Sub-Saharan Africa’s Most Valuable Asset
Oil has accounted for more than 30 percent of total wealth in Sub-Saharan African resource-rich countries, including Chad, the Republic of Congo, and Gabon; however, this is still significantly less than in some resource-rich comparators outside Africa, where average oil wealth can exceed 50 percent (World Bank 2021). There are both major producers, which are defined as those that produce an average of more than 100 barrels per day, and minor producers, which are defined as those that average less than 100 barrels per day. Before the boom period there were 14 petroleum-producing countries (7 major and 7 minor producers). After the boom period, the number of petroleum producers increased to 22 (10 major and 12 minor producers) (map 1.3).

Map 1.3 Evolution of the Number of Petroleum Producers in Sub-Saharan Africa, Preboom and Postboom

Source: Based on EIA 2022.

Note: Kb/d = thousand barrels per day.
Figure 1.12 shows that during the 2004–14 commodity boom, the share of giant petroleum discoveries concentrated in Sub-Saharan Africa soared, which led to an increase in petroleum production in the region.

Mihalyi and Scurfield (2021) identify a growing number of Sub-Saharan African hydrocarbon-rich countries following the commodity price boom. Based on 12 Sub-Saharan African countries with significant hydrocarbon discoveries during the boom period (2004–14), they find three key disappointments related to these discoveries: (a) lack of commercial development, (b) longer-than-expected timeline from discovery to production, and (c) lower-than-expected revenue mobilization. One of the explanations for these disappointments is overoptimistic expectations, where forecasts—and associated policy decisions—overshoot the subsequent reality. In the worst case, discoveries can lead to low or reduced rates of economic growth, a phenomenon dubbed the “presource curse” (Cust and Mihalyi 2017).

First, some discoveries, despite initial euphoria, did not generate wealth. In the best scenario, only 8 of the 12 oil discoveries resulted in commercially

**Figure 1.12 Giant Oil and Gas Field Discoveries, by Region and Decade, 1950–2018**

Source: Based on Cust, Rivera-Ballesteros, and Mihalyi 2021.

Note: The share of giant discoveries by decade and region is calculated as the number of giant discoveries by region in each decade divided by the total number of giant fields discovered in that decade in the world. Geographic regions are as defined by the World Bank: EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; SSA = Sub-Saharan Africa.
viable development (Mihalyi and Scurfield 2021). The initial finds in the other 4 countries—Guinea-Bissau, Liberia, São Tomé and Príncipe, and Sierra Leone—turned out to be dry wells or of low value and were abandoned. Announcements were also inflated. For instance, in São Tomé and Príncipe, the IMF in 2001 predicted oil production to start in 2006 despite no discovery having been confirmed. The discovery ended up being confirmed only in late 2006 by the company Chevron and its co-ventures. Although the company’s announcement indicated that it was too early to determine whether the discovery was commercially viable, it made reference to potential similarities with a large oil field in Nigeria. As a result, rumors emerged of at least 1 billion barrels being discovered. But these rumors were unsubstantiated, and it was later confirmed that the discovery was not commercially viable. No further discovery has happened since in either this or other blocks.8 Because of the disappointing exploration drilling results, all the major oil companies pulled out of the Joint Development Zone between São Tomé and Príncipe and Nigeria in 2012–13. In addition, the volume of discoveries in these countries since 2010, with the exception of Mozambique, has been disappointing, and the reserve-to-production ratio of all known reserves was less than expected. For instance, the ratio is about 50 years in Nigeria at the current production rate (and about 20 years for Angola, the other major oil producer in the region), whereas it is estimated to be more than 100 years in many of the major oil producers in the Middle East.

Second, the time from discovery to production and exploitation has been longer than expected. The initial forecast for the discovery-to-exploitation process for oil and gas was estimated to be 6.2 years for the 12 Sub-Saharan African countries studied by Mihalyi and Scurfield (2021), reevaluated to 11 years, on average, according to Mihalyi and Scurfield (2021). For instance, oil fields (Block 1, Block 2, and Block 3) in Uganda are now projected to be exploited between 15 and 17 years after discovery, a significant increase over the 3 to 5 years in initial forecasts. For gas fields (Block 1, Block 2, and Block 4) in Tanzania, Mihalyi and Scurfield (2021) estimate the discovery-to-exploitation process is between 15 and 17 years, up from 8 to 10 years in initial forecasts. Overall, 56 percent of the discovered hydrocarbon fields in Sub-Saharan Africa had not yet been exploited as of 2018, whereas only 33 percent of the discovered hydrocarbon fields for the rest of the world have not yet been exploited, according to Mihalyi (2020). Mihalyi (2020) reports survival models confirming that the process is longer in Sub-Saharan Africa than elsewhere for both oil and gas extraction, and even longer in the case of gas deposits compared with oil deposits. These results hold when controlling for the level of GDP, so cannot simply be explained by differences in income levels across countries and regions, echoing similar findings on the delays around mining projects (Khan et al. 2016).
Finally, revenue mobilization has underperformed. Revenues collected were 63 percent lower than those initially projected in the three countries that reached production—Ghana, Mauritania, and Niger. The Ghanaian case is particularly well documented in Mihalyi and Scurfield (2021). Following the massive Jubilee offshore oil find in 2007, in 2009 the IMF and the World Bank forecasted annual oil revenues to be at least US$1 billion from 2011 onward. Actually, from 2011 to 2017, annual oil revenues were only about US$0.6 billion according to Mihalyi and Scurfield (2021). The alleged factors behind these overoptimistic projections were a combination of overestimates of corporate income tax from exploitation and, more important, underestimates of cost recovery from additional new hydrocarbon production sites related to project ring-fencing provisions or lack thereof. Subsequent undershooting in revenues collected was also driven by falling oil prices. Many giant petroleum fields were discovered in Africa during the 2004–14 commodity boom (figure 1.13), creating a perception of a bonanza in resource-rich Africa; however, given the lead time to develop, few reached fruition before the end of the supercycle and declining world prices, further undermining the revenue contributions they could make.

