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Minerals Crime

GLOBAL ANALYSIS ON CRIMES THAT AFFECT THE ENVIRONMENT

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The Global Analysis on Crimes that Affect the Environment:

Part 2b – Minerals Crime: Illegal Gold Mining

May 2025

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Content

SPECIAL POINTS OF INTEREST

GLOBAL ANALYSIS ON

CRIMES THAT AFFECT THE ENVIRONMENT

1. The growing demand for minerals amplifies risks of crime, corruption and supply chain instability

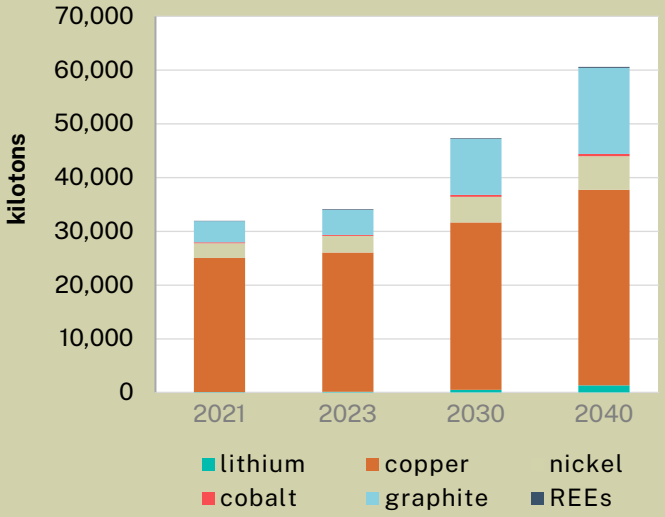
A global push for renewable energy technologies like electric cars and wind turbines brings benefits for the environment and economic opportunities for countries along the supply chain. But it also increases the demand for minerals needed to power and operate these products, which brings serious risks from crime and corruption.

Renewable energy technologies rely on so-called critical energy transition minerals (CETMs) for batteries, magnets and other components. Production and processing of these minerals – which include copper, lithium, nickel, cobalt and rare earth elements – is concentrated in a few countries. The International Energy Agency (IEA) has highlighted that demand is expected to continue to grow in the coming years and decades, as countries strive to meet the Paris Agreement targets and achieve net zero emissions by 2050. These factors combine with complex supply chain dynamics to make the sector vulnerable to political instability, trade restrictions, or criminal interference. If demand outpaces supply, the resulting pressure can create fertile ground for criminal actors to infiltrate, exploit, and distort supply chains.

Criminal actors may seize control of extraction sites, trade routes, or refining infrastructure, using corruption, violence and/or coercion to bypass regulations, evade taxation, and manipulate access to resources. Profits can then accrue to just a few powerful actors, who can determine who has access to the minerals. This control can, over time, exacerbate global inequalities and further destabilize a market already under pressure.

These crimes can cause harm on multiple levels. Local populations suffer damage to their ecosystems, countries are hit by lost revenues and weakened governance, and the global supply chain is destabilized. Criminal interference can delay access to essential minerals, undermine responsible sourcing, and ultimately slow the energy transition, while also deterring responsible investment and hindering sustainable development.

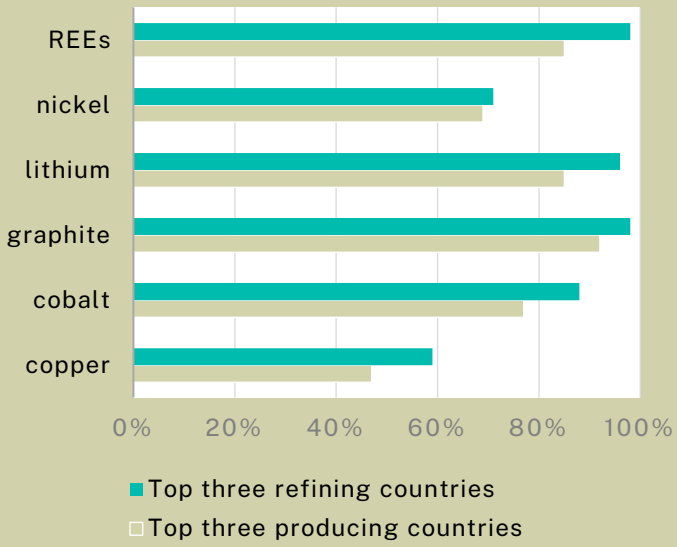
Estimated Demand for Six Major CETMs in the Announced Pledges Scenario (APS)*



Source: IEA, Global Critical Minerals Outlook 2024.

** The Announced Pledges Scenario (APS), introduced in 2021, refers to the extent to which announced ambitions and targets can deliver the emissions reductions needed to achieve net-zero emissions by 2050.*

Production and Refining Concentration of Six Major CETMs in 2023



Source: IEA, Global Critical Minerals Outlook 2024.

2. Gold is processed in complex global chains, which can create opportunities both for illegal activity and law enforcement responses

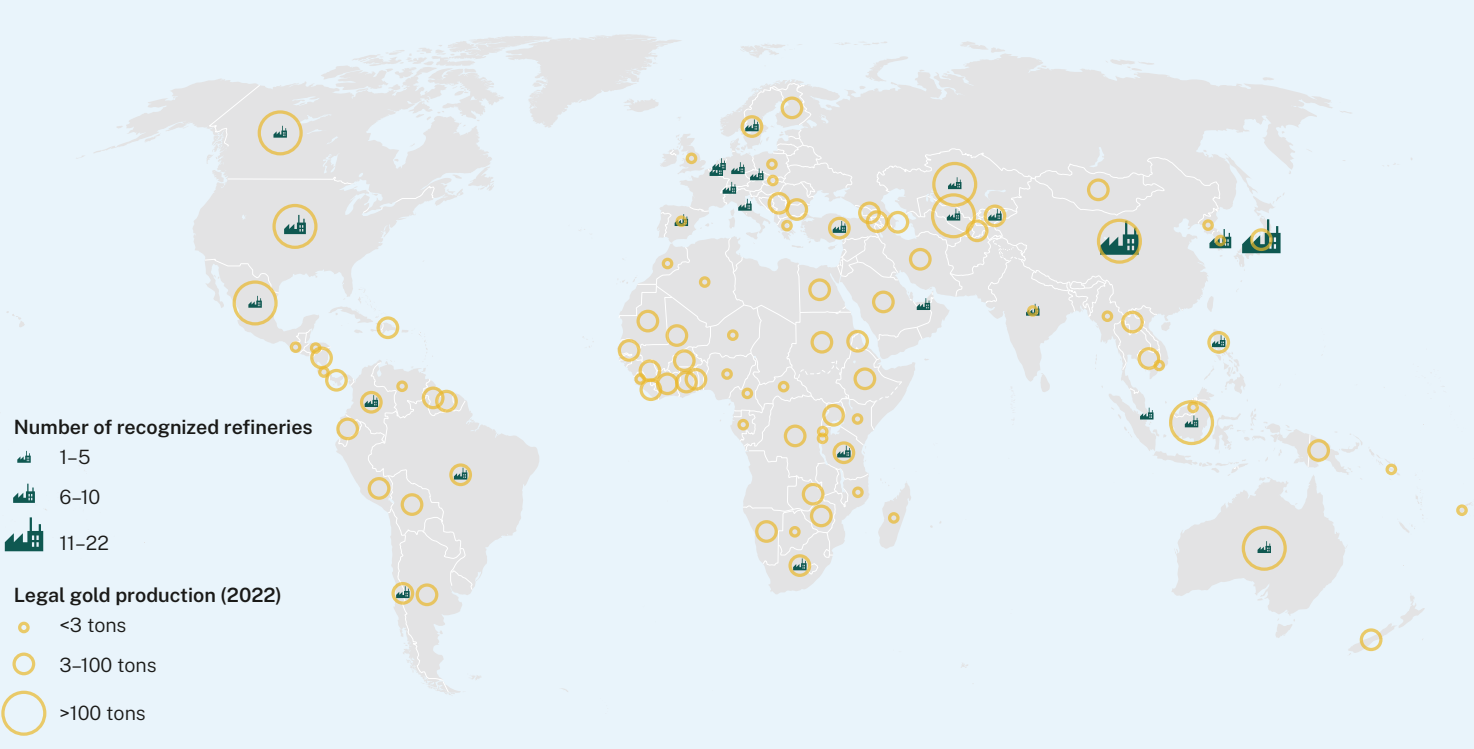
From the mines to the refineries and trading hubs, gold's journey to market is fraught with risk. The precious metal often crosses borders before it even reaches refining centres. These international movements offer criminal actors the opportunity to intermingle illegal product with legally mined metal. These risks have only grown since 2008, when the global financial crisis kicked off an unprecedented rise in gold's value.

Gold is mined mostly in Sub-Saharan Africa, Latin America and the Caribbean, and South East Asia. But the major refining hubs are concentrated in Europe, Eastern Asia, Western Asia, and Northern America.

Criminal groups will often take advantage of weak oversight, inconsistencies in documentation and regulatory loopholes along the trade routes to add illegally sourced gold to supply chains. After the refining and smelting phase, the origin of the gold becomes nearly impossible to trace, making it one of the most vulnerable points in the supply chain.

But the concentration of refineries also provides a strategic opportunity for intervention. Targeting regulatory actions at these hubs could more effectively disrupt the entry of illegal gold into the international market.

Locations of major recognized gold refineries



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.
Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.
A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

Sources: The Independent Precious Metals Authority (LBMA), Responsible Minerals Initiative (RMI), and UAE Good Delivery (UAEGD).

Note: Data are not available for all countries.

3. The risks and effects of illegal gold mining are shaped by the entities involved

Individual miners, organized crime groups (OCGs), traders and companies of varying size all help to shape illegal activities in the gold mining sector. Each entity brings its own risks and wider effects, ranging from forced labour and sexual exploitation to deepening corruption and armed conflict.

OCGs get involved in illegal mining often as part of a wider portfolio, using the income to fund other activities. The effects can be wide and deep. Politically motivated OCGs in parts of Africa have used profits from illegal gold mining to maintain control of territory, directly challenging state authority. Local populations are often left vulnerable to sexual exploitation, forced labour, and displacement, which can lead to recruitment into militias.

Corporations become involved in illegal mining in different ways. Some are legitimate entities that engage illegal practices to increase profits and reduce costs. They use bribery, operate without permits, and bypass labour and environmental regulations. Other corporate structures are specifically established to conduct illegal activities. OCGs that have moved into illegal gold mining are known to have set up shell companies to launder profits. More generally, companies throughout Africa and South America are known to have failed to properly vet their suppliers.

Gold traders and refiners also play an important role, often acting as intermediaries between miners and sellers, and the formal market. Some trading companies knowingly purchase gold from high-risk or illegal sources, while others fail to carry out meaningful due diligence. By obscuring the origin of gold or mixing legal and illegal batches, traders can launder illegally sourced or trafficked gold into the formal economy.

Continuum of corporate engagement in criminal activity

4. Organized crime groups are central actors in illegal gold mining, posing a global threat

OCGs have embedded themselves in gold supply chains to such an extent that they now pose a serious global threat. These groups are constantly adapting to enable and hide their operations. They exploit advances in transportation, finance, communications, and quickly adopt digital tools including cryptocurrencies. Many of these networks are well integrated into international trade, allowing them to launder proceeds and move illegal gold with relative ease.

OCGs are attracted by the sector's high profitability and, in some contexts, the perception of weaker enforcement compared with other illegal activities such as drug trafficking. Economic crises and metal price volatility further strengthen the appeal, particularly of illegal gold mining. The price of gold has risen sharply over the past two decades, reaching a record high in April 2025, nearly 50 percent more than the same time in 2024. Past price spikes have been linked to increasing OCG involvement in illegal mining, so it is likely the current surge will trigger further expansion.

However, the ways in which OCGs infiltrate the sector can vary widely. In Latin America, highly structured OCGs often with roots in drug trafficking have used established smuggling routes and infrastructure to expand into illegal gold mining. Revenues from gold are frequently reinvested into other criminal operations, reinforcing and diversifying illegal economies. In parts of Africa, some OCGs are focused on gold, while others use mining profits to fund armed activity, strengthen territorial control and fuel conflict. In both contexts, their presence heightens violence, corruption and environmental degradation, while exposing vulnerable populations to exploitation and human rights abuses.

THREATS FROM ORGANIZED CRIME IN ILLEGAL GOLD MINING

The increasing value of gold significantly contributes to the risks

5. Illegal mining can damage the environment with banned chemicals, waste dumping and deforestation

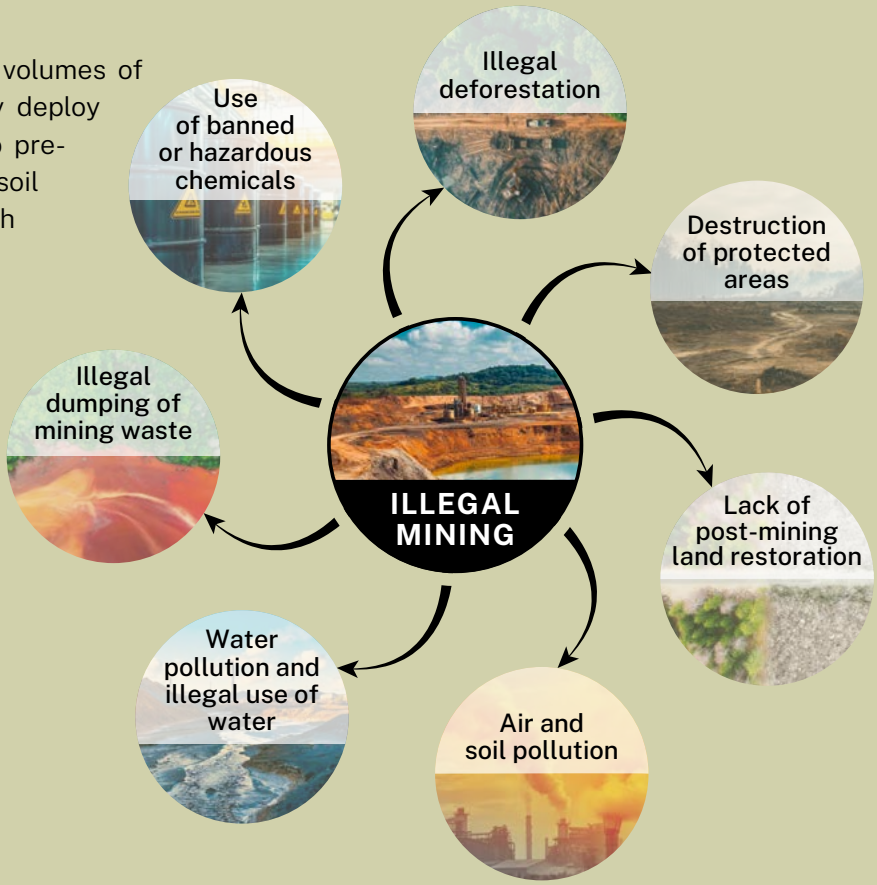
The use of banned or hazardous chemicals is one of the most damaging environmental impacts of illegal mining. Miners deploy these chemicals during the extraction and separation processes. For example, mercury is still widely used in gold mining, especially in artisanal and small-scale operations. It causes irreversible damage, contaminating soil and water sources, affecting not only the workers who come into direct contact with it but also nearby communities and biodiversity along river systems.

While legal mining operations are subject to regulations intended to minimize harms, illegal mining bypasses these safeguards, often resulting in severe environmental degradation. Illegal mining directly contributes to environmental destruction by clearing forests to access mineral deposits. This is especially harmful when it occurs in protected areas, where it leads to the degradation of sensitive ecosystems and accelerates biodiversity loss.

All mining operations produce large volumes of solid waste. Legal operations usually deploy specialist facilities and equipment to prevent contamination of surrounding soil and water. Illegal operations lack such systems, often resulting in untreated waste being dumped into water bodies or directly on to land.

However, illegal dumping is not limited to small-scale illegal or unlicensed mining operations. Legally registered corporations may also discharge waste without treatment in a bid to reduce costs. They may also falsify monitoring data to conceal pollution when they fail to comply with environmental regulations. Weak enforcement or regulatory gaps can further enable these violations, allowing even large-scale operations to circumvent environmental responsibilities while causing significant harm to ecosystems.

These practices have long-term consequences, contaminating soil, water, and air, and accelerating environmental degradation. Illegal operations typically have no plan for the land after the mining has finished, leaving behind damaged habitats. The absence of restoration efforts leads to further impacts, including increased soil erosion, heightened vulnerability to natural disasters, and desertification, particularly in water-stressed areas.



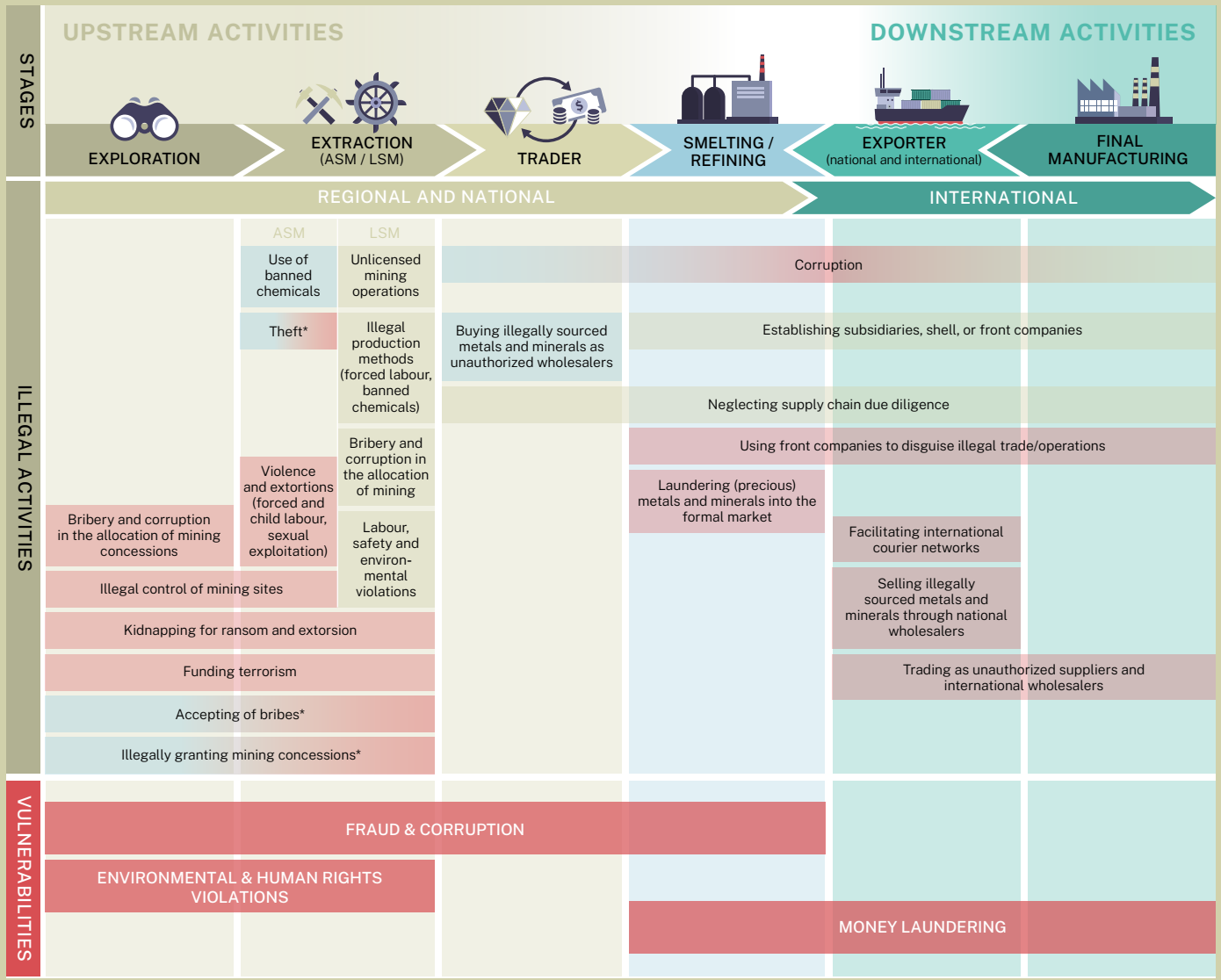
6. Illegal mining and trafficking are fuelled by fraud, corruption, and money laundering

Illegal mining and trafficking are often enabled by a combination of fraud, corruption, and money laundering. This allows illegally sourced and trafficked metals and minerals to enter global markets. OCGs, corporations, and traders play key roles in this process by exploiting legal loopholes and weak regulatory oversight to conceal the origin of illegal minerals and metals.