Figure 1.13 Largest Giant Petroleum Discoveries for Host Country Economy, Net Present Value of Discovery Scaled by Share of GDP, 1960–2020

Source: Based on Cust, Rivera-Ballesteros, and Mihalyi 2021.
Note: The figure shows countries where real net present value from giant field discoveries exceeded 10 percent of constant GDP. EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; SAR = South Asia; SSA = Sub-Saharan Africa.
Unlocking SME Potential in the Mining Sector

The mining sector in Africa is relatively top-heavy, being dominated by large, often foreign-owned, mining companies that, in turn, often use international suppliers for key inputs. Other countries and regions have achieved success with smaller-scale, sometimes more domestically owned, mining and mining supply chain firms. A more balanced portfolio of large, medium, and small miners and firms in Africa could help the sector deliver wider shared benefits.

Unlocking the potential of small- to lower-medium-scale mining in Sub-Saharan Africa requires a strong regulatory environment, business support, and access to finance. South African small and medium enterprises (SMEs) benefit from a favorable investment climate. A large number of supplier and enterprise development programs have been implemented by large mining firms because of Mining Charter III’s provision that allows companies to offset up to 30 percent of their procurement budget against supplier and enterprise development. Though capacity of SMEs is being built, financing is still scarce. Commercial banks have limited risk appetite, particularly given the number of large mining firms with years of financial statements and established profitability. To integrate SMEs into mining supply chains, a complementary suite of measures is needed, including the development of junior African mining companies (box 1.1).

Fiscal instruments to capture a share of revenues should be bifurcated for SMEs and large mining companies. Royalties, for instance, can be made progressive, where the rate is tailored to the size of the deposit. Different categories of royalties for each category of mines can promote the development of small and medium mine projects. A review of 46 Sub-Saharan African countries’ mining laws indicates that, except for Tanzania, none of the mining policies or mining laws explicitly and separately specify the existence of, nor contain special provisions for, medium-scale mining activities. As a consequence, small to medium-size mines typically have the same fiscal regime as large-scale mines.

Beyond laws and policies, governments can support SME development by creating an enabling environment for a dynamic and competitive private sector capable of meeting the demands of mining companies by producing locally instead of importing goods. The recent experience in Zambia highlights the challenges associated with domestic firm preferences that can replace different suppliers with locals but still fail to increase linkages. Instead, the focus should be on value added and building durable capabilities. Companies willing to invest and accordingly increase the national value added need more than just privileged access to procurement contracts. For instance, a company willing to invest in mining machineries, or the dynamite industry, or the garment
industry will need to have a sufficient local skills base, infrastructure (energy, transport, and logistics), and access to a dynamic financial system to be competitive. In this case, government support can be more effective when addressing these broader bottlenecks.

Skills
Developing and implementing skills-development programs aligned with both mechanization and economic diversification to absorb the decline in labor demand resulting from mechanization can be an important pillar of any private sector support strategy. Although mechanization results in substantially higher productivity and revenue, it has a strong impact on local labor dynamics by raising the capital intensity of production. In particular, it can shift the type of labor demanded from low skilled to high skilled and lead to an overall decline in the amount of labor demanded. The transition to mechanization requires the development of a suitably skilled workforce for these new needs, as well as management of the flow of lower-skilled workers to other industries and jobs that are positioned to absorb high amounts of lower-skilled labor. The increased

**BOX 1.1**

**Strengthening Support to Junior African Mining Companies**

Globally, the term “junior mining” refers specifically to prospecting companies engaged only in the early stages of mining development. But in South Africa, junior mining firms include midtier producers in addition to exploration companies. These firms are often supported by larger institutions. In Canada, junior mining companies are supported through the Prospectors & Developers Association of Canada. In South Africa, Minerals Council South Africa, the mining sector’s industry association, supports both junior and large firms.

Given high levels of information asymmetry, Minerals Council South Africa has established a Junior and Emerging Miners’ Desk to provide support and serve as a resource for small member companies within the association. The industry body provides support to junior mining firms that lack the capacity and resources to implement legislation and policies. The Junior and Emerging Miners’ Desk does not directly assist individual companies, but lobbies for junior mining firms at a policy level. For example, the Junior and Emerging Miners’ Leadership Forum successfully lobbied for concessions in the Mining Charter pertaining to smaller companies. Minerals Council South Africa also hosts breakfast seminars on topics such as mine community development, finance for junior miners, water management, and the Mining Charter and junior mining, and has set up a mentorship group to support junior and emerging miners.

tax revenue resulting from higher mining productivity can be used to finance skills-development programs, but proactive and nimble government support is also important.