Gold is a high-risk commodity, frequently used as a tool for money laundering owing to its high value, ease of transport, and because it can be quickly sold or exchanged for cash in many parts of the world. Traders often act as intermediaries, linking illegally sourced gold with formal markets by using falsified documentation to disguise its origin. Common tactics include declaring gold as recycled, misreporting its country of origin, forging export permits, and bribing officials to obtain mining concessions or avoid legal consequences related to environmental, labour, or safety violations. These corrupt practices can infiltrate the entire supply chain, and the risk of fraud and bribery often extends to public officials at local, regional, and national levels.

Money laundering is also a central component of illegal mining and trafficking. A common tactic involves the use of front or shell companies to facilitate the trade of illegally sourced gold, finance the purchase of banned substances such as mercury, and launder profits. These mechanisms blur the boundaries between legal and illegal operations, posing serious challenges for enforcement.

Potential disruptors and vulnerabilities in the mining supply chain



** Corrupt officials (at the local, regional, and national levels) may include and collaborate with a range of actors, including loosely organized individuals, members of corporations, or affiliates of OCGs/PMCGs.*

Source: UNODC elaboration of UNICRI 2009 study.

Note: The colours represent different categories of actors: blue indicates individual miners or loosely organized individuals, light green represents corporations, and red signifies organized crime groups (OCGs), including politically-motivated crime groups (PMCGs).

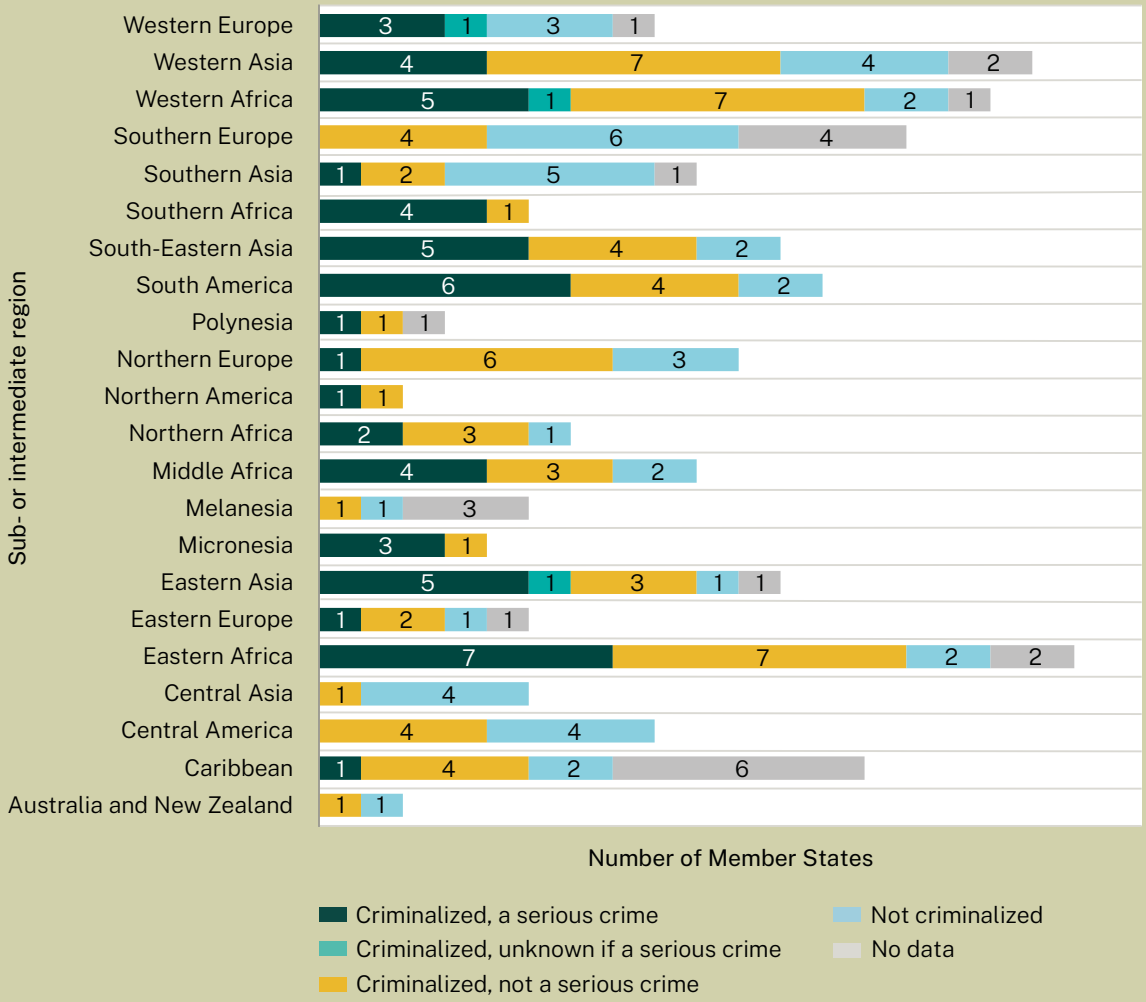
7. Better data and harmonization of standards can help tackle illegal mining and trafficking

Strengthening political commitments, enhancing national capacities, and aligning international frameworks are important steps to overcome the challenges of tackling illegal mining. UN official trade data shows incomplete submissions by some countries, poor quality data, and inconsistencies in the categorization of commodities. These limitations undermine the reliability and comparability of data, making it difficult to assess the true scale of illegal mining activities.

Weak political will, limited responses, and insufficient capacity in many countries contribute to the challenges. For example, major mining regions including Central Asia and Oceania do not criminalize minerals-related offenses. This legal vacuum creates a more favourable environment for illegal mining.

The lack of a universal definition of illegal mining further hampers efforts to establish coherent global regulations and enforcement mechanisms, making it harder to address the issue effectively at the international level.

State of criminalization for mining-related offences



Source: UNODC, *Global Analysis on Crimes that Affect the Environment*, Part 1 – The Landscape of Criminalization.

POLICY IMPLICATIONS

GLOBAL ANALYSIS ON

CRIMES THAT AFFECT THE ENVIRONMENT

1. A just energy transition requires targeted responses to crime linked to critical minerals

Crime plays a key role in disrupting supply chains of the critical minerals vital to the renewable energy transition. Yet there has not been a concerted focus on the phenomenon at international level. These minerals have discrete characteristics in terms of geography and geology, so it is essential to avoid generalising the challenges or assuming the same dynamics observed in the gold sector apply. Each mineral requires a tailored understanding of its extraction methods, processing stages, and supply chain dynamics to effectively address illegal activities and identify the actors involved.

Targeted research should assess the potential infiltration of OCGs and other criminal actors, the enabling role of corruption, and the broader impact of illegal sourcing and trafficking. This includes analysing how corporate actors may contribute to these crimes, whether through direct involvement in illegal mining and trafficking, by exploiting supply chain loopholes, or by facilitating trade and trafficking routes to move illegally sourced minerals.

Unlike gold, many critical minerals involve complex extraction processes. These minerals also operate within geological and geopolitical contexts very different from gold. These differences shape the types of criminal activity that may emerge. For instance, in contexts where artisanal and small-scale mining is possible, supply chains may be more vulnerable to OCGs, smuggling, and human rights violations. In contrast, where only large-scale mining is viable, risks are more likely to centre around corruption and corporate-level crime.

2. Strengthening due diligence and transparency can disrupt illegal gold mining and laundering

The global gold trade is exposed to significant vulnerabilities that allow illegally sourced gold to enter the formal market, often through the non-producing countries that dominate gold imports and refining. Given the central role of refineries and major trading hubs in the supply chain, they should be prioritised for action through strengthened due diligence requirements. Intervening at these critical points could significantly disrupt the laundering of illegal gold and enhance the integrity of the entire supply chain.

A key starting point is to reinforce mechanisms that track the origin, movement and transformation of gold. However, these traceability mechanisms by themselves will not ensure legal or ethical sourcing. They must be supported by audit systems and certification schemes. They must also be part of a broader framework that includes reliable data verification, public disclosure of supply chain information where feasible, and rigorous due diligence to identify and mitigate environmental, social and ethical risks. Integrating traceability into a robust due diligence system improves transparency and helps block entry points for illegal gold, particularly in high-risk or conflict-affected regions.

Transparency is equally important. Publicly accessible data on mine origins, supplier identities and trade flows can deter criminal activity and enable informed choices by buyers and consumers seeking responsible sourcing. For refineries, this would entail enhanced independent audits, import controls and harmonize legal frameworks. Traceability is not an end in itself. It is a tool to support transparency and accountability. Without enforcement and responsible conduct, traceability data will not stop illegal mining.

3. Responses to illegal gold mining should be adapted to local contexts and the actors involved

Illegal activities in the mining sector are carried out by a variety of actors. But there is a lack of clarity over basic definitions, which can lead to inappropriate policy responses that fail to address root causes and may hinder effective law enforcement interventions. Instead, tackling illegal gold mining requires tailored, context-specific responses.

The first step is to understand the structure, motivations, and modus operandi of the actors involved, as different groups require different approaches. A major challenge lies in the blurred and often poorly understood distinction between sometimes unregulated and small-scale mining, informal mining, and illegal mining (See Box 1 for definitions). This lack of clarity can lead not only to ineffective policies but also to overly punitive measures against unregulated or informal miners. This risks damaging community trust and pushing these actors further into informal or illegal practices.

Instead, a gradual approach that emphasizes incentives can be more effective. This could focus on reform of licensing processes – making them simpler, less expensive and more transparent. Training programmes to promote responsible mining practices could be rolled out alongside licensing. Stricter oversight and accountability mechanisms for local or national officials are also essential to address corruption, ensuring that regulations are applied fairly and transparently. For OCGs, interventions should focus on dismantling criminal structures through targeted law enforcement and intelligence-sharing, considering regional variations in structure and motivations.

Corporations should implement robust due diligence procedures within their supply chains to verify the legitimacy of suppliers and ensure compliance with relevant laws and regulations. They should be held accountable for safeguarding human rights, labour rights and environmental standards – particularly when sourcing metals from high risk or conflict areas. This accountability could be enforced through the legal system and internal governance, including from relevant parties and consumers. Law enforcement should consider classifying corporations engaged in illegal activity as OCGs, which would allow them to utilize the UN Convention on Transnational Organized Crime.

4. Countering OCGs involved in illegal gold mining requires understanding of regional differences

OCGs are involved in illegal mining operations in several global regions, and display regional and structural differences depending on the context. As such, a one-size-fits-all approach to the issue should be avoided. For example, if a group is involved in multiple illegal operations, targeting gold alone may have little overall effect. To address this, strategies should be tailored to the specific context of each region.

Decreasing the attractiveness of illegal mining can be achieved by ensuring key illegal practices are criminalized and enforcement is strengthened, in line with the UN Convention against Transnational Organized Crime. This would encourage countries to harmonize legislation with international standards, fostering a more coordinated global response.

Additionally, providing opportunities for legitimate participation in the mining sector can reduce the profitability of illegal operations. Empowering affected communities through democratic engagement, alternative livelihoods, environmental restoration projects, and gender-inclusive leadership can also help diminish the influence of organized crime. Such an inclusive approach strengthens community resilience, protects cultural heritage, and undermines OCGs.

5. Corporate accountability can be key to addressing environmental impacts

Illegal and irresponsible mining is linked to severe environmental and health impacts, from contamination of ecosystems to the misuse of hazardous chemicals. But there is not a simple remedy that fits all types of mining. Instead, any responses must be tailored to the distinct practices and impacts of mining operations.

Environmental harm from artisanal and small-scale mining, particularly in the context of gold extraction, is often tied to the widespread use of mercury and deforestation. To address this, a system to monitor and trace the import and use of illegal and hazardous chemicals in mineral extraction would help reduce associated environmental risks.

Large-scale mining led by corporate actors causes environmental degradation because of systemic failures in compliance and accountability. Corporations may cause significant harm through illegal dumping of toxic waste or inadequate treatment of hazardous by-products. Independent and transparent audit systems are essential to verify compliance with environmental regulations and waste management standards, and to reduce long-term ecological damage.

Strengthening liability mechanisms is also key. More Member States should adopt the provisions of the UN Convention against Transnational Organized Crime dealing with the liability of legal persons, ensuring that corporations are covered by legislation. Although 112 Member States already have legislative provisions for corporate liability for minerals-related offences, many cases of environmental degradation involving corporate actors in producing countries do not lead to sanctions or final convictions. This lack of accountability is not only down to weak enforcement but also to the absence of standardized methods to assess environmental harm at both national and international levels.

With global demand for critical minerals rising, particularly in the context of the energy transition, these regulatory gaps risk becoming even more pressing. National frameworks should clearly define environmental liability, set standards for assessing harm, and oblige companies to support environmental restoration and social reparations. Additionally, both corporations and state authorities should prioritise meaningful engagement with communities, ensuring that consultation processes adhere to the International Labour Organization's principles of Free, Prior and Informed Consent (FPIC).

6. Strengthening law enforcement is vital to disrupt illegal mining and trafficking networks

The illegal mining and trafficking of metals and minerals involves a complex network of fraud, corruption, and money laundering. To tackle this, it is essential to strengthen law enforcement mechanisms throughout the supply chains.

To detect smuggling and trafficking, controls should be bolstered at borders, airports, ports, and areas with special regulations, such as Special Economic Zones. Any customs and state officials convicted of corruption should face stricter penalties. And rules on liability should be changed to allow corporations to be held accountable for involvement in illegal mining. Sanctions should be increased across the board to deter misconduct and ensure greater accountability and integrity within the sector.

Law enforcement should monitor research into new technologies around traceability in supply chains. Innovations like digital certification systems can help to make it more difficult for illegally sourced minerals and metals to enter global markets. However, this progress needs to be scaled and more widely integrated across the sector, customs, and law enforcement. Increased investment and standardised international frameworks are important to ensure effective implementation and maximise their potential in disrupting illegal mining networks.

7. Enhancing data collection and international cooperation is vital for tackling illegal mining

Improving data collection, reporting, and standardization on a global scale is crucial to accurately assessing the scope of illegal mining and trafficking activities and enhancing efforts to combat them. The collection and publication of detailed mining statistics, disaggregated by region and mining type (artisanal, small-scale, industrial, semi-industrial, and corporate), should be prioritized by producing countries and extractive companies whenever possible, while ensuring alignment with the UN Comtrade reporting system.

Additionally, regions that do not criminalize minerals-related offenses should adopt comprehensive mining regulations. Political will and international cooperation are key to ensuring that countries share the necessary data and work together to strengthen global enforcement. International agreements should be supported to incentivize or require these regions to close existing loopholes, strengthen legal frameworks, and promote consistent global enforcement of mining laws.

Introduction

This study focuses on minerals crimes, especially illegal gold mining. Minerals crime refers to all criminal activities that occur along the metals and minerals supply chain, from exploration to trade and final manufacturing. In contrast, illegal mining mostly concerns illegal activities during the exploration and extraction phases, where environmental damage is often the most severe. Beyond extraction, this study also examines criminal activities in processing, refining, trading and transport. This broader scope offers a clearer understanding of the various motivations driving diverse actors to engage in minerals crime, as well as the destinations of the unprocessed metals and minerals and the proceeds from their trade. Such understanding is crucial for framing meaningful responses and effectively addressing the many issues related to illegal mining across different contexts.

Illegal mining is a widespread phenomenon that causes severe environmental and human harm, involving a range of illegal practices across different stages of the supply chain. Mining primarily refers to the extraction of valuable geological materials from the earth using a variety of methods.[1] This process often has significant environmental impacts due to the extensive human activity involved in excavation and resource extraction. While both legal and illegal mining affects the environment, illegal mining bypasses the legal frameworks and regulatory standards that are designed to minimize environmental and social harm and manage the fair distribution of the benefits from minerals extraction. These illegal activities include illegal or unregulated extraction and trade, the unauthorized use of toxic chemicals, and the illegal occupation of territories. Such activities may generate illicit profits and illicit financial flows (IFF).[2] These practices often result in severe environmental damage, such as deforestation, biodiversity loss, the depletion and contamination of water resources, and soil and air pollution caused by chemicals such as mercury and cyanide. These pollutants disrupt local ecosystems and negatively impact local communities. (See more on how illegal mining contributes to the triple planetary crisis in the full *Global Analysis on Crimes that Affect the Environment*.) In addition to its environmental and social consequences, minerals crime also undermines political and economic stability in resource-rich countries not only by depriving societies of tax payments and failing to channel benefits into public goods, but also by fuelling corruption, weakening governance, and supporting violent conflict. These activities often operate in parallel or are facilitated by organized criminal groups, undermining the authority of the state and the rule of law. Moreover, actors benefiting from illegal proceeds may further destabilize affected regions, heighten the risk of human rights violations, and threaten long-term peace and stability.[3]

The mineral sector is rapidly evolving due to various factors. Economic crises and market price fluctuations have increased demand for precious metals like gold, particularly from several Asian countries.[4] [5] Concurrently, manufacturing needs for electronic devices and technological advancements aimed at decarbonizing the energy sector, driven by climate change mitigation efforts, is creating a surge in demand for minerals critical to these technologies, such as lithium, cobalt, copper and rare earth elements, and is expected to drive increased exploration for new deposits worldwide.[6] However, the complexity of metals and minerals supply chains can lead to legal loopholes and raise questions about transparency and due diligence.[7]

While the mining sector is incredibly diverse in terms of minerals, metals, gems, and fuels, the gold industry is particularly well-documented and offers valuable insights into the wider environmental challenges of the mining sector. This study therefore predominantly focuses on the actors, modus operandi, and market dynamics and vulnerabilities related to the gold sector. Future research will shed light on crimes related to other metals and minerals.

Illegal mining of gold and precious metals is a highly profitable industry, particularly since the 2008 financial crisis when gold prices surged. Organized crime groups, including politically-motivated organized crime groups, play a significant role in driving illegal activities related to gold mining, as do corporations engaging in illegal activity (see *The actors* section for clarification on these terms). Studies indicate that organized crime groups adapt to changing circumstances. Some have diversified existing illegal operations to include gold mining. Others may have focused solely on illegal mining, attracted by the high profits of the business. In other cases, profits from gold are reinvested into other criminal activities, perpetuating cycles of dependency. Moreover, illegal mining sites can also become breeding grounds for other criminal activities.[8, 9]

The predominant criminal strategies in the mining sector include making false declarations of origin or value, using front or shell companies, infiltrating legal mining operations, coercing licenced miners, conducting transport robberies, extorting illegal fees from miners in exchange for access or protection, selling unauthorized chemicals or machinery used in illegal mining, and smuggling metals and minerals across borders.[10] Corruption is a critical enabler, with officials being bribed to overlook illegal activities, issue fraudulent documents, or provide protection, leading to systemic challenges within state institutions and regulatory frameworks, among others (see *modus operandi* section for further details).

Given the serious environmental consequences of illegal mining, this analysis aims to highlight the critical areas needing attention and improvement. Specifically, it documents the lack of sufficient and consistent data that hinders a full understanding of the global scope of these activities and their repercussions on the environment. Furthermore, it aims to provide evidence that can be used to strengthen regulatory frameworks to prevent and combat minerals crime and the corruption that facilitates it. It seeks to foster discussions around transparency and accountability within the supply chain by identifying vulnerabilities and offering insights into the complex dynamics of minerals crime. This study is part of the *Global Analysis on Crimes that Affect the Environment*.

Methodology and limitations

The data collection for this study focused on reviewing open-source information and reports related to international minerals crime. The primary method used was desk review, which drew on over 160 sources. This study also uses mirror trade data analysis, a method that compares official trade statistics by two trading partners for the same trade flow.[11] The data is primarily sourced from the UN Comtrade database,[12] supported by other studies using the same methodology.[13] [14] This methodology is employed to detect potential anomalies and discrepancies in trade data, particularly when identifying a positive trade gap. UNCTAD defines a positive trade gap as occurring when the volume of (gold) exports is lower than the volume of imports recorded by the partner country, indicating potential trade-related illicit outflows. [15] However, this analysis is complex and has several limitations. One of the major challenges is the lack of consistent data from different countries. Potential misclassification or misreporting of goods is common, as trading partners may use different classifications or sub-categories for the same items. Differences in reporting standards and limited verification procedures for exchanging data between countries, especially neighbouring countries, can also be a challenge. Goods may be unofficially traded across borders without being registered, and years of data and confidential information may be missing. These are some of the many factors that can lead to inaccuracies and compromise the reliability of data and results.[16]

To further substantiate the findings, an examination of court cases involving corporations convicted of committing or facilitating minerals crimes was conducted. Desk research revealed a significant lack of data due to various factors, including the complexity of cases involving transnational corporations, which may be operating via subsidiaries. Countries where metals and minerals are extracted may lack adequate legislation to hold legal persons liable.[17] Other challenges may include insufficient evidence, lengthy legal processes, and intimidation or threats against activists and Indigenous leaders.[18] Moreover, it is apparent from analysing open-source data that there is no international instrument governing minerals crime, and administra-

tive data related to minerals crime is notably scarce. Despite these challenges, the selected cases provide a broad overview of illegal activities in the mining sector, highlighting the need for more comprehensive data collection and transparency. This analysis focuses on seven court cases which were identified by reviewing the original sources of each case, including the court sentences and official documents. The selection focused on large corporations with extensive operations across the mining and extractive sectors in various countries or regions around the world, rather than on smaller entities. Only cases that had reached a final verdict in court and were no older than 2014 were selected. The aim was to cover different geographical regions to identify potential commonalities in minerals crime.

The reliance on open-source information and reports may not capture the most current or sensitive details about minerals crime due to the proprietary, classified, or unpublished nature of some relevant data. The geographic and sectoral coverage of the data collection, despite being extensive, might leave gaps in the analysis, failing to represent all areas or sectors affected by minerals crime. In addition, the reported data by countries are often of poor quality. Moreover, inconsistencies in reporting practices, such as the use of different sub-categories for mineral byproducts by importing and exporting countries, lack of specificity, or the inclusion of incorrect data, can undermine the reliability of the information and limit the possibility for meaningful comparison.[19] As seen in Part 2a of the *Global Analysis* on Crimes that Affect the Environment –Forest Crimes: Illegal Deforestation and Logging, between 2014 and 2021, 20 to 47 Member States from ten world subregions submitted data on the number of acts that resulted in the depletion or degradation of natural resources via the United Nations Survey of Crime Trends and Operations of Criminal Justice Systems (UN-CTS). 'Acts that result in the depletion or degradation of natural resources' include both illegal logging and illegal mining, so the small dataset is further limited by not distinguishing between these crimes (see Box 1). A further 16 Member States potentially have publicly available data that need further review.[20]

BOX 1: ILLEGAL MINING: definition and scope

There is no universally accepted definition of illegal mining. For the purposes of this publication, illegal mining refers to mining activity that is: (a) carried out by a person, natural or legal, or a group of people without complying with the requirements of applicable laws or administrative regulations that govern these activities; or (b) carried out in areas where the exercise of such activities is prohibited or using prohibited equipment, devices or chemicals.[21]

As is the case for many other types of crime that affect the environment, depending on the national legislation, illegal mining activities may either involve contraventions of administrative regulations or constitute a criminal offence. The term "informal mining" is often adopted in the literature to refer to operations conducted in violation of existing regulations, and incurring administrative sanctions, but which do not constitute a crime.[22]

Artisanal and small-scale mining (ASM) refers to legal or illegal mining operations with predominantly simplified forms of exploration, extraction, processing and transportation.[23] Many artisanal and small-scale mining operators engage in "informal mining", meaning that their activities are not regulated or fully compliant with legal frameworks but are not considered criminal under penal law. Informal miners typically operate on a small scale and are often in the process of formalizing their operations, although they have yet to meet all the necessary legal requirements.[24] In contrast, illegal mining in the context of ASM operations refers to activities that explicitly violate national, regional or international legislation. This includes activities such as mining in protected areas or failing to adhere to environmental, tax, and labour regulations.[25]

This study examines all types of mining activities conducted in violation of national law, which are considered illegal, as well as activities that may contravene regional or international agreements, when these agreements are implemented through national legislation. This study specifically focuses on activities involving *organized criminal groups* as defined by the UN Convention against Transnational Organized Crime.[26] It encompasses informal mining activities when conducted by organized criminal groups. Illegal mining can occur in both artisanal small-scale settings (ASM) and within large-scale mining (LSM) operations and be committed by a number of different actors, including private corporations and politically-motivated organized crime groups. These entities exploit mining operations to generate revenue, often involving extortion or other forms of illegal financial gain.[27]

Key drivers and global dynamics

The mining sector is a crucial part of the world's economy, producing raw materials that are essential for infrastructure development, technology production, energy generation, and manufacturing industries globally. In some countries, mining is a major contributor to GDP, with certain economies heavily reliant on the extraction and export of minerals and metals.[28] However, alongside legal operations, a vast and complex network of illegal mining persists, driven by high demand, substantial profits, and weak regulatory frameworks.

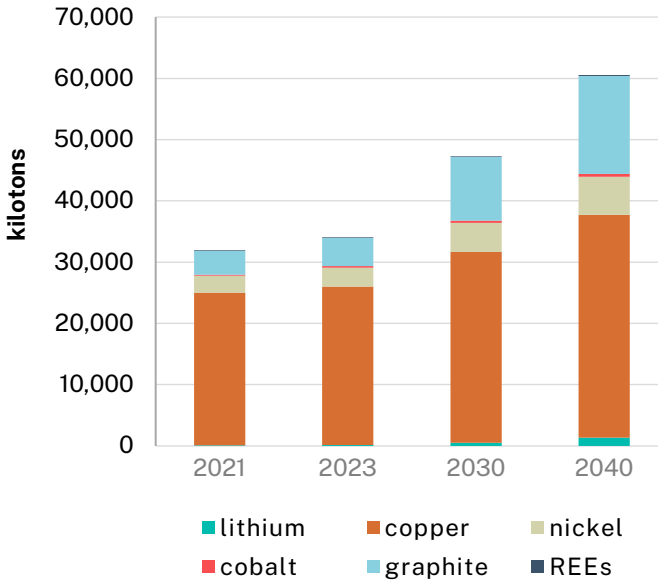
Growing pressures on the mineral sector

The increasing demand for minerals, fuelled by technological advancements, economic development, and the transition to low-carbon energy, has intensified pressures on mining operations. These minerals are frequently referred to as *critical* by many countries, which assess their criticality based on strategic interests and national priorities. As there is no universally agreed understanding or classification of what constitutes critical minerals, this study uses the term critical energy transition minerals (CETMs), in line with the United Nations Secretary-General's Panel on Critical Energy Transition Minerals (September 2024), which defines them as indispensable for renewable energy technologies and therefore critical for the energy transition.[29] Critical energy transition minerals include, but are not limited to, aluminium, cobalt, coltan (tantalum), copper, graphite, lithium, manganese, nickel and rare earth elements (REEs).[30] While minerals such as aluminium, copper and nickel have been extracted for centuries, others, including cobalt, lithium and REEs, have seen rapid growth in demand due to their application in lithium-ion batteries, electronics and renewable energy technologies. These technologies require far more mineral inputs than fossil fuel-based systems.[31] For instance, an electric vehicle requires six times the mineral inputs of a conventional car.[32] According to the International Energy Agency (IEA), the progressive shift to low-carbon power generation to meet climate targets is expected to triple mineral demand from this sector by 2040 (see Figure 1).[33] [34] Demand for specific minerals is expected to rise sharply, with lithium demand rising by 30 per cent, and the demand for nickel, cobalt, graphite and rare earth elements increasing by 8 to 15 per cent.[35] In response, new mining projects are being developed at a rapid pace. Investments in critical minerals mining grew by 10 per cent, and exploration spending increased by 15 per cent in recent years.[36] A 2024 UNCTAD technical report identified 110 new mining projects initiated worldwide in 2022, with the majority located in lower-income countries.[37]

Geopolitical risks and supply chain vulnerabilities

The IEA (2021) highlights that both the production and processing of critical energy transition minerals are highly concentrated in a small number of countries (see Figure 2).[38] This concentration, alongside growing global demand and the complexity of supply chains, leaves the mineral sector highly vulnerable to physical disruptions, whether caused by political instability, trade restrictions, or interference by criminal networks. These structural vulnerabilities, together with the sector's high commercial value, make critical mineral supply chains an attractive target for criminal exploitation. In countries with limited regulatory capacity, these risks are further amplified, creating favourable conditions for illegal activity. Gaps in governance and oversight enable criminal actors to infiltrate and operate throughout the supply chain of critical energy transition minerals, facilitating the emergence and proliferation of illegal practices. Beyond these structural risks, mineral supply chains also

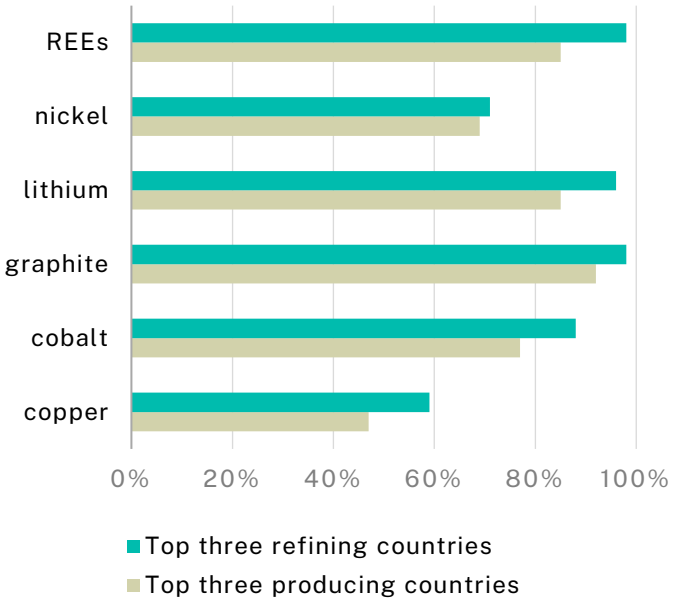
Figure 1 – **Estimated Demand for Six Major CETMs in the Announced Pledges Scenario (APS)***



Source: IEA, Global Critical Minerals Outlook 2024.

** The Announced Pledges Scenario (APS), introduced in 2021, refers to the extent to which announced ambitions and targets can deliver the emissions reductions needed to achieve net-zero emissions by 2050.*

Figure 2 – **Production and Refining Concentration of Six Major CETMs in 2023**



Source: IEA, Global Critical Minerals Outlook 2024.

face serious environmental, social and governance challenges. These include corruption, environmental destruction, human rights violations, and the presence of organized crime groups, which can exploit regulatory gaps across producing, transit and processing hubs.[39]

In the case of gold, major refineries are concentrated in four main regions (see Map 3), which do not necessarily overlap with the main gold-producing countries. This geographical disconnect means that gold is often traded internationally to reach refining centres. These cross-border movements present opportunities for infiltration and exploitation by criminal actors, who may take advantage of weak oversight, inconsistencies in documentation and regulatory loopholes along the trade routes. (See *Trade and import patterns* section for further details.)

Gold's role in illegal mining

While much attention in recent times has been directed towards CETMs due to their role in the energy transition, gold remains one of the most prominent minerals and at the heart of illegal mining operations worldwide. In 2023, Africa played a major role in global gold production, with an output of 870 metric tons.[40] (See *A focus on gold* section for further details.) The continent also holds vast reserves of minerals critical for the energy transition, including cobalt, manganese, and platinum. A good portion of extraction occurs through artisanal and small-scale mining, which in 2019 engaged nearly 10 million people, particularly in Sub-Saharan Africa.[41] However, in the Sahel region, artisanal and small-scale gold mining is closely linked to gold smuggling and transnational organized crime.[42] (See *The actors* section for further details.)

South America has rich deposits of lithium, copper, silver, and gold, with alluvial gold being widespread in the Amazon.[43] [44] The continent is also a hotspot for illegal mining, especially gold. For instance, in 2016 it was estimated that between 28 and 90 per cent of the gold produced in some areas of South America was sourced from illegal mining.[45] A 2022 UNODC report found that of the alluvial gold mining detected in Colombia, 73 per cent (69,123 ha) of the sites could be classified as illegal (an increase of 5,000 ha from the previous year); these alluvial gold mining sites can be broken down into two categories –: those in areas excluded from mining (49 per cent, 46,500 ha) and those in areas free of environmental restrictions (51 per cent,

48,183 ha.)[46] Furthermore, between 2014 and 2023, four South American countries collectively exported over 3,080 tons of gold of unknown origin.[47]

South-eastern and Central Asia also play a key role in global mineral production, particularly nickel, tin, copper, and REEs.[48, 49, 50] According to a media source, the region has seen widespread illegal mining, with estimates in 2021 suggesting that in just one South-eastern Asian country, 3.7 million people were engaged in illegal mining at nearly 2,741 locations.[51]

Key drivers

Illegal mining is not just an environmental or economic concern; it is deeply embedded in organized crime networks and corruption, and it is fuelled by a complex interplay of demand, profitability, regulatory weaknesses, and external global factors.

High demand and market value

Gold is a particularly attractive commodity for organized criminal groups due to its portability, value retention, and role in illicit financial flows. It is widely used as a financial asset because of its price stability and cultural significance, especially during global crisis, when it is seen as a safe haven.[52, 53] The global precious gemstones market has also grown steadily, with an estimated value of USD 32 billion in 2023, projected to reach approximately USD 56 billion by 2033.[54] While supply has increased, many metals remain rare, and demand often exceeds availability, making them lucrative investments and driving illegal extraction.[55]

Copper, widely used in construction and electronics, is also targeted by illegal mining operations.[56] Rapid urbanization and economic growth in low-income countries have driven demand,[57] while high market prices, rising by 80 to 120 per cent for nickel and copper between 2021 and 2022, may have further incentivized illegal activities.[58] [59]

Lucrative criminal enterprise

In some cases, the volume of illegal proceeds seized by authorities in relation to illegal mining suggests that it a very profitable crime. For instance, a 2016 report estimated that in just five South American countries, between 28 and 90 per cent of gold production in 2014 and 2015 was illegal, with the market value of this illegally sourced gold reaching approximately USD 7 billion.[60] Similarly, a 2016 assessment by INTERPOL and the United Nations Environment Programme (UNEP) estimated that losses in market value from illegal gold mining ranged from USD 12 to 48 billion.[61] Furthermore, profits derived from illegal extraction and trade of diamonds, gold, tin, tantalum, and tungsten have been linked with financing conflicts in Sub-Saharan Africa.[62]

Weak oversight

The expansion of illegal mining is frequently driven by insufficient government oversight in metal- and mineral-rich regions. In areas like the Amazon, many mining sites are remote and difficult to access,[63] making it challenging for governments to maintain effective oversight and therefore enabling criminal groups to take control. Additionally, political instability and the lower perceived risk associated with illegal mining compared to activities like drug trafficking further facilitate these operations.[64, 65] In Africa, politically motivated organized crime groups force artisanal miners to accept below-market prices.[66, 67] In some cases, gold is sold outside formal supply chains at higher prices, indicating links to money laundering. Gold smuggling is also rampant. For example, between 2014 and 2016, artisanal gold from neighbouring countries was smuggled into Togo, where buyers offered above-market prices to evade currency restrictions, distorting local economies and facilitating money laundering.[68]

External factors and global events

Global events such as the COVID-19 pandemic have demonstrated how fluctuations in the price of gold can significantly influence the incidence of illegal gold mining operations.[69] In August 2020, the price of gold reached a historic high of USD 2,070 per ounce, and this trend continued with the highest peak registered at USD 2,753 per ounce in November 2024.[70] These price surges, coupled with the economic shutdown during the pandemic, pushed workers from other sectors toward illegal mining in the Amazon as an alternative source of income,[71] underscoring the profound impact such global events can have on the dynamics of illegal mining operations.