Mechanization also requires capability development to ensure sufficient entry of local suppliers. Currently, nearly all of the mechanized machinery used in Sub-Saharan Africa is imported from overseas, as is the labor to operate and repair the machinery. Therefore, providing local suppliers and servicers with the necessary training is key to making domestic mining technology and service firms competitive with international counterparts. Given the skills shortage facing many mining communities, this upgrading will require capacity-building in the areas of technical and business development and increased access to finance to support the development of linkages while also widening the beneficiary base of the mining sector. Existing local content policies largely focus on direct employment quotas but less on skills development for the creation of indirect employment in linked sectors. Shifting the focus of local content policies to the latter would help grow the mining multiplier effect along with productive linkages. Additionally, investment and development of technical and vocational education and training in Africa can play an important role in providing the needed skilled jobs for the sector. Africa’s youthful population provides a significant opportunity for these next-generation skills to be home-grown and home-sourced from across the continent.

**Capacity and Governance**

Policy recommendations to strengthen the governance of the mining sector can be broadly grouped into four areas: (a) strengthen the transparency and accountability of the sector, (b) honor existing fiscal and social agreements, (c) create policies that require firms to consistently cover all costs, and (d) strengthen revenue collection.

Improving transparency and accountability is critical for improving trust between mining companies and governments and for managing expectations between communities and firms. Historically, distrust has been rampant and has translated to abrupt policy changes and operational stoppages. For example, in 2017, the Tanzanian government accused London Stock Exchange–listed firm Acacia, the country’s largest gold mining company, of tax evasion, and handed the firm a US$190 billion tax bill—about four times the country’s GDP—for underreporting output and thus underpaying taxes, an allegation the company denied (World Bank 2019). Widespread adoption of the Extractive Industries Transparency Initiative (EITI), as well as accompanying standards such as routine contract disclosure, can reduce information asymmetry and help develop a mechanism to promote trust and collaboration between governments, firms, and civil society. The EITI standard requires information along the extractive value chain, including extraction, rent transfer, and how it benefits the public.
The EITI aims to reduce elite capture by shedding light on how licenses and contracts are allocated, who benefits from those operations, what the legal and fiscal arrangements in place are, how much is paid, how those revenues are allocated, and what extraction contributes to the economy, particularly for employment. Companies are increasingly stepping up their own practices, including making contracts public and open to scrutiny, along with more detailed project-level reporting on taxes paid and other social investments. High standards in environment, social, governance, and emissions reporting can also serve to improve channels of accountability.

Investors value policy stability, which includes consistent fiscal arrangements over time that are flexible to different price conditions. Policy and institutional stability can be central to keeping and attracting investments. For example, in 2020, 72 percent of mining firms surveyed by the Fraser Institute stated that uncertainty regarding the administration, interpretation, and enforcement of existing regulations was a mild deterrent, strong deterrent, or a reason that they would not pursue investment in South Africa (Yunis and Aliakbari 2020). This inclination follows years of relative policy change and uncertainty.

The Mining Charter was first developed in 2002 to help address the legacy of apartheid. It was amended in 2010 and revised again in 2017 and 2018. In 2019, the Minerals Council filed an application to take the third Mining Charter to judicial review, challenging several key provisions, including procurement and ownership. Under these provisions, companies that were previously compliant with the 26 percent ownership target in the past would remain compliant even if their Black Economic Empowerment (BEE) partners choose to exit the transaction. However, with the revised charter, these companies would lose their compliant status when they renew or transfer their mining rights, and would have to top up their BEE shareholding to the new minimum of 30 percent. This was contrary to a North Gauteng High Court ruling from April 2018, which stated that companies that met, but then fell below, the 26 percent target would not have to top up their BEE shareholding. The shift in policy created uncertainty among many existing firms and potential investors, largely because it was unexpected and would require substantial change on the part of firms.

Honoring existing fiscal agreements is also critical. There has been an increase in resource nationalism across Sub-Saharan Africa, which has translated to tax increases, increases in requirements for state equity, and local beneficiation requirements. When governments unilaterally amend or break existing fiscal agreements they have with mining firms, they signal that future investments or projects are high risk and vulnerable to abrupt changes. For example, despite being Sub-Saharan Africa’s second-largest copper producer, Zambia has struggled to keep existing investments and mobilize new investments,
compared with neighboring Democratic Republic of Congo. Although there are a number of reasons, one that could have a high impact is the unpredictable fiscal climate—in 2018, Zambia increased its royalty rates for the tenth time in 16 years, which created uncertainty for investors.

Developing and consistently enforcing policies that require firms to cover their social and sustainability costs from exploration to mine closure should be a central part of governance of the sector. A primary reason that governments develop policies that can be perceived as punishing mining companies is because of the substantial negative externalities mining firms generate, historically and at present, including pollution, health consequences for workers and communities, infrastructure damage, and irreversible land damage. These costs must be covered by the firms that profit from mining activities. However, these costs should be built into the agreements that firms and governments enter into so that there is also clarity and the potential for policy stability, as discussed in the previous recommendation.

And finally, governments should maximize revenue collection while being mindful of the hurdle rate, so that firms are adequately compensated for the risk associated with mining. Revenue from the mining sector is particularly low in some countries. For example, in 2017, South Africa’s mining and quarrying sector accounted for just 1.3 percent of total revenue collected by the country government, compared with the 7.3 percent that this sector contributed to GDP in that year, partially owing to tax incentives and provision payments.