Corruption and community vulnerability

Widespread corruption at various levels plays a crucial role in enabling minerals crime. This includes the forgery of documents, such as mining licences or permits, and cases where local authorities accept bribes or offer protection to those involved in illegal mining

operations. (See *Corruption* section for further details.) Another key factor is the vulnerability of local communities, which can facilitate the expansion of these operations. Many communities lack viable alternative sources of income, making artisanal mining a necessary means of survival. This dependency leaves them exposed to exploitation by illicit actors who capitalize on their economic hardship.[72] Bribery and corruption also allow companies to bypass environmental and social regulations. For example, in Indonesia's tin industry, 21 individuals were investigated in 2024 for authorizing illegal tin exports.[73]

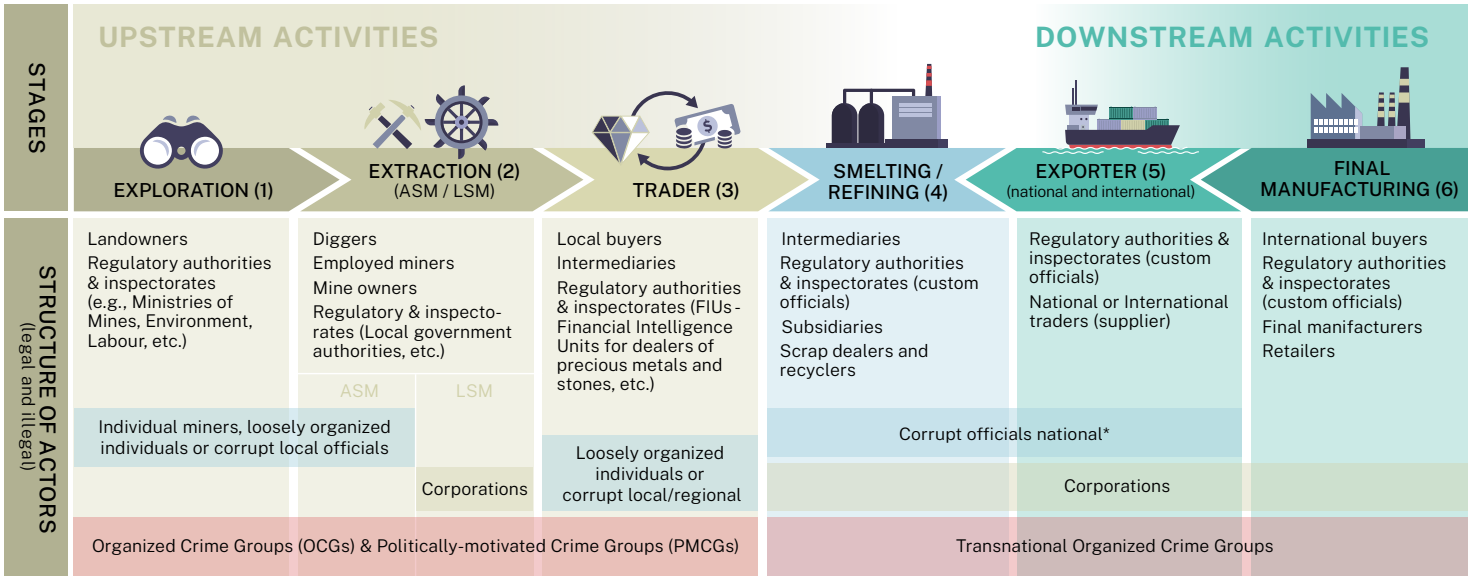
The (il)legal supply chain of metals and minerals

The global supply chain of metals and minerals is a complex network, spanning from mining sites to end-user products. It involves multiple steps within the country where the mining products are sourced, including initial processing. However, the final stages of processing, refining, and sale of finished products may take place domestically or internationally. Various actors are involved both in the upstream (from local mines to smelters and refiners) and downstream (manufacturing to sale of end products) segments of supply chains.[76]

There is typically no clear distinction between the supply chains for legally and illegally sourced or traded metals and minerals. Illegally sourced materials frequently enter the same supply chains as legally sourced goods, resulting in what is referred to as the '(il)legal supply chain'. Infographic 1 provides a diagrammatic representation of the six stages of the supply chain with the relevant actors. The actors listed may operate entirely within either the legal or illegal sphere. There are, however, also actors who have a legitimate occupation or business but may engage in minerals crime to further their profits.

Understanding each phase of the metals and minerals supply chain, and the potential involvement of both legal and illegal actors, is crucial for identifying the vulnerabilities that enable criminal activity. Interactions and overlaps between legal and illegal actors can occur throughout the supply chain, creating entry points for illegal practices that compromise the integrity of formal operations. Mapping these risks enables the development of targeted responses to detect and disrupt illegal activities at each stage of the supply chain. Each phase will be examined in more detail in the following sections.

Infograph 1 – **The mining supply chain and actors**



** Corrupt officials (at the local, regional, and national levels) may include and collaborate with a range of actors, including loosely organized individuals, members of corporations, or affiliates of OCGs/PMCGs.*

Source: UNODC elaboration of UNICRI 2009 study.

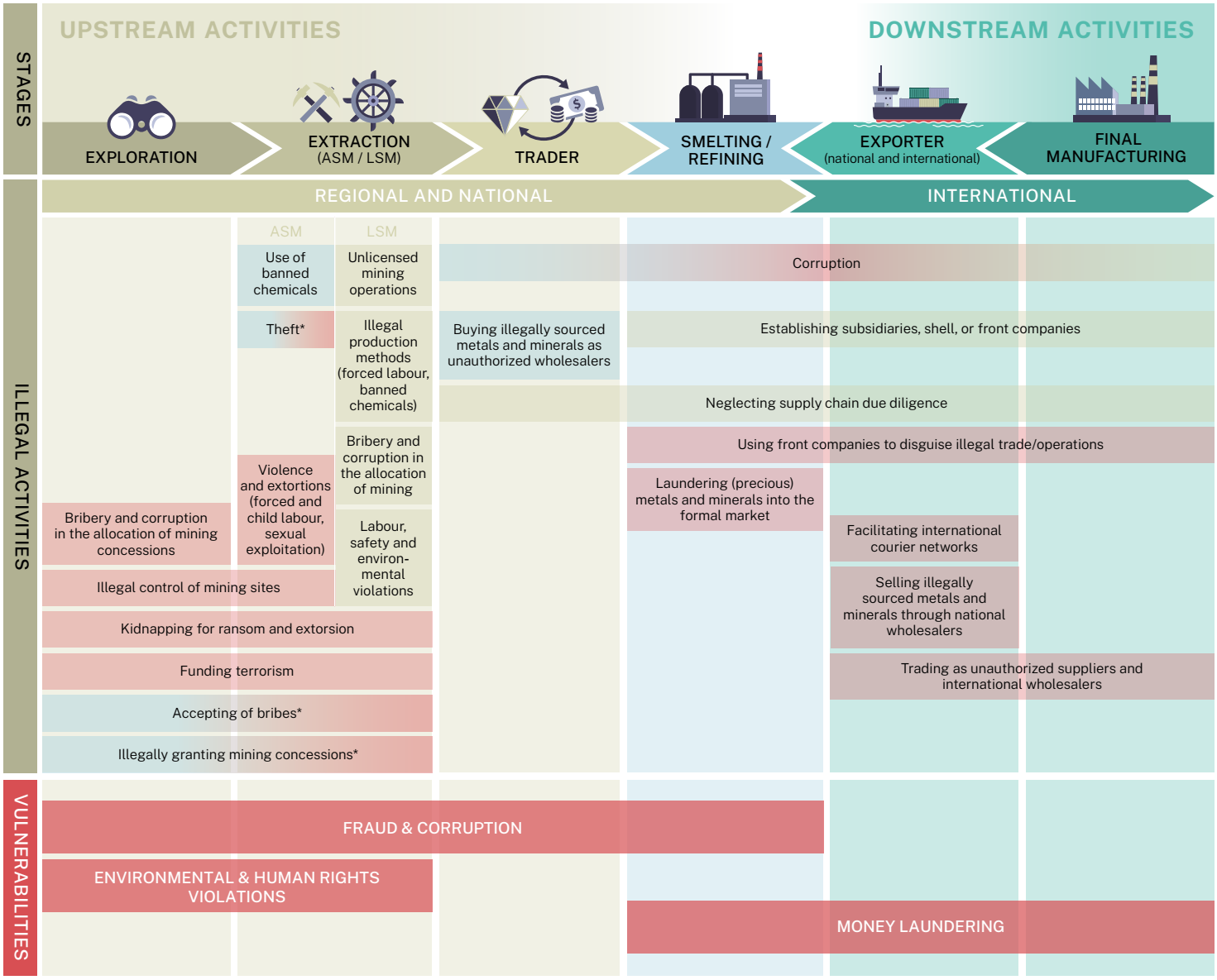
Note: The colours represent different categories of actors: blue indicates individual miners or loosely organized individuals, light green represents corporations, and red signifies organized crime groups (OCGs), including politically-motivated crime groups (PMCGs).

As outlined in Infographic 1, a model supply chain of mining products can involve six primary phases:

1. Exploration
2. Extraction
3. Local (national or regional) or international trade
4. Smelting/refining
5. Exporting
6. Final manufacturing and selling.

In Infographic 2, a visual representation illustrates the illegal activities that can occur at different phases of the supply chain. This representation helps to better understand overlaps between phases and identify vulnerabilities related to specific activities.

Infograph 2 – **Potential disruptors and vulnerabilities in the mining supply chain**



** Corrupt officials (at the local, regional, and national levels) may include and collaborate with a range of actors, including loosely organized individuals, members of corporations, or affiliates of OCGs/PMCGs.*

Source: UNODC elaboration of UNICRI 2009 study.

Note: The colours represent different categories of actors: blue indicates individual miners or loosely organized individuals, light green represents corporations, and red signifies organized crime groups (OCGs), including politically-motivated crime groups (PMCGs).

Supply chain phases

1) **Exploration**: the first phase, the exploration phase involves identifying potential mining sites through geological surveys, mapping, and sampling.[77] This phase is critical as it lays the groundwork for all subsequent mining activities. Key actors in this phase include landowners, who own or have rights to the land being explored; regulatory or local authorities, who provide necessary permits and regulatory oversight (e.g., Ministry of Mines); and inspectorates, who ensure compliance with environmental and safety regulations. During this phase, corruption can take various forms, including bribery, nepotism, grand corruption, and facilitation payments.[78] Officials responsible for granting mining concessions might accept bribes in exchange for awarding these rights improperly, speeding up application processes, or favouring certain corporations, which could be also linked to their own family or personal interests. This corruption can lead to unqualified or unethical corporations gaining control of valuable mining areas, bypassing legal and regulatory requirements. There is an additional risk of having criminal organizations invest illicit funds to finance exploration activities, disguising their origins in order to integrate them into the legitimate economy.[79]

2) **Extraction**: it is in the extraction phase that the actual mining takes place, involving the physical removal of metals and minerals from the earth.[80] Two different methods of extraction can be distinguished at this stage, which consequently involve different actors: artisanal and small-scale mining (ASM) and large-scale mining (LSM) operations. ASM typically entails the extraction of metals and minerals using rudimentary tools, which can be carried out by non-professional miners using simple technologies.[81] However, depending on the level of investment, organization, and access to resources, ASM operations may also rely on mechanized methods and heavy machinery. In contrast, LSM is typically conducted by corporate or state-backed entities, and is characterized by significant financial investment, advanced mechanization, and a specialized labour force.[82] Regardless of the scale, the extraction phase tends to be labour-intensive and may involve a range of equipment and machinery depending on the operational context.

Key actors in this phase include: diggers or (employed) miners, including those formally organized in cooperatives, who perform the manual or mechanical work of extracting the metals and minerals; mine managers, who oversee operations and ensure that the extraction process runs smoothly and efficiently; mine owners or corporation managers, who provide the financial backing and overall strategic direction for the mining activities; and regulatory authorities and inspectorates, who ensure that the extraction is conducted in compliance with legal and environmental regulations.[83]

Risks in this phase include operating without proper licences or using illegal methods, such as forced labour or banned chemicals.[84] Illegal operations may also occur in protected areas, including Indigenous territories, often without prior consultation or consent.[85] In some countries, licences are too expensive for small-scale miners, who must also cover additional costs related to mining operations such as environmental permits, taxation, equipment costs, and sometimes unofficial payments. These financial barriers may discourage them from pursuing formalization and obtaining a licence, pushing them to operate illegally.[86, 87] In impoverished areas, illegal mining sites may attract individuals with the hope of improving their economic condition, as they often represent one of the few accessible source of income.[88] In other cases, even licenced miners may prefer to work independently to retain a larger share of profits. However, doing so can expose them to greater risks, including being targeted by organized criminal groups or thieves during the transport of metals and minerals to local dealers.[89]

Risks in the extraction phase also extend to the use and trafficking of chemicals essential to mineral processing. Certain substances, such as mercury and cyanide, are banned or heavily restricted in gold mining due to their severe environmental and health impacts. Despite these restrictions, they continue to be used in illegal operations. The supply chains of these chemicals are vulnerable to diversion and illegal trade, with chemicals often diverted and exchanged between legal and illegal actors. For example, mercury often reaches processing sites through illegal imports and trade, reselling by licenced enterprises, recovery from mining waste, and cross-border smuggling.[90]

3) **Local or national trading**: the third phase involves the processes of transporting and selling metals and minerals within the country. This phase begins once the metals and minerals have been extracted and prepared for sale or transport to local markets or

further processing. However, roadblocks set up by organized crime groups, including by politically-motivated organized crime groups, can hinder or disrupt the legal trade and provide a source of income for these groups.[91] Key actors in this phase include: local buyers, who purchase metals and minerals directly from the mines or intermediaries; traders, who act as intermediaries to buy, sell, and distribute the metals and minerals to various markets; and regulatory authorities such as customs officials, who regulate and monitor the movement of metals and minerals to ensure compliance with national laws and regulations.[92] Trading or exporting metals and minerals without the necessary licences is at high risk for illegality in the national trading and shipping phase.[93] Additionally, there is a risk that legitimate corporations knowingly or unknowingly purchase smuggled metals and minerals or those produced through illegal means, which consequently finances criminal organizations and "launders" illegal goods into the legal supply chains.

4) **Smelting or refining**: In this phase, ores are processed to extract pure metals. In most refining processes, ores are smelted, which involves heating the ore to high temperatures to separate the metal from impurities, while refining further purifies the metal to achieve the desired quality. These processes are essential for transforming extracted metals and minerals into usable materials for manufacturing and other applications. A common early step in this process takes place in beneficiation plants, which carry out preliminary processing to improve the quality of the ore before it is refined. This includes activities such as crushing, milling, gravity separation, or flotation to remove impurities and increase metal concentration. Where such facilities exist, ore can be beneficiated in the country of origin. If not, it is often exported for refining elsewhere.[94]

This stage is at risk of being used for laundering metals into the legal supply chains. After smelting and refining, illegally purchased metals can be accompanied by legal documents, making it difficult to trace their origin. In the case of gemstones for instance, organized criminal groups may exacerbate laundering by using fake suppliers who forge certificates that declare a different country of origin.[95] As a result, this stage often serves as the entry point for illegally acquired metals, minerals and gemstones to be legally purchased on the international market. This is also evident with gold,[96] which is primarily refined in major international hubs where refineries possess the technology necessary to achieve the purity standards required for the global market.[97] [98]

In this phase, various actors play vital roles. Intermediaries facilitate the transfer of raw minerals to smelting facilities, ensuring a steady supply chain.[99] Dealers then handle the sale of refined metals to manufacturers, bridging the gap between production and end-use.[100] Inspectorates are crucial in ensuring that refineries comply with environmental regulations and safety standards, conducting regular inspections and audits to maintain operational integrity. Meanwhile, customs officials assess that regulations are being applied to the import and export of metals and minerals, verifying documentation and preventing illegal activities such as smuggling or under-declaration of value. This stage is vulnerable to smuggling, under-declaration of mineral value, and corruption.[101] Some refineries may utilize untraceable cash payments and engage in refinery-to-refinery trading to conceal the origin of the metal.[102] Additionally, organized criminal groups may use refineries to launder illegally mined metals into formal supply chains investing proceeds from illegal mining into their illegal operations, further entrenching illegal activities within the supply chain.[103]

5) **Export**: In this phase processed metals and minerals are traded for sale on the international market. International buyers, including commodity traders, specialists who buy, transport, and sell raw materials to optimize supply and demand,[104] purchase refined metals and distribute them across various industries, while ensuring that they meet quality standards.[105] Corporations play a crucial role on this phase and across the downstream supply chain. While legal requirements to verify the origin of metals and minerals differ by country and commodity, corporations are expected, under both binding regulations and voluntary standards, to carry out due diligence on their supply chain. For example, in the case of gold, several jurisdictions have introduced mandatory due diligence requirements for importers and publicly listed companies. Failure to conduct adequate due diligence poses a significant risk, as it allows minerals linked to illegal mining practices to enter global supply chains.[106] Additionally, organized criminal groups may use front or shell companies at this stage, a tactic also observed during the smelting and refining stage, to disguise il-

legal activities, often facilitating illicit financial flows and money laundering.[107, 108]

Finally, custom officials play a crucial role by overseeing cross-border movements, ensuring compliance with international trade laws, preventing smuggling, and verifying declared values to assess duties and taxes. This phase is particularly vulnerable to corruption, as customs officials may be exposed to bribery or other forms of illicit payments to bypass regulations and facilitate illegal trade.

6) **Final manufacturing**: Final manufacturers use metals and minerals to produce goods such as electronics, automobiles, and jewellery, relying on a consistent supply to meet market demands. This phase is also vulnerable to the laundering of the origin of metals and minerals that were illegally sourced earlier in the supply chain and continue through the final manufacturing stage. This can occur through the use of shell or front companies to disguise illegal trade or operations by criminal actors or organized crime groups. While this risk is particularly high for precious metals and stones, other metals and minerals may also be affected. Additionally, transnational organized criminal groups, leveraging their networks of international buyers, can facilitate the laundering of stolen precious metals into the legal system.[109] The use of illegal mining proceeds in final manufacturing processes poses significant risks, potentially contaminating global supply chains with illegally sourced materials.[110]

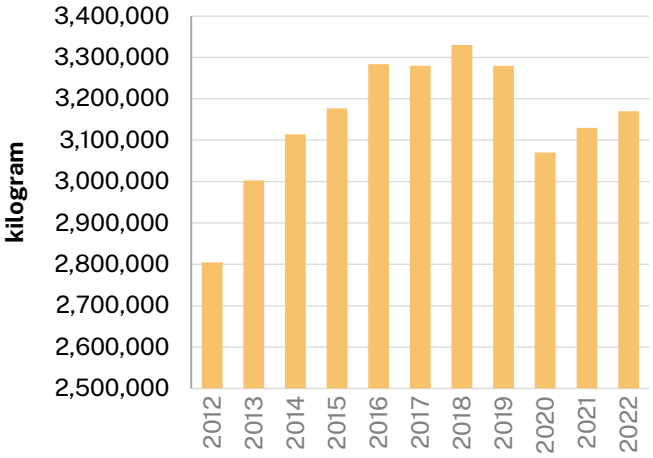
A focus on gold

The supply

The gold supply chain extends across different geographies: gold is typically extracted (produced), refined, and sold in different countries depending on natural resources, refinery capacity, and market size. Despite gold being a rare metal, its production has been steadily increasing, with annual output exceeding 3 million kg per year between 2013 and 2021 (Figure 3).[111] In 2021, half of the world's gold production was based in Sub-Saharan Africa, Latin America and the Caribbean, and Southeastern Asia.[112] Before reaching end markets, gold extracted in one country may be refined domestically, in a neighbouring country, or in distant geographies.[113]

As with the other illegal environmental commodities studied for the *Global Analysis on Crimes that Affect the Environment*, the legal and the illegal markets overlap. For instance, in the Sahel, some actors involved in gold mining "may run a fully legal supply chain, others may purposely participate and promote illegal activities, while others may inadvertently or forcibly contribute to parts of the illegal supply chain".[114]

Figure 3 – **World's gold production (mineral production), in kg, 2012–2022**

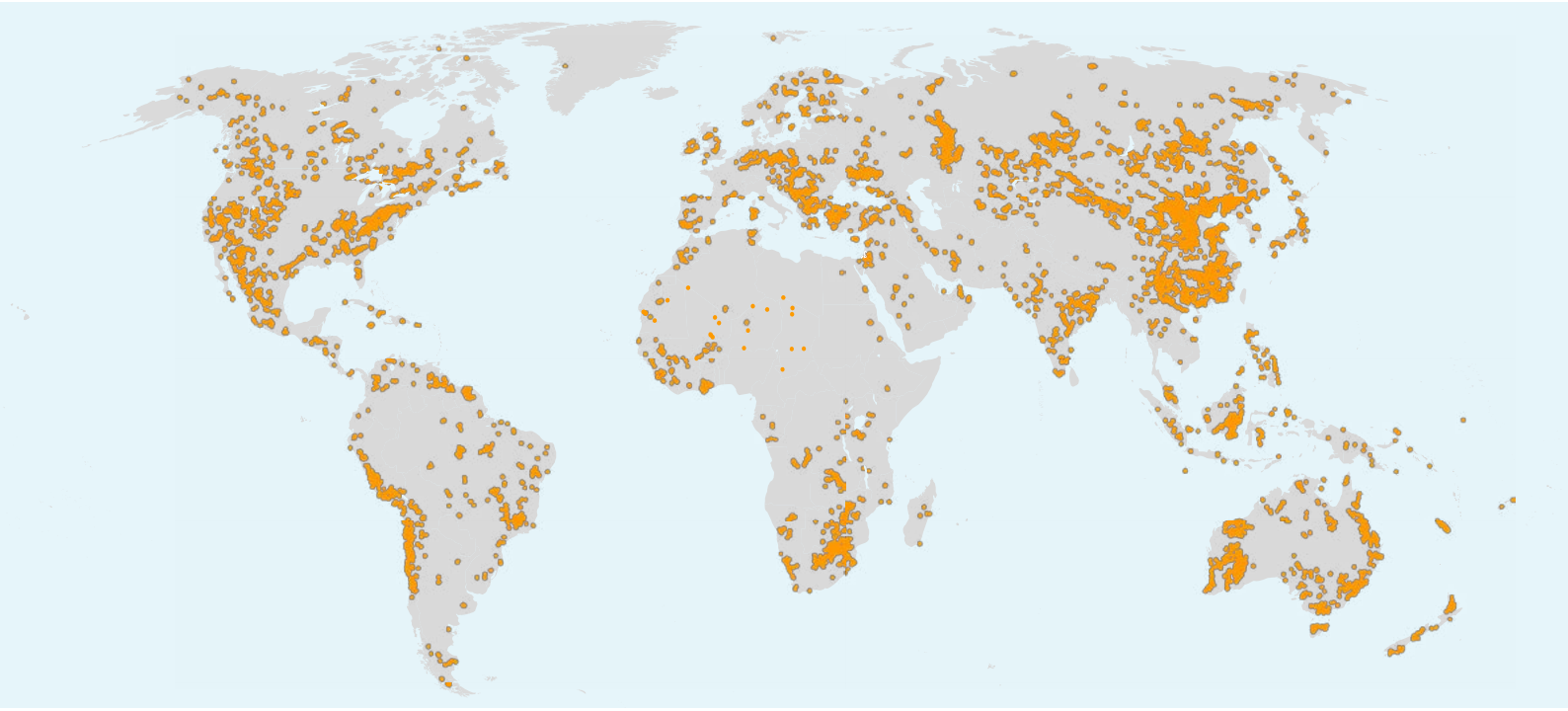


Source: UNODC elaboration of OECD data.

In South America, not all gold-producing countries possess refineries, which hinders their ability to export gold at the minimum 99.5 per cent purity, the standard required by international markets. Gold in bullion form (24 karat) is the most commonly traded form of gold on the international market. The usual purity for gold bullion is 99.9 per cent.[115] Gold extracted in South America, often with lower purity, is frequently exported for refining elsewhere due to limited number of gold refineries in the region. (see Map 3). Gold ore is typically sent to refining hubs where it is processed to meet international quality standards. However, this stage presents a significant risk of being exploited to launder illegally sourced gold, allowing it to appear legal before reaching end markets.[116] In Brazil's case, smuggled or illegally produced gold undergoes laundering processes before being legally commercialized in national markets, primarily sold to banks and jewellery companies.[117] Gold is then often exported to countries with greater processing capacities, where most of the global imports take place.[118, 119, 120]

Similarly, not all major gold-producing nations in Sub-Saharan Africa have refining facilities within their borders, and several countries serve as a refining stop for inter-regional trade.[121] Some countries in Eastern and Southern Africa, such as South Sudan, Uganda, Zimbabwe, Kenya, and South Africa, also export gold directly to the United Arab Emirates, which serves not only as an end market but also as major refining destination.[122, 123] Considering the significant production of gold by ASM in many African countries, this raises potential concerns about the traceability of gold and the risk that some of the gold imported may be smuggled[124, 125, 126] or sourced from conflict areas, potentially benefiting politically-motivated organized crime groups.[127]

Map 1 **– Areas affected by mining activities*, 2023**



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Sources: UNODC elaboration of Tang, L., Werner, T.T. Global mining footprint mapped from high-resolution satellite imagery. Commun Earth Environ 4, 134 (2023). https://doi.org/10.1038/s43247-023-00805-6, with additional mining sites from Gold Trafficking in the Sahel, TOCTA Sahel, UNODC, 2023.

**Mining activities can impact the environment up to 50 km from where the mining is happening according to Sonter, L.J., Dade, M.C., Watson, J.E.M. et al. Renewable energy production will exacerbate mining threats to biodiversity. Nat Commun 11, 4174 (2020). https://doi.org/10.1038/s41467-020-17928-5*

The demand

Global demand for gold mainly results from a combination of purchases made for four main purposes (Figure 4):

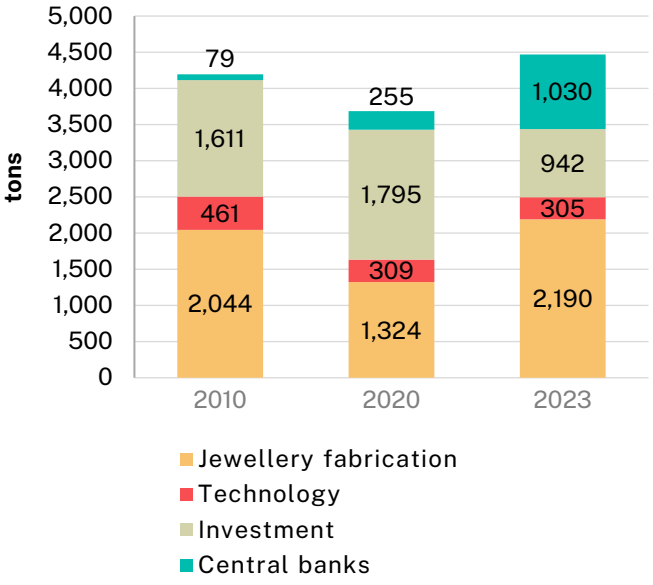
1) **Jewellery fabrication.** In 2020 jewellery fabrication accounted for around 36 per cent of the global demand for gold, a decrease from previous decades. This drop can be attributed to the COVID-19 pandemic. Despite this, jewellery demand remained strong, holding at 49 per cent in both 2022 and 2023.[128, 129]

2) **Investments,** either in the form of bars and coins (traditional use of gold as an instrument for storing value), exchange traded funds (ETFs),[130] or similar products.[131] Since 2008, global demand for bars and coins has significantly increased, from below 20 per cent to 32 per cent in 2022 and a similar trend in 2023.[132] In contrast to the overall market, demand for ETFs and similar products has widely fluctuated over the last twenty years and registered a sharp decline in 2022 and 2023 after reaching a peak in 2020 with 37 per cent of the global demand.[133, 134]

3) **Central banks' reserve assets**. Global gold reserves in 2023, and similarly in 2022, increased by four times compared to 2019.[135] Gold's characteristic long-term value and its high liquidity are among the key reasons for the increase in purchase.[136]

4) **Industrial purposes** accounted for an average of nearly 8 per cent of the global demand for gold over the period 2011–2023.[137] This share has remained broadly stable with only a minor decline, mainly driven by electronics and dentistry.[138]

Figure 4 – **Global demand of gold by type in tons, 2010, 2020, 2023**

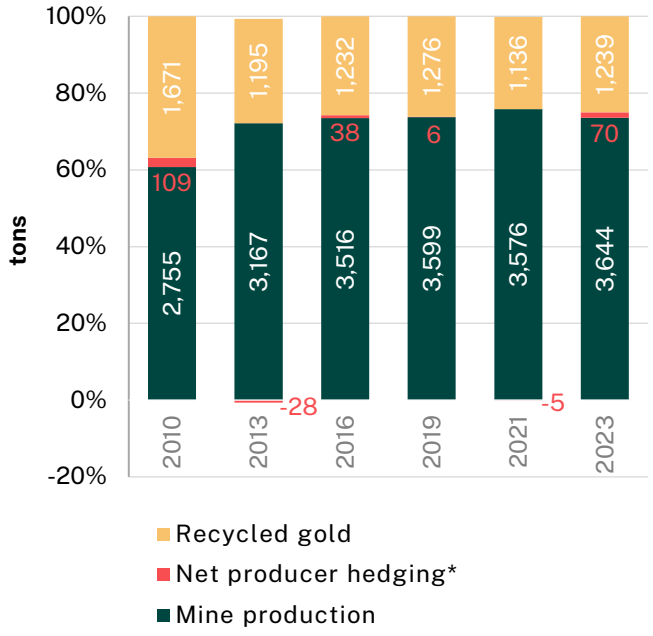


Source: UNODC elaboration of World Gold Council data.

Trends in supply

In the last thirty years, while demand for gold has remained stable, the investment base has become more diverse.[139] Between 2010–2023, the supply of gold saw an increase in the share coming from mining, while the share of recycled gold decreased (Figure 5). In 2010, just over 60 per cent of the gold supply came from mining, and nearly 37 per cent from recycling. By 2023, mining's share had risen to nearly 74 per cent, with recycled gold making up approximately 25 per cent of the total supply.[140] According to the London Bullion Market Association (LBMA), the organization that sets standards for the international trade of gold and silver, the percentage of recycled gold reported to refineries is significantly higher than official estimates, highlighting a discrepancy in data. While ASM gold production accounts for less than 1 per cent of the total supply, observers have noted that a substantial portion of gold labelled as "recycled" may, in fact, originate from ASM sources, raising concerns on the transparency of recycled gold in the global supply chain.[141] These trends can be attributed to rising gold prices, which may have stimulated global mining activities as well as recycling.[142, 143]

Figure 5 – **Global supply of gold in tons, by type, 2010, 2013, 2016, 2019, 2021, 2023**



Source: UNODC elaboration of World Gold Council data.

Net producer hedging refers to measuring the impact of mining companies' gold forward sales, loans, and options in the physical market. Hedging accelerates gold sales by releasing existing stocks, but over time, it does not increase the overall gold supply.[144]

While existing literature indicates that major consumers of gold include jewellery companies, investors, and electronics manufacturers,[145] [146] the specific pathways through which illegally sourced gold enters international markets and reaches end-users are often insufficiently documented. The high value of gold, its market characteristics (value/volume ratio), lack of control, portability and anonymity are some features that create opportunities for the trade in illegal gold. Gold mining is largely driven by its market price, which is influenced by gold's role as a reserve asset for both states and individuals, serving as a store of wealth and a safe investment.[147] Due to its scarcity and its socio-economic value, the legal supply of gold is highly regulated.[148]

Legal and regulatory gaps

Insufficient regulatory mechanisms may enable the laundering of illegal gold, blurring the distinction between legal and illegal sources and complicating efforts to quantify the extent of illegal transactions and the total market of gold that is exclusively illegally sourced or traded. As illustrated in Map 2, which compares the levels of criminalization of mining-related offences with global legal gold production (estimated, as not all data is available from Member States), the darkest areas, where red and blue overlap, represent countries that are the most vulnerable due to insufficient legal frameworks addressing illegal production. This is important also for importing countries as they face the risks associated with failing to determine the origin of gold. For the analysis of criminalization, mining-related offences or illegal mining was defined as

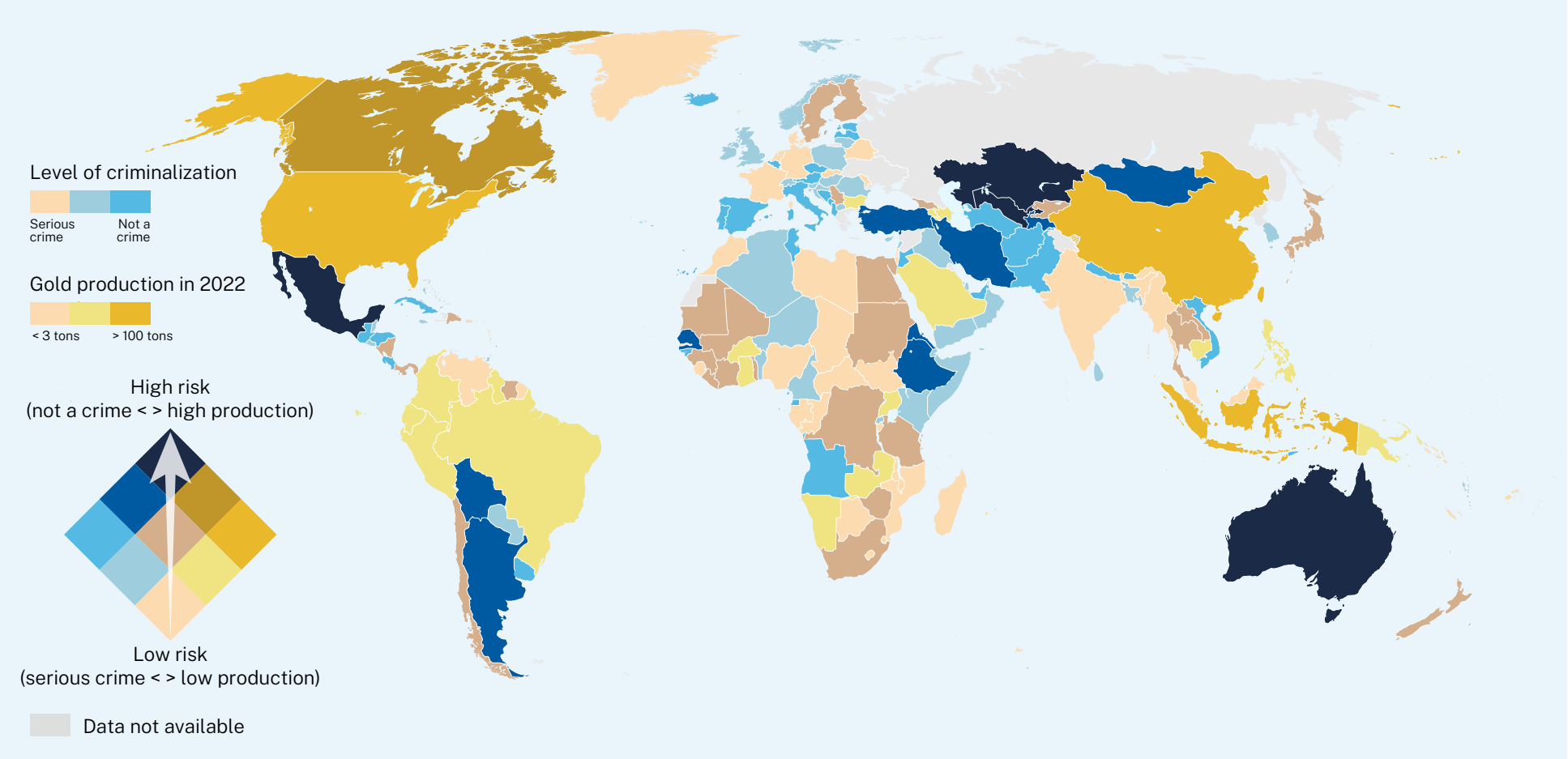
> *"Any person who engages in any mining activity of a mineral resource (a) without lawful authority where such authority is required by law; (b) without a relevant license, permit, certificate, or other legal permission granted by the competent authorities; (c) by contravening the conditions of said license, permit, certificate, etc.; or (d) in a manner that otherwise contravenes the relevant legislation".*[149, 150]

The map shows that areas such as Central Asia and Oceania, along with some countries in South and Central America, have substantial gold production but do not appear to criminalize unlawful mining. As a result, mining offences may go unpunished or face only administrative sanctions that may not dissuade – and could even encourage – the illegal extraction of metals and minerals.

Trade and import patterns

Globally, the primary importers of gold, according to official trade statistics (which may also include illegally sourced gold that has infiltrated the formal market), are mainly regions such as Europe, Western Asia, Southern Asia, and Eastern Asia.[151] These regions serve as major hubs for gold consumption and trading, where demand is met across various industries.[152] Between 2004 and 2023, the world's gold imports were channelled through five key countries: Switzerland, United Kingdom of Great Britain and Northern Ireland, the United Arab Emirates, India, and China[153] (Infographic 3).[154] In 2023, these countries were estimated to account for 56 per cent of global gold imports.