Governments would benefit from adequate institutional arrangements for effective and efficient mining revenue collection, including improvements in data capacity. The ability to measure and monitor extractive sector activity can increase the governments’ ability to enforce existing fiscal requirements but also give them a wider range of taxation instrument options. The recommendation to join EITI to increase transparency and accountability, as well as to reduce information asymmetry, would enable governments to have accurate information with which to create adequate tax policies and use a combination of production taxes, royalties, and regulatory taxes to efficiently capture rents while ensuring firms are profitable. Furthermore, risk-based auditing can help maximize the impact of limited tax administration capacity.

The Low-Carbon Energy Transition Will Be Mineral-Intensive
Demand for metals and minerals could rise to supply the low-carbon economy. For those countries rich in certain metals and minerals, the prospects may be rosier. Those with resources needed for low-carbon energy technologies or electronics could see increased demand in the future as the carbon transition accelerates. Such countries may have opportunities to benefit, but also must mitigate the resource curse in the face of strong demand for their exports.
High population growth and job creation pressures cause increased scrutiny of contributions by the extractive sector. As a capital-intensive but highly politically visible sector, the job creation contribution of mining is subject to intense debate and political pressure in many Sub-Saharan African countries. An examination of past performance in the region and beyond can bring more evidence and data to this passionate public discussion.

Automation and technological advancement are under way in the extractive sector. A looming question is to what extent automation and other technological innovations will affect investment prospects, new frontiers of exploration and extraction, or the labor intensity (and hence job creation potential) of the sector.

The carbon transition coincides with the need for a Sub-Saharan African energy transition. Supply shortages combined with low overall access and growing populations suggest the need for a step-change in the approach to electricity systems. An important question is how much Sub-Saharan Africa’s fossil fuel resources can and should contribute to this change versus embracing emerging technologies that may offer more decentralized and sustainable approaches to powering the continent.

The transition from fossil fuels to clean energy will create a demand for 3 billion tons of minerals and metals needed to deploy solar, wind, and geothermal energy by 2050. This energy transition will increase the demand for raw material inputs involved in clean energy technologies. The Sub-Saharan Africa region has significant mineral and petroleum deposits. Lithium, cobalt, and vanadium, for example, are critical for the deployment of energy storage, whereas copper, indium, selenium, and neodymium are essential for the production of wind and solar power generators. Some minerals, such as platinum group metals (platinum, palladium, and rhodium), are crucial for maintaining the current energy fleet based on the “legacy energy commodities,” for example, internal combustion engines. For some of these key energy transition resources, Sub-Saharan Africa is already a major supplier and exporter. Wind power and photovoltaic facilities, various battery systems, hydrogen storage, electric vehicles, and light-emitting diodes are just a few examples of mineral-intensive technologies (Wellmer et al. 2018). For example, an increasing market for EV lithium-ion batteries is accelerating a global demand surge for metals and minerals that are required to produce them (figure 1.14).

The projected rapid increase in production of EVs, and to a lesser extent of static energy storage, has attracted the focus of mining analysts and investors toward a range of minerals critical to their manufacture. A 2018 study by the McKinsey Center for Future Mobility estimates that global annual EV production will increase to 13 million to 18 million by 2025 and to 26 million to 36 million by 2030, with China accounting for 50–60 percent of output (McKinsey 2018). These figures appear relatively optimistic,
particularly in light of the uncertain impact of COVID-19, which produced a plunge in EV sales of 60 percent in February 2020 compared with the same month in 2019 (IEA 2020b). In April 2020 sales rebounded to 80 percent of prepandemic levels, and the EV industry likely reverted to its trend along the lines of the IEA’s (2020b) medium- to long-term production estimates of almost 14 million EV units in 2025 and 25 million in 2030. These figures are consistent with the IEA estimates that by 2030 there may be as many as 140 million EVs in circulation worldwide with existing government policies (which, however, will only represent 7 percent of total vehicles expected to be on the road by that time) (IEA 2020b).

The transition to clean energy will require the mining sector to reduce its own carbon footprint. Such transformation requires, among other things, stringent energy efficiency measures, a significant decrease in total primary energy demand for oil and natural gas, and a massive increase in global renewables capacity. Estimates suggest that 80 percent of proven fossil fuel reserves must remain underground to meet targets (Bos and Gupta 2019).

The mining sector is one of the primary consumers of coal and fuel, and reducing its reliance on these energy sources is critical for reducing the sector’s impact. For example, in Namibia, B2Gold, the country’s largest gold mining company, opened the Otjikoto solar plant in 2018, which is one of the world’s first fully autonomous hybrid plants, with 7 megawatts of solar capacity to reduce reliance on a 24-megawatt heavy fuel oil facility. Within the first year, Otjikoto Mine had reduced heavy fuel oil consumption by 2.1 million liters and

Figure 1.14  Actual and Projected Global Metals Demand from EV Lithium-Ion Batteries

Note: EV = electric vehicle.
reduced overall fuel consumption by 17 percent. Importantly, the renewable energy solution created broader community benefits. B2Gold’s solar plant was part of its corporate social responsibility program; it will continue to provide power to local communities even after the mine shuts down. The Otjikoto solar plant was a triple win, improving economic returns, reducing environmental impacts, and providing sustainable energy to surrounding communities. Other countries could encourage similar initiatives to reduce the sector’s carbon footprint.