Map 2 **– World's gold production and overlay with criminalization of mining-related offences**



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.
Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.
A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

Source: UNODC, Part 1 – Global Analysis on Crimes that Affect the Environment, 2024; OECD Compare your country, Trade in Raw Materials – 2024 Edition.

Infograph 3 – **The five major gold importers and exporters in 2023**

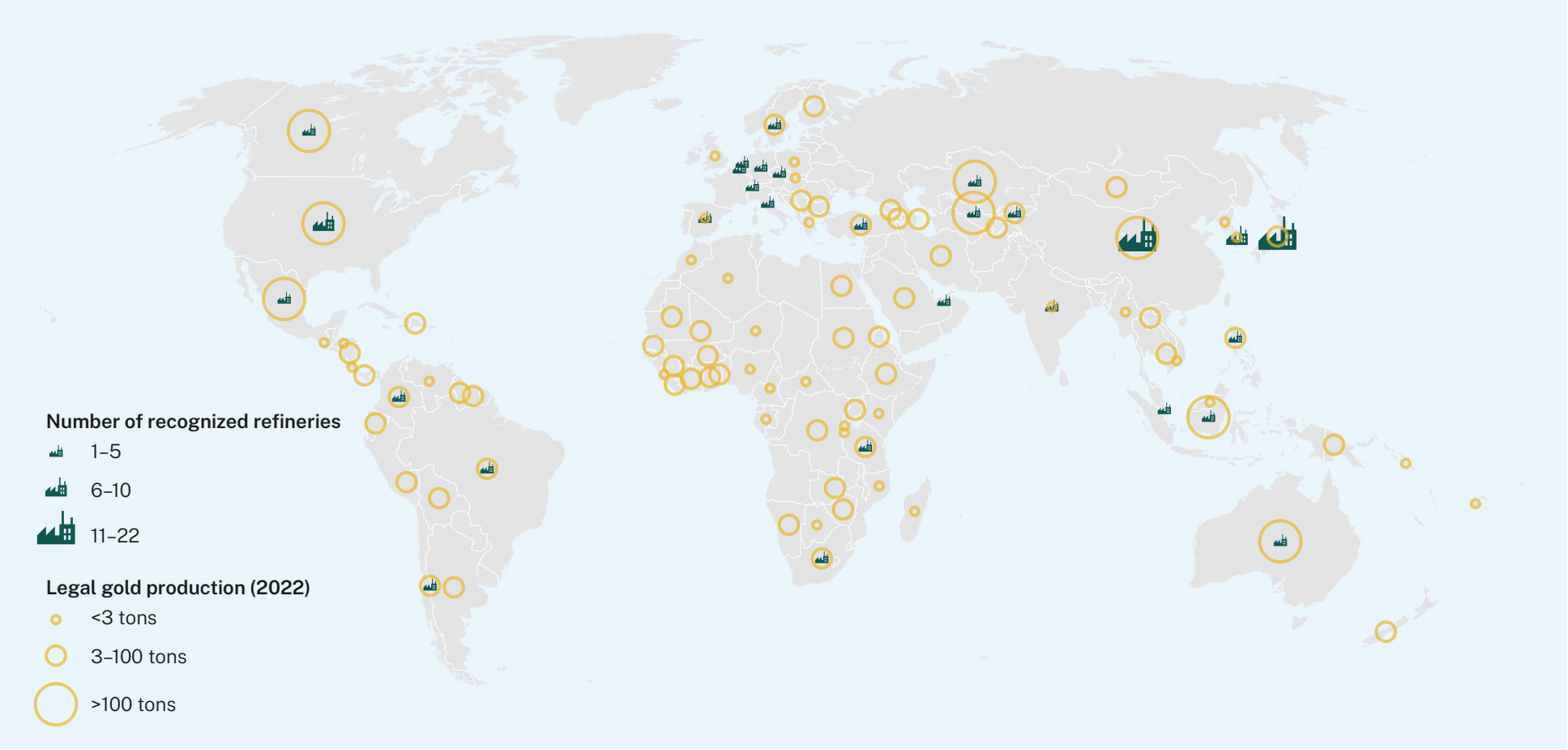
Source: UN Comtrade.

Notes: Countries highlighted in yellow are gold producers. The countries are listed from highest to lowest in terms of value.

These major players are both importers and exporters of gold, except for India, which, despite being a significant importer, is not a major exporter. In 2023, China, Switzerland, the United Arab Emirates, the United States of America, and the United Kingdom of Great Britain and Northern Ireland accounted for an average of 76 per cent of global gold exports. While these countries are prominent consumers and traders, they do not possess substantial gold reserves or production capacities, except for the United States of America and China. It is important to note that the gold traded in these countries is typically already refined and does not match production data. Map 3 shows the locations of the main known gold refineries overlaid with estimated global gold production (due to data gaps from several Member States, production figures are an approximation). The overlay reveals a clear mismatch between the locations of gold production and the concentration of refineries. This indicates that gold must be traded and exported internationally for processing, reinforcing the transnational nature of the gold supply chain.

The locations of these refineries align with the main trading countries (Infographic 3), highlighting concentrations in four key regions: Europe, Eastern Asia, Western Asia, and Northern America. The map displays known gold refineries – the underlying figure is based on three separate and widely recognized refinery lists, each associated with different accreditation and standards. The most common of these is the LBMA Good Delivery List, the primary internationally recognized standard for physical gold purity (minimum 99.5% for gold).[155, 156] The second is the Responsible Minerals Assurance Process (RMAP) Gold Standard, which, unlike LBMA standards, places greater emphasis on responsible sourcing and alignment with the OECD Due Diligence Standard.[157] The third list includes members of the UAE Good Delivery (UAEGD) programme,[158] launched in 2021 by the government of the United Arab Emirates as a voluntary accreditation system. The country has around 10 active gold refineries, although only three adhere to these standards.[159] (See Box 2 for further details.)

Map 3 – Locations of major recognized gold refineries



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.
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A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

Sources: The Independent Precious Metals Authority (LBMA), Responsible Minerals Initiative (RMI), and UAE Good Delivery (UAEGD).

Note: Data are not available for all countries.

It is important to note that not all active refineries are included in these lists, as participation is voluntary and depends on a facility's willingness to undergo independent assessments. Nonetheless, adherence to these lists signals a degree of commitment to responsible sourcing, due diligence, and compliance with international standards to ensure gold is sourced from conflict-free areas.

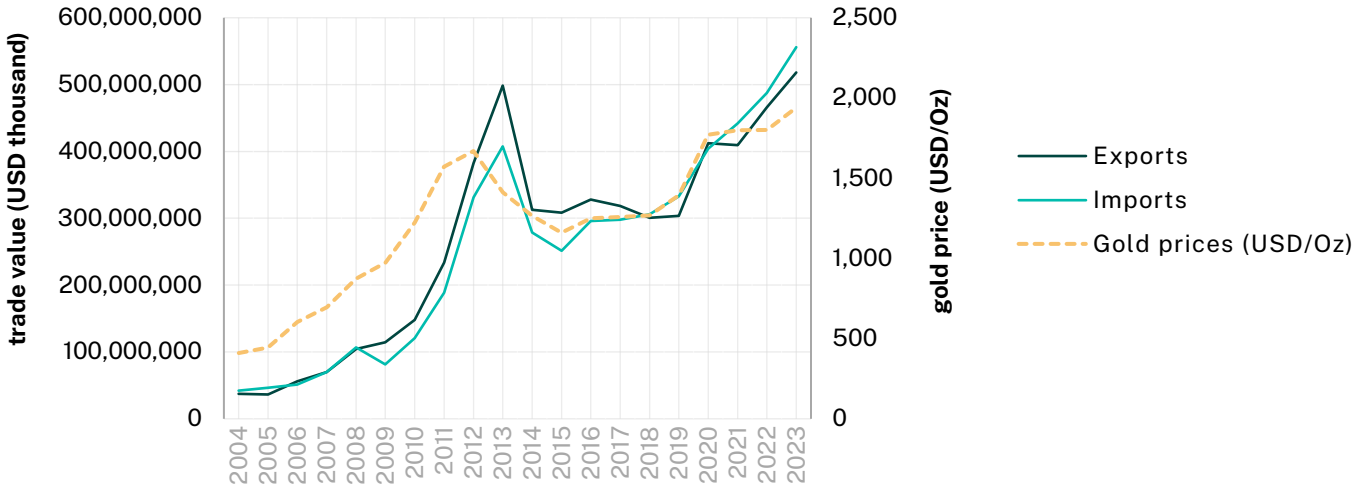
Global trends in gold import and export closely follow fluctuations in gold prices, as indicated by the dotted line in Figure 6. This is evident from the sharp increase in gold trading volumes and production since the early 2010s, driven by rising gold prices. While India primarily imports gold for internal consumption, mainly for jewellery and investments,[160] other key players' economies heavily rely on gold trade. Notably, Switzerland and the United Arab Emirates are home to some of the world's leading gold refineries.[161] Despite being a major oil producer, with crude and refined petroleum accounting for over 40 per cent of its exports, the United Arab Emirates has successfully diversified its economy by investing in gold since 2012. In less than a decade, the United Arab Emirates has become the third largest importer of gold, with imports significantly exceeding exports, which almost doubled by 2022. Additionally, the United Arab Emirates was in 2022 the third-largest gold exporter globally, despite lacking domestic gold reserves. Gold and jewellery now represent nearly 11 per cent of its exports, making this a crucial component of its economy, second only to oil.[162]

Trade discrepancies

Comparing official trade statistics to detect potential anomalies in gold trade is a valuable method for investigating illicit trade between trading partners. While the analysis is complex and often constrained by many factors including insufficient or non-standardized data, it serves as a useful foundation for identifying potential risks or irregularities that require further investigation.

The review of trade data on UN Comtrade, along with other studies, has been used in this study to detect discrepancies in trade data, in particular when identifying a positive trade gap, meaning cases where gold exports are reported as lower than imports by the partner country. Depending on the context and data availability, either the value or the volume of trade is used to identify such gaps. If importing countries do not have a large internal demand for gold, these gaps

Figure 6 – **Trend in the global value of gold imports and exports (USD thousand) and the price of gold (USD/Oz), 2004–2023**



Source: UN Comtrade and World Gold Council (the price of gold, in millions of US dollars per ton, in October of each year was used as a reference).

may indicate potential illegal activities related to gold mining and the use of gold to trade proceeds of crime, including cross-border financial flows from the illegal market and corrupt activities. Discrepancies between imports and exports may also be the result of illicit tax and commercial practices, like tax evasion through trade misinvoicing.[163] However, due to the limitations of the mirror data analysis, this study uses trade data as a starting point to identify discrepancies that require further investigation and research.

In addition to analysing a positive gap in trade data, studies have shown that there is a correlation between illicit finance and conflict areas. Illicit finance, and related illicit financial flows, involve the movement of illicit income, such as from the trade of illicit goods and services, often organized by criminal networks to make a profit. These activities are part of illegal markets that operate in a structured, profit-driven way, similar to legal supply chains.[164] Especially in regions controlled by organized criminal groups and/or politically-motivated criminal groups, these groups may generate a large volume of IFFs through income made from illegally exploiting natural resources, engaging in illicit trade of legal goods, and committing crimes, like extortion and trafficking, including of drugs.[165] These activities typically generate both inward and outward IFFs, which strengthen the ability of these groups to evade law enforcement and finance their operations.[166] In conflict zones, illegal income exacerbates violence by facilitating arms smuggling, undermining peacebuilding efforts and fuelling cycles of political instability.[167, 168]

The review of gold trade data on UN Comtrade from 2017 to 2022 reveals that several major gold-producing countries, such as Uzbekistan and South Africa, do not report their trading partners, instead listing them as “Area Nes” (Areas Not Elsewhere Specified). This makes it difficult to trace the origin of the gold.[169] Colombia, another important gold-producing country, stands out as a major exporter to Special Economic Zones or Free Trade Zones (FTZs), where gold is imported and re-exported without being subject to customs regulations and taxes imposed by the host country.[170] According to the OECD, FTZs are “designated areas that lie outside the Customs jurisdiction in the economies concerned and are not subject to Customs duties and taxes that would otherwise apply to imported merchandise”.[171] The risk associated with these zones is that they can be considered outside customs jurisdictions, resulting in reduced or limited regulatory oversight.[172] In 2022, exports to these zones from Colombia made up its third-largest destination in terms of quantity of gold, making it difficult to determine the ultimate destination of a significant part its gold.[173]

Several other anomalies are evident in the data. For instance, in 2014 Iraq provided overall trade data but excluded gold. However, mirror data analysis from Trade Map,[174] a platform developed by the International Trade Centre (ITC) that primarily uses UN Comtrade data and information from national statistical agencies, shows that Iraq experienced a significant spike in the value of its gold exports in 2020, amounting to nearly USD 8 billion. This analysis relies on trade information reported by other countries. Given that Iraq neither has gold reserves nor produces gold, it is noteworthy that in 2020 the value of gold exports attributed to Iraq reported by other countries was about 22 times higher than the value of imports, indicating a substantial gap in trade reporting.[175] Another anomaly arises with the Russian Federation, which has a significant positive trade gap and ceased reporting trade data in 2021. Despite being a gold-producing country, its primary importer is Belarus, a nation that neither reports trade data on gold nor produces it. Cross-checking trading partners showed that Switzerland and the United Kingdom of Great Britain and Northern Ireland have remained the main importers of gold from the Russian Federation since 2021. However, following the sanctions imposed on the Russian Federation, the United Kingdom of Great Britain and Northern Ireland significantly decreased its imports in 2022, while Switzerland doubled its imports in 2023.[176]

A 2024 study by SWISSAID, which included extensive interviews and cross-referencing of diverse data sources with official UN Comtrade statistics, reveals a significant risk of undeclared ASM gold mining across Africa.[177] This trend increased from 2012 to 2022, posing a major risk of this gold being illegally smuggled across borders, refined, and then entering the formal supply chain. Trade data shows that gold from African countries is mainly imported by Switzerland, India, and the United Arab Emirates.[178] In 2022, their imports accounted for 80 per cent of declared African gold.[179] Notably, the majority of industrial gold from Ghana and Mali is exported to South Africa, Switzerland, and India. In contrast, the United Arab Emirates imports

the vast majority of ASM gold.[180] In 2022, the country reported importing 626 tons of gold from 43 African countries, with a total value of USD 34 billion. This is approximately 58 per cent of the total value of all gold imported by the United Arab Emirates in 2022. This figure marks an increase from previous years, with a rise of over 15 per cent compared to 2021 and nearly 12 per cent more than in 2020.[181]

However, a closer analysis of UN Comtrade data for 2022 reveals significant discrepancies in reported gold trade between many African countries and the United Arab Emirates. A positive trade gap was observed with countries such as Mali, Ghana, Niger, Togo, Zambia, Kenya, and Benin, where the value of gold these countries reported exporting to the United Arab Emirates exceeded the value of imports recorded by the United Arab Emirates itself.[182] In other cases, including Guinea, Sudan, South Africa, Libya, Ethiopia, Eritrea, and Malawi, no bilateral gold trade was reported, leaving no data available to assess potential irregularity.[183] These gaps in reporting point to weaknesses in trade transparency and oversight, which are particularly concerning in relation to ASM gold trade.

There is also noticeable gap in the trade data of South Africa's reported gold imports and exports. South Africa is a major gold producer housing a large gold refinery, and it is also the main destination of declared exports from other African countries.[184, 185] A recent study found that a significant portion of gold mined in various African countries and exported to non-African countries is inaccurately reported as originating from South Africa. The value reported by non-African importing countries often exceeds the amount that South Africa officially exports.[186] As aforementioned, a major problem remains the large volume of ASM gold mined in Africa that is undeclared and which is frequently smuggled across borders. For instance, gold produced in Zimbabwe, a major ASM gold producer,[187] is often smuggled into South Africa, where it is refined and then exported to other countries, concealing its true origin.[188] The trade statistics also reveal inconsistencies and anomalies. Zimbabwe reported importing gold from South Africa until 2020, with the reported quantity being more than four times lower in 2020 compared to previous years. However, South Africa has never reported importing gold from Zimbabwe.[189]

BOX 2: THE UNITED ARAB EMIRATES GOLD SECTOR AND THE UAE GOOD DELIVERY SYSTEM (UAEGD)

The United Arab Emirates introduced a series of regulatory reforms following its Grey Listing by the Financial Action Task Force (FATF) in 2022, which identified deficiencies in the country's frameworks for anti-money laundering (AML), countering the financing of terrorism (CFT), and countering proliferation financing (CPF).[191] These reforms included the expansion of AML/CFT obligations to the Dealers in Precious Metals and Stones (DPMS) sector and the adoption of due diligence requirements based on the OECD Due Diligence Guidance to strengthen oversight and compliance. New AML/CFT regulations also impose stricter due diligence requirements on gold operators,[192] particularly in relation to supply chain risks.

In September 2023, the OECD published a new Handbook on *Environmental Due Diligence in Mineral Supply Chains*,[193] to support companies in incorporating environmental considerations when applying the OECD Due Diligence Guidance for Responsible Mineral supply chains. It is worth noting that under current FATF standards, dealers in precious metals and stones are not subject to mandatory cross-border reporting obligations, although some jurisdictions have begun addressing this regulatory gap.[194]

These inconsistencies, combined with noticeable gaps in data reporting, raise significant concerns about the actual origin and traceability of the gold. This analysis ultimately intends to highlight the complexities of gold trade routes and the potential for illegal activities that distort the economic landscape, suggesting that a large volume of ASM gold produced in Africa remains undeclared. While ASM gold can be legally sourced, it remains more vulnerable to smuggling and the influence of transnational organized criminal groups.[190]

South Africa is also a significant exporter of gold to the United Arab Emirates,[195, 196] with shipments typically traveling by air.[197] Many African countries, especially in Eastern Africa, have direct flights to Dubai, making the journey short and convenient.[198] Over the past decade, the United Arab Emirates has become a major global gold market hub, serving as a key transit point for gold trade to other countries. The country is home to approximately 10 refineries and several local and international gold bullion dealers.[199] In 2022, the major importers of gold from the United Arab Emirates were Switzerland, China, Türkiye, and India.[200] The United Arab Emirates has sought to further strengthen its role as a key player in gold refining and trade, particularly with the introduction of the UAE Good Delivery (UAEGD) system in 2021.

Gold trafficking

On a global scale, the production of gold is widespread (see Map 2). Production does not directly correspond to export as evident when comparing producing countries (see Map 2) with the major global traders (see Figure 4) and countries with refining capacity (see Map 3). Not all gold producing countries have refineries and not all places with refineries have manufacturing. This creates a complicated relationship between production, import and export. Although international regulations and due diligence standards have been established to monitor the gold trade, achieving full compliance with these standards remains a challenge on the African continent[201, 202] and elsewhere. Monitoring mechanisms for artisanal and small-scale gold are particularly fragile worldwide. This poses a serious issue, considering the substantial amounts of artisanally-sourced gold that go unreported and the risk of it being mined illegally.[203, 204]

Global flows of illegally sourced or traded gold occur through a complex network involving various actors, mechanisms, and criminal activities throughout the supply chain (see Infographic 1). Prior to reaching consumer markets, illegally sourced gold from unauthorized, conflict-affected, and high-risk areas may undergo local illegal trade or exploit institutional loopholes for laundering and subsequent legal commercialization at the national level. In the Amazon region, for example, criminal organizations engage in laundering of illicitly sourced gold through the falsification of documents and permits, misrepresenting the gold's origin as legal, and selling it to authorized businesses.[205] In Southern African countries, corrupt officials, security forces, and criminal organizations are involved in the laundering process of illegally mined artisanal gold, often melting the extracted gold to obfuscate its illegal origins.[206]

A trend observed in South America and several regions in Africa involves the smuggling of illegally sourced gold to neighbouring countries before export to other regions.[207, 208, 209] A 2023 study published by UNODC on gold trafficking in the Sahel revealed that most of the ASM gold trafficked from Mali, Niger, and Chad in recent years has been smuggled into neighbouring countries such as Togo, Burkina Faso, and Guinea.[210] Guinea has been a particularly attractive destination due to its favourable currency exchange conditions and lack of export taxes on ASM gold since 2016.[211] Gold smuggled from Burkina Faso has been recorded to frequently pass through neighbouring countries like Mali, Togo, and Niger, depending on factors such as security conditions and financial arrangements with buyers and traffickers, before reaching its final destination.[212] ASM gold operations in this region were often controlled by transnational crime groups and politically-motivated organized crime groups, making this trade particularly vulnerable to illicit activities.[213]

Gold smuggling may occur through collusion with corrupt officials or criminal organizations to circumvent customs controls and regulations.[214] Smuggled gold from Eastern and Middle Africa, for instance, enters other countries via hand-carrying and transportation by road and commercial flights.[215] In 2019, some countries in Eastern Africa reported gold exports totaling USD 1.25 billion, surpassing their annual production capacity, raising suspicions of significant smuggling from neighbouring countries.[216] Similarly, in South America, examples from Colombia and Venezuela show that gold can be smuggled to neighbouring countries, where it is refined and laundered before being sold in local markets or exported to international markets.[217, 218] Regional smuggling can be driven by various factors: a lack of refining facilities in the country of production, necessitating refinement elsewhere; less stringent regulations in neighbouring countries; lower commercialization taxes in neighbouring countries; and/or higher gold prices in neighbouring markets.[219, 220]

Once refined into bars and ingots with higher purity levels, tracing the origin and legality of this gold becomes even more challenging. After refinement, illegally sourced or illegally traded gold may find its way to the (legal) market and be exported to international market hubs. This has been documented , for instance, in the trade of gold and other metals such as tin and coltan from the Democratic Republic of the Congo to Rwanda and Uganda.[221] In international refining and trading hubs, loopholes can enable the laundering of illegal gold through legal channels.[222, 223] An analysis of gold from South Africa identifies factors such as inadequate implementation of trade regulations, insufficient border controls for hand-carried gold, and lack of thorough audits and money laundering regulation in large refineries, all of which contribute to the facilitation of illegal trade and international gold flows.[224]

Factors enabling the illegal gold trade

Studies conducted in various countries[225, 226] highlight different factors that facilitate the flow of illegally sourced or traded gold in specific contexts. Taken together, these factors include:

- Inadequate and outdated regulations and due diligence practices concerning artisanal and small-scale gold mining.
- Participation of powerful companies from high-income countries in illegal mining operations in producing countries (mostly low and middle income), often exploiting loopholes in regulations. (See *Examples of legal corporations or businesses involved in illegal activities* section for further details.)
- The high value of gold, even in small volumes, incentivizes individuals to smuggle illegally extracted gold, significantly contributing to its illicit flow.
- Corruption among public officials, border forces, and political figures, enabling the illegal movement of gold across borders and illegal commercialization.
- Weak border controls, which fail to detect and prevent the smuggling of gold and substances associated with its extraction, such as mercury.
- Low quality or lack of audits or oversight conducted in refineries, allowing illegally sourced gold to be processed and distributed.
- Absence of certification, rigid monitoring, and traceability systems, particularly concerning the origin of gold.
- Use of cash payments in gold trade transactions, facilitating anonymity of traders and making it difficult to track transactions.

BOX 3: INTERNATIONAL LEGAL AND POLICY FRAMEWORK

While few specific references to mining appear in international law, several international legal and policy instruments address the different aspects of illegality associated with mining and the trafficking of metals and minerals. These instruments aim to regulate the industry, prevent illegal activities, and promote sustainable and ethical practices, but are voluntary. Key instruments (divided into three categories and in chronological order) include:

1. INTERNATIONAL TREATIES:

- **International Labour Organization (ILO) Conventions:** Various ILO conventions, such as C182 on the Worst Forms of Child Labour and C169 on Indigenous and Tribal Peoples, are relevant in addressing labour issues in mining, including illegal mining practices. (1999/1989 – compulsory for States Parties)
- **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal:** prevents the cross-border dumping of hazardous wastes, including mining waste such as tailings, slag, sludge, and waste rock. It controls the export and import of hazardous mining by-products and requires the environmentally sound management of mining waste. (1989)
- **Stockholm Convention on Persistent Organic Pollutants (POPs):** Addresses pollutants from mining activities, such as the use of chemicals like cyanide in gold extraction. (2001)
- **Financial Action Task Force (FATF) International Standards on Combating Money Laundering and the Financing of Terrorism & Proliferation**: Standards for anti-money laundering and countering the financing of terrorism, with specific guidelines for dealers in precious metals and stones. (2012)
- **Minamata Convention on Mercury**: This international treaty is designed to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds, which are often used in artisanal and small-scale gold mining. (2013 – compulsory for States Parties)

2. PRINCIPLES AND VOLUNTARY GUIDELINES:

- **The Voluntary Principles on Security and Human Rights**: This set of principles guide oil, gas, and mining companies in conducting comprehensive human rights risk assessments in their engagement with public and private security providers to ensure human rights are respected in their operations and the protection of company facilities and premises. (2000)
- **United Nations Guiding Principles on Business and Human Rights (UNGPs):** These principles provide guidelines for States and businesses to prevent and address human rights abuses in business activities, including those in the mining sector. (2008)

3. REGIONAL AND SECTOR-SPECIFIC PROCESSES:

- **Kimberley Process Certification Scheme (KPCS):** Specifically targeting the trade in rough diamonds, the KPCS aims to prevent the flow of conflict diamonds and ensures that diamond purchases do not finance violence by rebel movements and their allies. (2003)
- **Extractive Industries Transparency Initiative (EITI)**: The EITI is a global standard for good governance in the oil, gas, and mineral sectors. It seeks to address key governance issues in the extractive sectors, with its focus on beneficial ownership, contracts disclosure, fiscal and legal arrangements, and revenue reconciliation and allocation. (2003)
- **OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas:** The OECD Guidance consists of a five-step framework providing companies all along the supply chains with sector-specific recommendations to identify and mitigate supply chain risks, including serious human rights abuses, conflict financing, tax evasion, money laundering, and corruption. It applies to all mineral and metal supply chains and has a global scope. (2011)
- **Andean Policy to Combat Illegal Mining, Decision No. 774:** This Decision approves the Andean Policy to Combat Illegal Mining, aimed at addressing illegal mining and related activities in a comprehensive, cooperative, and coordinated manner. These activities threaten security, the economy, natural resources, the environment, and human health. To this end, the Andean Committee to Combat Illegal Mining is established. (2012)
- **Organization of the Amazon Cooperation Treaty (Belém Declaration):** It includes a commitment to prevent and combat illegal mining. This commitment is specifically addressed in Articles 61 to 67 of the chapter on Police, Judicial, and Intelligence Cooperation in the Fight Against Illicit Activities, Including Environmental Crimes. (2023)

The actors

A diverse array of actors is involved in in minerals crime and related activities, ranging from traditional organized crime groups to actors in the legal economy and individuals operating for subsistence. They may serve as perpetrators, facilitators, or unwilling complicit buyers, traders, transporters or financers.

Traditional organized crime groups expand and/or diversify their illegal activities to benefit from illegally sourced minerals and metals, and the related profitable markets involving environmentally sensitive commodities. These criminal groups usually have a hierarchical structure with a centralized command. **Politically-motivated organized crime groups** are motivated by profit just as other OCGs, but the money typically funds their activities to maintain territory and challenge the government.

Businesses and corporations can be legitimate entities that engage in parallel, illegal activities to maximize their profits, or they may be specifically established for the purpose of undertaking illegal activities or engaging in illegal trade within the formal market.[227, 228, 229] Additionally, some businesses or corporations may facilitate illegal activities by failing to perform due diligence on their supply chain.[230] [231] It is important to distinguish between legal business façades, created and dissolved by OCGs depending on trafficking activities or money laundering needs, and legal businesses, which may operate parallel illegal businesses, businesses that may not do due diligence, those that unknowingly absorb illegally sourced metals and minerals, and those that intentionally do so.

Here, it is important to distinguish between artisanal and small-scale mining (ASM) and large-scale operations (LSM). ASM operations are usually smaller in scale and can be either legal or illegal operations with predominantly simplified forms of exploitation, extraction and transportation, whereas large scale operations are more frequently conducted by legal entities, which may or may not be engaged in illegal activities.[232]

Lastly, **individuals or loosely organized individuals** include a broad range of actors who engage in illegal activities but are not directly linked to any OCGs or politically-motivated organized crime groups, even though some may form alliances with OCGs.[233]

Table 1 provides a general overview of the main actors and their involvement at different stages; however, it should be noted that it does not capture the full complexity of the different actors. Furthermore, this classification does not preclude the existence of overlaps, as illegal activities in the mining sector may involve the collaboration or assistance of multiple actors at the same stage of the supply chain. All actors may rely on corruption to advance their activities. Corruption can include bribery to gain access to mining sites or to enable minor illegal activities, as well as grand corruption or state capture as strategic approaches.[234]

BOX 4: DIFFERENCE BETWEEN INDIVIDUAL MINERS ENGAGING IN ILLEGAL MINING AND ASM MINERS

It is important to distinguish between ASM miners and individual illegal miners based on their intent, legal standing, and scale of operations. ASM miners typically engage in small-scale, subsistence-driven mining, often operating informally due to several factors such as excessive state control and prohibitive licensing fees. Costly and complex bureaucratic procedures can exclude small-scale or informal miners from legal operations.[235] While their activities may not fully comply with legal frameworks, many countries recognize their status, and they are not considered criminal from a criminal law perspective. In contrast, individual illegal miners deliberately violate national, regional or international laws, engaging in activities such as mining in protected areas, using illegal substances or equipment, and evading taxes.[236] Some may also be linked to organized crime groups. Economic hardship, lack of legal opportunities, and the high value of metals and minerals may serve as incentives, pushing individuals toward illegal mining operations. Although a widespread phenomenon, illegal subsistence mining is not addressed in this study.

Actors of upstream and downstream activities

UPSTREAM ACTIVITIES (exploration, extraction, trade)		DOWNSTREAM ACTIVITIES (refining, export, final manufacturing)
ASM	LSM	Companies/corporations Transnational organized crime groups (national and international traders)
Individual miners or loosely organized individuals Small or medium sized businesses Politically-motivated organized crime groups Organized crime groups	Companies/corporations Politically-motivated organized crime groups Organized crime groups	

Source: UNODC's elaboration.

Organized crime groups

Studies have shown that different OCGs across different regions have adapted to changing circumstances by evolving into entrepreneurial organizations.[237] [238] [239] Illegal mining, particularly gold mining, is highly lucrative and in Colombia or Brazil, for example, has been shown to be intertwined with other serious crimes in the same territories.[240] [241] Therefore, it is crucial to understand OCGs in the mining sector not as independent actors, but as part of a larger, increasingly complex network of criminal activities involving multiple actors. For instance, in South America, OCGs have developed by creating and using shell companies to launder money from drug trafficking. They established intricate transnational networks involving corporations in various countries to launder illicit proceeds.[242] [243] In Ecuador, since 2023 there has been growing evidence of OCGs taking control of gold mining sites alongside other criminal activities, such as extorting miners for fees, drug trafficking and arms smuggling. This has contributed to a rise in violence and instability in affected regions.[244]

In the Sahel, some transnational OCGs control mining operations and smuggle gold across borders to Western Asia, depriving Sahelian countries of millions of dollars in fiscal revenue each year.[245] In some parts of South America, these groups may also form alliances, sharing information or accessing smuggling routes to enhance their operations.[246] (See *Crime convergence and connectivity* section for further details)

Politically-motivated organized crime groups

Politically-motivated organized crime groups may control remote regions or areas with weak state presence, often have political or ideological objectives and resort to violence to pursue their goals.[247] The involvement of such groups has been documented in parts of Africa, South America and in Southern Asia,[248, 249, 250] where illegal activities related to mining provided financing, enabling them to sustain and expand their operations, including territorial control and the acquisition of weapons. Whether an OCG is politically-motivated or not is not always clear, as there can be overlaps. OCGs may form alliances to fund their operations or adopt an ideological-political façade to legitimize their activities.

Examples show that politically-motivated organized crime groups may establish their presence primarily through violence, intimidation, extortion, and corruption – tactics that are also commonly employed by OCGs, with violence being a key component.[251] In the Democratic Republic of the Congo and the Central African Republic, mining profits have been used to fund their activities and maintain territorial control, thereby challenging state authority.[252] [253] The consequences for the local population are often severe, including vulnerability to unemployment, sexual exploitation, forced labour, including child labour, and displacement of populations, which can lead to recruitment into militias or forced labour in mines. In Afghanistan and Central African Republic, local power brokers have leveraged existing ethno-religious tensions to exploit local populations for recruitment of new militia and patronage payments, trapping communities in a cycle of broader ethno-religious conflict.[254]

Mining territories not only provide economic advantages but also strategic power, allowing these groups to influence local communities and establish authority. The United Nations Environment Programme (UNEP) has proposed a typology for the involvement of politically-motivated organized crime groups in mineral resources exploitation in Middle Africa, which may also be applicable to other regions.[255] This includes politically-motivated organized crime groups – and in some cases also OCGs – acting as a) security providers for mine operations, b) those directly stealing minerals, and c) groups controlling the entire supply chain from extraction to sale.

The UN Security Council Counter-Terrorism Committee Executive Directorate reported in 2022 that the mining of gold and other precious metals and minerals had become an increasingly significant source of terrorism financing for terrorist groups, such as the global affiliates of the Islamic State of Iraq and the Levant (ISIL) in Africa, especially during the COVID-19 pandemic.[256, 257] Terrorism financing through the mining sector may originate from various sources, ranging from direct control of mining sites, kidnapping for ransom, misuse of non-profit organizations, and illegal trading of minerals like oil, gold, diamonds, among others.[258] The Security Council Panel of Experts on Mali reported that miners and gold merchants in some areas of the Sahel must pay the finance unit of the Coordination of Movements of Azawad (CMA) to work there.[259] Politically-motivated organized crime groups in the Sahel are drawn to illegal mining for three main reasons: financial gain, territorial control, and community influence.[260]

By providing employment opportunities, mining attracts new recruits and can boost the standing of politically-motivated organized crime groups in the community, bolstering their overall power and social support in the region. For instance, it has been reported that the presence of politically-motivated organized crime groups in Côte d'Ivoire also affected the buying price of gold, often forcing the price down within their areas of influence (reportedly at 60 per cent or less of the London Bullion Market Association (LBMA) value of gold), which further benefits these groups by maximizing their profits.[261]

In addition to gold smuggling, in South America, FARC and ELN were also known for having smuggled coltan across regional borders using established routes, including maritime ones. This occurred alongside the drug trade, contributing to the financing of drug cartels. In 2021, two investigations into the activities of an ELN member and a FARC dissident group led to a seizure of around 6.2 kg of coltan, estimated at more than USD 2 million.[262, 263]

Examples of legal corporations or businesses involved in illegal activities

In Colombia there have been cases of collaboration between individuals affiliated with an OCG and gold companies.[264] Court cases in the United Kingdom of Great Britain and Northern Ireland and the United States of America have shown that corporations have been involved in bribing local authorities for mining licences, operating without necessary permits, and bypassing established labour and environmental standards, including neglecting consultations with local communities. Further, corporations have been implicated in corrupting state officials and money laundering.[265, 266, 267] In Rwanda supply chain negligence has stood out as a primary facilitator, with companies failing to adequately vet their suppliers or subcontractors, thus allowing illegally-sourced metals and minerals to infiltrate their supply chains.[268] This negligence has also been documented in Latin America, where it enables the flow of metals and minerals obtained through illegal mining practices, contributing to the demand for such materials.[269] In the case of metals and minerals mined in conflict areas like coltan in the Democratic Republic of the Congo, companies have been criticized in the media for turning a blind eye to the origins of the metals and minerals in their supply chains, thereby indirectly fuelling illegal mining operations.[270] Furthermore, certain companies have been reported to be connected to OCGs involved in illegal mining operations in Colombia.[271]

Another way in which illegal profits are made in the mining industry is by setting up shell or front companies to avoid regulatory oversight.[272] As documented in Latin America and the Caribbean, companies or OCGs operating through legal shell entities can exploit regulatory loopholes and launder money. This is achieved through activities such as extracting metals and minerals in quantities that exceed permitted limits, as well as engaging in other illegal economic activities, such as drug trafficking.[273, 274] Front companies may exploit lax regulations in certain jurisdictions or take advantage of ineffective oversight mechanisms to continue their illegal activities with minimal risk of detection or intervention. Also, utilizing front companies helps shield the parent company from legal liabilities and reputational damage associated with illegal mining.[275]

One of the largest refiners and traders of precious metals based in the United States of America was involved in a case of money laundering. Operating through local subsidiaries, this corporation accepted gold from particular suppliers, primarily based in South America, without adequately requesting or obtaining information on the gold's source and origin. The investigation uncovered that the gold had been smuggled across borders, with suppliers utilizing rotating front companies to obscure its origin and that these specific suppliers were trafficking illegally sourced gold. In 2018, the corporation was convicted of failing to comply with anti-money laundering laws and was fined, while three former employees were sentenced to imprisonment for money laundering.[276, 277]

In 2022, one of the world's largest corporations, involved in both the mining and energy sectors and based in the United States of America and Switzerland, pleaded guilty to bribery charges and widespread corruption to secure business advantages in many countries in Africa and Latin America. The investigation revealed that the corporation was operating in various countries to manipulate markets and undermine local government structures to secure business interests and licences. The corporation was convicted by courts in both Northern America and Northern Europe and sentenced to pay substantial fines.[278, 279]

Furthermore, firms might engage in unlawful practices by bypassing established labour, safety, and environmental standards, thereby generating profits illegitimately.[280] One example is a case involving a European corporation operating a copper mine in Eastern Africa. In 2019, the corporation was sued by a local community for polluting soil and water sources, which adversely affected their members' health and livelihoods. The corporation agreed to settle the claims without admitting liability.[281]

Individual miners or loosely organized individuals

A lack of economic opportunities can drive individuals to take extreme risks and engage in the illegal mining as a means of survival. Limited access to legal rights further entrenches this issue, as seen in South Africa in the context of illegal gold mining, where many artisanal and illegal miners are drawn to work illegally in abandoned mines due to their status as unregistered foreigners with few legal alternatives.[282] Additionally, excessive state control, prohibitive licensing fees, and costly and complex bureaucratic procedures can exclude small miners from legal operations.[283] All these factors can push them towards illegal mining as a means of survival.