However, growth of the mineral sector to meet the needs of the clean energy transition will not translate to a proportional increase in direct jobs. The sector is capital-intensive, and is increasingly becoming more so, which leads to a demonstrated improvement in efficiency, but also to reduced labor intensity. In South Africa, Anglo American Platinum’s Mogalakwena open-pit mechanized mine employs 1,800 people. The mine runs four shifts a day, and 85,000 tons are extracted in one shift. At Impala, its conventional counterpart, 85,000 tons are extracted each month and 14,000 people are employed. The per person output is 11 times higher at the mechanized mine. Thus, identifying ways to create jobs in other parts of the supply chain, and elsewhere in a diversified economy, will be increasingly important.

How Can Sub-Saharan Africa Capitalize on Growing Mineral Demand? Insights from Trade Elasticity of Supply and Demand

Analysis of trade elasticities of the demand and supply of minerals and fossil fuels can help us understand how future changes in demand and supply might affect African economies. An examination of historical trade data can aid an evaluation of how African economies have performed relative to the rest of the world, allowing policy insights to be drawn on how governments might need to improve sector investments and responsiveness to capitalize on any potential mineral boom spurred by the low-carbon transition (see annex 1A at the end of this chapter).

The economies of many Sub-Saharan African countries rely heavily on the export of mineral commodities. Chemicals and allied industries (2 percent), base metals (8 percent), precious stones and metals (14 percent), and hydrocarbon mineral products (54 percent) together made up more than 75 percent of the current value of the region’s exports to the rest of the world between 1995 and 2018. They accounted for, on average, 25 percent of total Sub-Saharan African government revenues in 2014 (figure 1.15).

Along with other confounding factors, volatility in mineral prices can affect growth of Sub-Saharan African countries (Renner and Wellmer 2020; van der Ploeg and Poelhekke 2009). The COVID-19 crisis, for example, had a significant effect on mineral resource prices and exports. Average yearly forecasts of Brent oil prices in 2020 were revised downward from US$62.70 to US$39.00 per barrel,
Figure 1.15  Nonrenewable Resource Exports as a Share of Government Revenue, by Region

Sources: Based on the UNU-WIDER Government Revenue Dataset, the International Monetary Fund, the International Centre for Tax and Development, and the Extractive Industries Transparency Initiative (February 2020 version).

Note: EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and the Caribbean; MENA = Middle East and North Africa; SAR = South Asia; SSA = Sub-Saharan Africa. Dotted lines correspond to region averages.
and of nickel prices from US$6.20 to US$5.70 per pound (S&P Global Market Intelligence 2020). Mining company operations have been interrupted by both isolated outbreaks and by government-mandated shutdowns in key exporting countries (Deloitte 2020). South Africa’s lockdown, for example, disrupted 75 percent of the global output of platinum, a key material in many clean energy technologies and emissions control devices, although the country later allowed mines to operate at 50 percent capacity (IEA 2020a). The Democratic Republic of Congo has experienced an even greater shock, with both a shutdown of the key Mutanda cobalt mine and demand reduction owing to COVID-19. Mining companies in Zambia, Sub-Saharan Africa’s second-largest copper producer, suffered a 30 percent drop in revenues when the COVID-19 pandemic hit the global economy (Reuters 2020).

Sub-Saharan African countries export mineral commodities to the world’s largest countries and trading blocs, including China, the European Economic Area, India, Japan, and the United States, which this report refers to as “main importers.” The export structure of these commodities has changed significantly over the past two decades, both in absolute terms and across trading partners (figure 1.16). This demand is likely to increase.

Although mineral products (including mineral fuels such as oil and gas, metal ores, and salts) remain the largest source of Sub-Saharan Africa’s exports and make up more than 54 percent of the region’s trade to other regions, their value has declined considerably in recent years (figure 1.16, panel a). Base metals make up a relatively smaller portion of exports from Sub-Saharan Africa, and have also seen a small decline (figure 1.16, panel b). There is positive momentum in exports of precious or semiprecious stones and precious metals (figure 1.16, panel c). These have grown every five years since 1995, and are more than twice as large as base metals and articles thereof today. Though relatively smaller, chemicals or allied industries have seen no periods of decline every five years since 1995 (figure 1.16, panel d). Finally, the export destinations of Sub-Saharan Africa’s mineral commodities have changed over time. While the European Economic Area is a consistently large importer of all Sub-Saharan African minerals, China has demonstrated a large and growing role in imports of mineral products and metals since 2009.

What is the outlook? Countries with significant mineral energy materials (MEM) reserves have an opportunity to expand their exports and capture the potential of the global energy transition and the recovery from COVID-19. The trade elasticity analysis suggests that the region’s MEM exporters will have to become more export responsive to take advantage of anticipated rising demand from the global energy transition.

The elasticity results also suggest that Sub-Saharan African hydrocarbon producers face relatively low demand import elasticity compared with the
Figure 1.16 Changes to the Sub-Saharan African Mineral Commodity Export Structure across Main Importers, 1995–2018

a. Mineral products

b. Base metals and articles of base metal

c. Precious or semiprecious stones and precious metals

d. Chemicals or allied industries

Source: Galeazzi, Steinbuks, and Cust 2020.
Note: Mineral products (chapters 25–27) include ores, slag, and ash; mineral fuels (oil, gas), mineral oils, and products of their distillation; bituminous substances; mineral waxes; salt; sulfur; earths and stone; plastering materials, lime, and cement. Base metals and articles thereof (chapters 72–83) include iron and steel, copper, nickel, aluminum, lead, zinc, tin, etc.; cements and articles thereof. Precious or semiprecious stones and precious metals (chapter 71) include natural or cultured pearls, precious or semiprecious stones (diamond, etc.), precious metals (silver, gold, platinum, palladium, etc.); metals clad with precious metal, etc. Chemicals or allied industries (chapter 28) include inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements, or of isotopes. CHN = China; EUA = European Economic Area; IND = India; JPN = Japan; USA = United States.

rest of the world, which implies that the potential remains for hydrocarbons to continue to be a significant source of export revenues over the short to medium term. Because global oil and gas demand may begin to decline permanently as the global energy transition progresses, Sub-Saharan African hydrocarbon-producing countries will need to adapt to these new market conditions. For the moment, however, they still have some time to manage an orderly transition away from fossil fuels.
Conclusions

Sub-Saharan Africa is blessed with significant natural resource wealth. The number of countries counting themselves among the resource rich has been growing since the turn of the millennium. Now the majority of countries in Sub-Saharan Africa are categorized as resource rich, with even more on the path to reaching this status given recent major discoveries.

Despite these large reserves, the conversion of subsoil wealth into above-ground equitable prosperity has had limited success. Since the decline in commodity prices in 2014, resource-rich Sub-Saharan Africa has grown more slowly than the region’s average growth rate. Poverty is increasingly concentrated in resource-rich Sub-Saharan Africa. Meanwhile, the mining sector’s contribution to employment has been declining amid mechanization; therefore, new approaches and policies may be required to ensure a more equitable distribution of benefits from extractive industries to other parts of the economy.

According to World Bank estimates, in 2018, Sub-Saharan Africa’s stock of natural resource wealth reached US$3.9 trillion, from which US$1.1 trillion were held in petroleum and mineral deposits (World Bank 2021). This represents almost one-third of Africa’s total stock of wealth in natural resources. Considering its relatively underexplored mineral reserves and untapped investment potential, the region can potentially become an important part of the clean energy transition. Significant resources include precious platinum group elements (59 percent of total world resources) and diamonds (48 percent) and a dominant position in ferroalloy metals such as cobalt (75 percent) and manganese (68 percent) (Guj et al., forthcoming).

Sub-Saharan Africa has seen more major discoveries of petroleum since 2000 than any other region of the world, accounting for 50 percent of the world’s giant discoveries in the 2010s. Before the boom period, there were 14 petroleum-producing countries (7 major and 7 minor producers). After the boom period, the number of petroleum producers increased to 22 (10 major and 12 minor producers).

Harnessing natural resource wealth to drive economic transformation remains central to Sub-Saharan Africa’s economic future. The extractive sector is well placed to support the economic recovery phase that Sub-Saharan Africa now faces. Rising Asian demand for commodities has deepened investment in, and hence reliance on, natural resources. Despite decarbonization and depletion, the amount of natural resource wealth available for development continues to increase, providing a potential engine of structural transformation.
Tapping into this potential is in the hands of policy makers. Without appreciating the lessons of the booms and busts, as well as how emerging trends will shape the future, it will be hard for both the World Bank Group and policy makers to find adequate measures to promote sustainable growth in resource-rich Africa.

**Policy Recommendations**

Governments must focus on developing stable policy environments that enable firms to have certainty and governments to collect revenue and protect communities, workers, and the environment from bearing the costs of mining.

*First, strengthen the governance and transparency of the sector.* Various governance frameworks have been developed that provide useful benchmarks for policy makers to measure themselves against. Adoption of frameworks such as the Natural Resource Charter and the Extractive Industries Transparency Initiative (EITI) can help countries enhance disclosure and policy practices. The EITI standard requires information along the extractive value chain, including extraction, rent transfer, and how it benefits the public. The EITI aims to reduce rent capture by looking at how licenses and contracts are allocated, who benefits from those operations, what legal and fiscal arrangements are in place, how much is paid, how those revenues are allocated, and what extraction contributes to the economy, particularly for employment. Widespread adoption of the EITI, as well as accompanying standards such as routine contract disclosure, can reduce information asymmetry and help in the development of a mechanism to promote trust and collaboration.

Companies are increasingly stepping up their own practices, including making contracts public and open to scrutiny, in addition to providing more detailed project-level reporting on taxes paid and other social investments. High standards in environment, social, governance, and emissions reporting can also serve to improve channels of accountability; however, they must be accompanied by strong regulation and enforcement by government, given the inherent limitations of voluntary measures by the private sector.

*Second, clear and consistent fiscal and social agreements set in law, rather than negotiated on a contract-by-contract basis, can help create policy stability, thereby promoting investments.* For example, in 2020, 72 percent of mining firms surveyed through the Fraser Institute stated that uncertainty regarding the administration, interpretation, and enforcement of existing regulations was a mild deterrent, strong deterrent, or a reason that they would not pursue investment in South Africa (Yunis and Aliakbari 2020).
Third, develop policies that help ensure that firms internalize their social and sustainability costs from exploration to mine closure. A primary reason that governments develop policies that can be perceived to be punishing mining companies is because of the substantial negative externalities mining firms generate, historically and at present, including pollution, health consequences for workers and communities, infrastructure damage, and irreversible land damage. These costs must be covered by the firms that profit from mineral activities. But, these costs should be built into legislation and the agreements that firms and governments enter into, so that there is also policy clarity and stability, as discussed in the previous recommendation.

Fourth, maximize revenue collection across both high- and low-price conditions, while being mindful of the hurdle rate, so that firms are adequately compensated for the risk associated with mining. In practice, some combination of royalties and taxes on profits can ensure rent capture for the government and its citizens. Countries should avoid and minimize tax incentives. Revenue from the mining sector is particularly low in some countries. For example, in 2017, South Africa’s mining and quarrying sector accounted for just 1.3 percent of total revenue collected, compared with the 7.3 percent of GDP the sector accounted for (World Bank 2019), partially owing to tax incentives and provision payments. Governments would benefit from adequate institutional arrangements for effective and efficient mining revenue collection.

**Annex 1A Analysis of Trade Elasticities**

Trade elasticities can provide further insight by showing the relative attractiveness of products or exporters in the world market. Low import demand elasticity (import demand strength) implies that importers’ consumption of mineral commodities is little changed if their prices increase or decline. High export supply elasticity (export supply strength) indicates that exporters can rapidly ramp up or down production if the commodity’s price increases or decreases. From the exporter’s perspective, low import demand elasticity and high export supply elasticity provide the best combination.

To analyze Sub-Saharan African export attractiveness for energy transition resources, import demand and export supply price elasticities for Sub-Saharan Africa relative to the rest of the world are calculated. Figure 1A.1 shows calculated elasticities for main importers and all commodities broken down into 97 Harmonized System (HS) chapters for the world as a whole. The size of the bubbles represents the size of trade for each product to the main importers. The energy transition resources are shown in red. The figure shows, for example, that inorganic chemicals and compounds of precious metals have higher import demand strength than oil and gas because the import demand for these
Nickel and articles thereof
Oil and gas
Ores and concentrates, etc.
Platinum group metals
Salt; sulfur; graphite

Figure 1A.1 Export Supply and Import Demand Elasticities of the SSA Exporters to Main Importers Relative to the Rest of the World, by Chapter

Source: Galeazzi, Steinbuks, and Cust 2020 based on UN Comtrade version HS92; cleaned by CEPII published in BACI database. Elasticity calculations are based on modifications made by Broda and Weinstein (2006) and Soderbery (2015).

Note: In this figure, each bubble represents the difference between the elasticities calculated using [CES elasticities for all countries except SSA] – [the CES elasticities calculated using all countries]. The Y axis contains the difference for CES supply elasticity and the X axis contains the difference for CES demand elasticity. A negative value in the y axis indicates that adding SSA increases the elasticity of supply [which is good]. A negative value in the x axis indicates that adding SSA decreases the elasticity of demand [which is good].

Nickel (HS chapter 75); copper (HS chapter 74); salt, sulfur, and graphite (HS chapter 25); platinum group metals (HS chapter 71); oil and gas (HS chapter 27); inorganic chemicals, including rare earth metals (HS chapter 28); ores and concentrates (HS chapter 26). HS = Harmonized System; REE = rare-earth elements; SSA = Sub-Saharan Africa.

commodities is less elastic. Their export supply is more elastic than that of oil and gas, also relatively beneficial for the exporter.

Figure 1A.1 plots the differences of import demand and export supply elasticities between all countries except Sub-Saharan Africa, and all countries. The size of the bubbles provides a gauge of the importance of exports from the Sub-Saharan African region. A negative value in the y-axis indicates that adding Sub-Saharan Africa to the sample increases the elasticity of supply, which is beneficial to exporters. A negative value along the x-axis indicates that adding Sub-Saharan Africa decreases the elasticity of demand, which is also beneficial to exporters.

Figure 1A.1 therefore suggests the following:

• Nickel, salt, sulfur, and graphite exports from the Sub-Saharan African region have relative export supply strength and relative import demand weakness, compared with the exports from the rest of the world.
• Platinum group metals, copper, and oil and gas exports from the Sub-Saharan African region have relative *import demand strength* and relative *export supply weakness*, compared with the exports from the rest of the world.

• Inorganic chemicals, including rare earth metals, have relative *strength for both import demand and export supply*.

• Ores and concentrates exports from the Sub-Saharan African region have relative *weakness for both import demand and export supply*.

These results indicate that there is substantial export potential for the Sub-Saharan African region to meet growing demand for some key new energy transition resources, such as selenium and other critical minerals. They also suggest that the Sub-Saharan African region’s exports of legacy energy resources such as oil and gas, and of platinum group metals as well as copper, are relatively more resilient to import price fluctuations. On the other hand, Sub-Saharan African exports of metal ores are less attractive as compared with the rest of the world.

To analyze the future potential of Sub-Saharan Africa’s largest energy mineral exports, trade elasticities are estimated for the following commodities: crude oil, cobalt, copper, and nickel (figure 1A.2). The three vertical sections of figure 1A.2 show the following:

• The importance of the Sub-Saharan African region in total trade for that commodity and the importance of the commodity in total Sub-Saharan African trade

• The price forecast for the commodity according to S&P Global Market Intelligence

• The export value forecast for the commodity, accounting separately for the price effect, based on the estimated elasticities

The COVID-19 (coronavirus) pandemic has had a significant effect on demand for and prices of crude oil, currently the main export commodity of the Sub-Saharan African region and about 30 percent of its total trade value in 2018 (panel a of figure 1A.2). COVID-19 led to a downward revision of 2020 prices from about 86 to 54 index points (2018 base year) in forecasts by S&P Global Market Intelligence (panel b of figure 1A.2). Prices are expected to range from about 54 to 91.5 index points between 2019 and 2028 and rejoin pre-COVID-19 forecasts only in 2026. The price elasticity of demand effect in 2020 is not met by supply and other factors, and the market clears at about US$75 billion in current dollars (main importers, excluding India and the United States). Likely causes are a production curtailment by OPEC+ and an overall decline in global demand, including demand for crude oil. The future growth of oil export revenues is thus expected to be modest in the coming decade.
Figure 1A.2 Effect of Energy Minerals in Sub-Saharan African Export Revenues

a. Oil, % of total SSA trade (solid, right scale), % of total world trade of oil/gas (dashed)

b. Oil (Brent), price forecast, 2018 = 100

Indexed price 2018=100

2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028

Crude Oil-Brent Crude Oil-Brent (Pre-COVID)

2019 2020 2021 2022 2023 2024 2025 2026 2027 2028

–150 –100 –50 0 50 100 150 200

Cobalt ores (orange) and metal (green), % of total SSA trade (solid), % of total world trade in cobalt (dashed, right scale)

e. Cobalt, price forecast, 2018 = 100

Indexed price 2018=100

2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028

Crude Oil-Brent Crude Oil-Brent (Pre-COVID)

2019 2020 2021 2022 2023 2024 2025 2026 2027 2028

–150 –100 –50 0 50 100 150 200

f. Cobalt, ores (yellow); metal (red, right scale), price elasticity of demand effect (red) and other factors (yellow), US$

(continued next page)
Figure 1A.2 (continued)


Note: Harmonized System codes: oil, 2709; cobalt ores, 2605; cobalt metal, 8105; copper cathodes, 7403; unwrought nickel, 7502. Selection between metals, ores/concentrates, and other alternatives of the same commodities based on availability of data and importance of trade for Sub-Saharan Africa. SSA = Sub-Saharan Africa.
Cobalt prices are expected to modestly recover after their collapse in 2019. Between 2019 and 2029, price forecasts range from about 45 to 65 index points (2018 base year) (panel e of figure 1A.2). The effect of price elasticity of demand (red in panel f of figure 1A.2) is expected to pale in comparison to other factors for Sub-Saharan African cobalt. New demand is likely to come from increased deployment of battery technology for energy storage in transport, power, and consumer electronics, creating opportunity for future export revenue growth for Sub-Saharan African cobalt exporters, particularly the Democratic Republic of Congo.

On the other hand, between 2019 and 2029, price forecasts for copper and nickel range from 91 to 130.5, and from 94 to 139 index points, respectively (2018 base year). The price elasticity of demand effect seems to contribute a larger portion of the market clearing value in copper compared with nickel, suggesting alternative demand and supply factors, affecting the growth of the Sub-Saharan African nickel market. This should benefit exports of major Sub-Saharan African exporters such as Côte d’Ivoire and Zimbabwe.

Notes

1. Impressive progress on poverty reduction in countries such as China and India means that poverty is becomingly increasingly concentrated in those countries that have stagnated or regressed on poverty alleviation in recent years. These countries are disproportionately resource-rich low-income countries, many of which are located in Sub-Saharan Africa. Combined with higher-than-average population growth rates, this makes the remaining poverty alleviation challenge significant.

2. This report focuses on the Africa region, defined by the World Bank as 48 Sub-Saharan African countries.

3. This report focuses on the World Bank Africa region, which is predominantly Sub-Saharan Africa, comprising 48 countries in total (https://data.worldbank.org/region/sub-saharan-africa). This group of countries is referred to as Sub-Saharan Africa throughout. The report follows the IMF definition of resource richness to distinguish between the groups of countries for analysis (IMF 2012) and to chart changing patterns of resource dependency.

4. Based on World Bank and the ICTD/UNU-WIDER Government Revenue Dataset 2019, only considering Sub-Saharan African countries with nonmissing data. For more discussion of resource rents and government take, see Cust and Rivera-Ballesteros (2021).

5. This number is calculated as 10 percent of resource-rich Africa’s average annual difference between natural resource rents (World Bank 2021) and natural resource revenues (UNU-WIDER), averaged over 2015–18. Resource-rich Africa includes countries listed in the IMF (2012) resource-rich definition, except for the Central African Republic, Côte d’Ivoire, Madagascar, Mozambique, Niger, Tanzania, and Togo, for which resource revenue data were missing.
7. The countries are Ghana, Guinea-Bissau, Kenya, Liberia, Mauritania, Mozambique, Niger, São Tomé and Príncipe, Senegal, Sierra Leone, Tanzania, and Uganda.
8. A “block” refers to a geographic area where a company is licensed for the exploration and production of oil or gas.
10. OPEC+ is a term used to refer to non-OPEC members that are among the world’s top oil producers, including Azerbaijan, Bahrain Darussalam, Brunei, Kazakhstan, Malaysia, Mexico, Oman, the Russian Federation, South Sudan, and Sudan.

References