Estimating the numbers of individual miners or quantifying the productivity of these activities is difficult. Nonetheless, studies conducted in specific countries provide some information on the scale of this phenomenon. For instance, in South Africa, estimates range from 8,000 to 30,000 individuals engaged in clandestine mining operations.[284, 285]

Examples from several countries, such as Venezuela, Peru, and the Democratic Republic of the Congo, show that individual miners may be exposed to violence and intimidation by criminal groups who force them to take part in illegal activities or facilitate illegal operations.[286, 287, 288] These small-scale miners, working outside the legal framework, may not be able to formally secure property rights or access legal recourse. They therefore may be forced to rely on organized criminal groups to sustain their livelihoods or to be protected from other criminal groups in the same areas. A 2016 OECD report states that, “lack of legal certainty increases the likelihood of predatory behaviour in search of immediate profits, eschewing long-term investments that would boost productivity while conserving natural capital”.[289] Due to the social embeddedness of organized criminal groups in local communities and the control they may have on the political order, these miners often choose not to report their victimization to the police.[290]

Modus operandi

Criminal strategies

Some of the modus operandi employed by criminal actors along the supply chain include:

- **False declarations of origin or value**: This involves misrepresenting the source of minerals, metals, and gemstones, often declaring them to be extracted from authorized or in-process-of-formalization mines or even depleted legal mines. The earlier illegal metals and minerals enter the legal supply chain, the more difficult it becomes for law enforcement authorities to distinguish them from legally mined products. Criminal actors also mis-declare the true value or nature of the metal or mineral to circumvent existing regulatory frameworks or for tax avoidance.[291] For example, importers have been found to smuggle scrap gold from Central to Northern America at an undervalued price, later providing payments to the exporters at overvalued amounts.[292, 293]
- **Extortion for protection:** In some mining areas, security can be a major concern for both ASM and LSM operators. They may be forced to pay protection money to organized crime groups in order to be able to operate in certain areas. Security threats include the abduction of miners/employees for ransom, attacks and pillaging.[294] Criminal groups often control and influence the supply chain of controlled substances (e.g., mercury and cyanide) and may provide informal miners with various types of machinery and equipment for their mining operations.[295, 296]
- **Use of front or shell companies for illegal purposes:** such entities can be established to facilitate the extraction, transport and sale of illegal metals and minerals, as well as the purchase of mercury or machinery. These entities exploit regulatory loopholes and may be set up by criminal groups to launder money from illegal mining or other illegal activities, such as drug trafficking, helping to conceal the criminal origins of the proceeds. Front companies enable these groups to take advantage of lax regulations and ineffective oversight, minimizing the risk of detection and protecting the parent company from legal and reputational damage.[297] Additionally, front or shell companies are also commonly used in the smelting, refining, and trading/export stages to further launder illegal proceeds.[298] Other businesses such as hotels and dance clubs visited by those who mine illegally may also play a role in smuggling the stolen products out of the mine.[299] They may also be used to funnel illicit payments to organized criminal groups present in the area.
- **Concealment tactics** involve a variety of methods to avoid detection, including burying of machinery in the ground and the disguise of precious metals and minerals, for instance, by covering them with steel or silver layers or by using them in the form of jewellery declared as personal possessions to avoid security checks.[300] Precious metals are often transported in an unrefined or semirefined state to international refiners. To smuggle gems from mines to brokers in other countries, organized criminal groups may use individuals using virtually every means of transportation (especially airplane, but also cars, trucks, trains and boats). A media report highlights that women have been forced to cross dangerous areas and multiple border checkpoints where inspections by officials are lacklustre.[301] In Bolivia, gold was illegally transported in shielded vehicles, motorcycles and planes.[302]
- **Theft of metals, minerals and gemstones:** Three criminal strategies to steal from legal mines have been described in the diamond industry.[303] These practices could also be applied to other (precious) commodities, such as gold.

- **Infiltration:** criminal actors gain access to mining operations with the intention of stealing and trafficking diamonds from within.
- **Coerced or corrupt cooperation:** criminal organizations manipulate licenced miners or other industry employees, either through threats or lucrative offers, to facilitate theft.
- **Robbery during transport:** diamonds are stolen while being transported from mines to their next destination.

Corruption

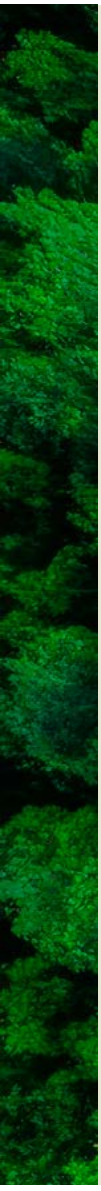
Corruption has been documented in different regions and may involve accepting bribes from individuals involved in illegal mining activities in exchange for turning a blind eye to their operations or providing them with protection from legal consequences.[304] [305] For instance, a UN Group of Experts uncovered instances where criminal groups used fraudulent export documents obtained through corruption to transport gold from the Democratic Republic of the Congo to Uganda.[306]

State actors may coordinate with criminal actors involved in illegal mining, providing logistical support, access to resources, or protection in exchange for financial gain or other benefits. One example from a study conducted in Ghana revealed a systemic issue of corruption within state institutions, where various actors, including chiefs, government officials, and local elites, benefit from illegal mining operations.[307] Instances have been highlighted where politicians offer protection to organized criminal groups in exchange for financial support during election periods, perpetuating a cycle of weak or poorly enforced regulations and support to criminal groups.[308]

The pervasive risks of fraud and corruption of national officials permeate the entire supply chain,[309] encompassing procurement processes, security protocols, regulatory frameworks (including licences and permits), and logistical management aspects. In LSM, concerns are primarily centred around the bribed acquisition or negotiation of mining rights, especially when expanding into new markets or during the process of obtaining licences,[310] as well as the involvement of intermediaries and subcontractors. As shown in a court case in the United Kingdom of Great Britain and Northern Ireland, corruption can be used by corporations, as previously mentioned, to secure business advantages, such as paying off local officials and manipulating regulations, thus undermining local governance structures to further business interests.[311] Another court case in the United Kingdom of Great Britain and Northern Ireland in 2024 shows a similar pattern of state officials paying bribes for mining rights. However, in this case, the corporation played an active role in reporting the corruption to law enforcement, leading to an investigation. The officials were found guilty and sentenced.[312]

In South-eastern Asia, corruption has also been reported as a facilitator of illegal mining activities.[313] In August 2023, media sources reported that Indonesian authorities arrested a former top mining ministry official accused of facilitating unlawful mining of nickel that caused a loss of approximately USD 375 million in state revenue. The companies allegedly involved were mining on 157 hectares of land that was part of a concession belonging to a state mining company, resulting in significant losses in state revenue.[314] According to the Organization of American States, investigations have uncovered widespread corruption within Ecuador's Mining Regulation and Control Agency (ARCOM) and the Ministry of Energy and Mines. A 2021 report indicates that officials engaged in irregular practices when issuing mining permits and concessions, often in exchange for bribes. This corruption has facilitated the authorization of numerous illegal mining operations, allowing companies to exploit resources without proper regulation.[315]

Additionally, as shown in Western Africa, some companies may engage in corrupt practices by bribing government officials or law enforcement agencies to overlook their illegal mining operations or facilitate their non-abidance to existing regulations.[316] By bribing national officials, these companies evade regulatory oversight and enforcement, allowing them to operate outside the bounds of the law to make a profit. For instance, companies in South-eastern Asia and Africa have been known to bribe officials to overlook their illegal mining operations or obtain fraudulent 'Mining Business Permits' as the licensing process is time-consuming, requires many legal documents, and is costly.[317] [318] A key factor enabling this corruption is the lack of transparency around beneficial ownership, which allows companies to hide their true owners and further evade accountability in the licensing and regulatory process.[319]



BOX 5: CASE STUDY ON CORPORATE INVOLVEMENT IN MONEY LAUNDERING ASSOCIATED WITH ILLEGAL MINING

In 2022, a major global commodities trading and mining corporation pleaded guilty to multiple corruption charges. The corporation, based in Northern America, Northern and Western Europe, employs over 140,000 people and operates in the mining and energy sector worldwide.[320] A 10-year investigation in Northern Europe and Northern America revealed a complex strategy to manipulate markets and secure business through illicit means. The corporation admitted to paying millions in bribes to government officials in several countries in Africa and South America, disguising the payments as legitimate business expenses. It also engaged in market manipulation, artificially influencing commodity prices and manipulating offers to obtain favourable contracts. To facilitate these activities, it used offshore accounts and shell companies to launder money and conceal the true nature of transactions. The investigations uncovered a corporate culture that tolerated and sometimes encouraged unethical practices. The guilty plea resulted in substantial fines and compliance reforms, underling the need for stricter oversight. Although the corporation was primarily found guilty of bribery and manipulating fuel oil markets to secure oil contracts in many countries in Africa and Latin America, it was also found guilty of using similar schemes in its copper and cobalt mining operations in Middle Africa.[321, 322]

Crime convergence and connectivity

In the illegal mining sector, especially gold mining, strong links have been documented between illegal mining and other criminal activities, such as human trafficking, human rights violations, financial crimes, drug trafficking, and crimes that affect the environment. This intermingling of multiple criminal operations can include connectivity between criminal markets and the convergence of criminal practices.[323, 324] Illegal mining serves both to generate proceeds and as a method to launder money from other criminal activities.[325] For example, a 2023 UNODC report on drug trafficking in the Amazon highlights that drug trafficking organizations are diversifying their activities, using their technical skills and networks to trade and ship other raw materials, including (precious) metals and minerals.[326] In 2022, the Brazilian Federal Police launched three operations (Ganância, Golden Greed, and Comando) targeting illegal gold mining and associated crimes such as corruption, money laundering, and organized crime. The investigation revealed that a criminal group had created its own cryptocurrency to launder money from illegal gold mining operations, demonstrating the evolving technical methods used to conceal proceeds. Additionally, the operation uncovered severe environmental damage caused by illegal mining. These investigations resulted in multiple arrests, asset seizures, and the blocking of accounts tied to the group.[327, 328]

This diversification is probably driven by the high-profit, low-risk nature of the sector, particularly in the case of gold after the 2008 financial crisis, when its price surged exponentially.[329] Studies also highlight significant overlaps between the illegal mining sector and other forms of organized crime, including trafficking in persons, forced labour, child labour and trafficking for sexual exploitation. Moreover, criminal groups may evolve into business enterprises in response to external circumstances.[330] These illegal economies are intertwined and sustain each other. For example, mining creates a demand for labour and sexual services, which is supplied by trafficking in persons and exploitation. Additionally, financial profits from other illegal activities are often reinvested into mining operations.[331, 332]

BOX 6: ILLEGAL GOLD MINING IN BRAZIL

A series of UNODC studies examine small-scale gold mining activities in the Tapajós River Basin, Pará, in the Brazilian Amazon. This region, known for small-scale mining activities, is home to diverse species and protected areas. The research, conducted in partnership with research institutions in Brazil and the United States of America, found that two-thirds of the region's gold production is illegal. This illegal mining, facilitated by complex laundering mechanisms, leads to severe socio-environmental destruction. Based on over 800 interviews with gold miners (*garimpeiros*) in early 2023, the study found that 40 per cent of *garimpeiros* are potential victims of trafficking for forced labour. Among the workers, 44 per cent reported fraudulent recruitment and poor working conditions, averaging 12.5 hours a day and 6.5 days a week. Health issues are widespread, with 71 per cent suffering from conditions including anxiety and depression, and 44 per cent having experienced serious accidents. Additionally, 61 per cent of the miners expressed a need for support services to find new jobs, and most were unaware of their labour and human rights. The research also highlights the convergence of other crimes with illegal goldmining, such as crimes that affect the environment and crimes against the rights of Indigenous people, involving encroachment on Conservation Units and Indigenous Lands. There is significant trafficking of women and girls for sexual exploitation, along with reports of sexual and gender-based violence. Violent deaths have also risen in recent years. Furthermore, there is a noticeable intersection between illegal gold mining and drug trafficking, evidenced by the shared use of private runways and supply points, and money laundering operations.[333, 334, 335]

Crime convergence has also been reported in the Sahel region, where "many gold-mining areas are located along historic regional trafficking routes and have evolved alongside – and with linkages to – various illicit economies, such as drug trafficking, human smuggling, arms trafficking and banditry, some of which largely pre-date the gold rush".[336] The regional instability has also facilitated the proliferation of criminal actors, such as politically-motivated organized crime groups around gold-mining areas, which in turn have often become logistical hubs for trafficking activities.[337] There are numerous reports regarding trafficking for the purpose of forced labour around goldmining activities in West Africa and the Sahel region. Traffickers deceive prospective miners into coercive labour agreements where miners are not able to end their employment and their attempts to escape expose them to risks of violence and retaliation from the employer.[338] Forced labour has also been reported in other geographical contexts.[339] Again, as small-scale mining sites are often located in remote areas, it is very difficult for authorities to identify and rescue victims of such abuses. Women and children are particularly vulnerable as they are not only exploited as cheap labour in the mining sites, but are subjected to sex trafficking, sexual abuse, domestic violence and other human rights abuses. According to a small study conducted in Bolivia in 2014, of the 45,000 people who were reportedly working in illegal goldmining, some 13,500 were children, almost half of whom were unpaid.[340] In 2015 a World Bank study estimated that "globally there are considerably more than two million children engaged in child labour in ASM and quarrying".[341]

The nexus between drug trafficking and illegal mining has been reported in different regions, with the proceeds of each activity often being reinvested into the other. In Colombia, gold mining has been infiltrated by organized criminal groups connected to the drug trade.[342] Additionally, a 2022 study by UNODC shows that in 44 per cent of Colombian territories with alluvial gold exploitation, coca cultivation was also present.[343] Unlike drugs, illegal mining allows transnational criminal organizations to benefit from a legal supply chain, making it easier for them to conceal their involvement by mixing illegal activities with legitimate trade. A media report indicated that in Brazil's Ama-

zon region, the Federal Police investigated links between drug traffickers and illegal gold mining, where gold mining was used to launder proceeds from drug trafficking activities.[344, 345] In Central America, drug cartels are known to engage in illegal iron mining.[346] Similar multifaceted criminal engagements are observed in Mexico, where criminal groups are involved in diverse activities, including trafficking in persons, illegal firearms trade, train robberies, alcohol and cigarette smuggling, kidnapping, extortion, and illegal oil tapping and mining.[347] In recent years, this trend was also observed in Ecuador, where OCGs that gained power through their involvement in drug trafficking have begun diversifying their criminal activities. This change, particularly evident since 2022, was driven by a combination of intensified anti-drug efforts and the fragmentation of criminal gangs, prompting them to seek alternative sources of revenue. Illegal mining emerged as a highly profitable option.[348] Similarly, in South-eastern Asia, especially in conflict areas, the 2024 UNODC World Drug Report points out that illegal mining and smuggling of precious stones, gold and rare earth elements have become a critical source of income for politically-motivated organized crime groups and other criminal actors.[349]

Harms from minerals crime

Illegal mining not only poses a direct threat to the well-being and rights of the communities residing in mining areas but also jeopardizes a healthy environment for present and future generations. The consequences of deforestation and soil erosion resulting from mining extend beyond the immediate mining sites, impacting surrounding ecosystems and communities.[350] Local communities, especially Indigenous groups living in affected areas, are the first to feel the impacts of mining operations.[351] Indigenous communities are especially vulnerable during the exploration and extraction stages, which often have significant effects on Indigenous territories. These operations can lead to environmental degradation, cultural erosion, and displacement of local populations. Traditional livelihoods, such as agriculture and hunting, may be disrupted, affecting the well-being and health of Indigenous people who additionally often suffer from a lack of respect for their right to free, prior, and informed consent.[352]

Recent research has found a substantial 625 per cent surge in illegal mining areas within Indigenous lands in the entire Amazon region, including Brazil, Venezuela, Colombia, Ecuador, Peru and Bolivia, over the past decade.[353] In the Brazilian Amazon region, Indigenous peoples are also affected by smoke pollution from deforestation fires within their lands, which partially may be linked to illegal mining.[354]

Illegal mining operations necessitate a support network involving heavy machinery (backhoe shovels, jet nozzles, dredges, rafts), fuel[355] and in some cases toxic substances, such as mercury and cyanide. According to one scholar, "the unabated illegal mining in the Amazon violates the Yanomami right to life because their lives, culture, and religion are inextricably linked to the Amazon and its natural resources".[356] Mercury poses severe risks to workers, the local environment, and communities whose livelihoods depend on natural resources. As an illegal substance, its trade and use are regulated under the Minamata Convention,[357] yet it remains widely used in artisanal gold mining to separate gold. This illegal practice has irreversible consequences for human health and the environment.[358, 359] (See more on how illegal mining contributes to the triple planetary crisis in the full *Global Analysis on Crimes that Affect the Environment*.) A recent study conducted in tropical forests across four countries in Central and South America, sub-Saharan Africa, and South-eastern Asia has highlighted the impact of crimes that affect the environment on women, particularly those from Indigenous communities. Women hold the responsibility for food and water security, and their households rely on the forests for various necessities such as food, clean water, construction materials, firewood, natural medicines, and land for agriculture. However, due to activities like illegal mining, logging, and land grabbing, women are forced to travel deeper into the forests, increasing their exposure to the risks of violence and sexual assault as well as sexual corruption to access necessities, especially near the mines which are areas predominantly controlled by men. In addition, some women may seek employment in domestic roles within logging and mining camps, which also places them at risk of violence and assault.[360]

Illegal mining may also contribute to social inequality within affected communities. It has been shown that the economic gains from illegal mining operations in Latin America are often concentrated in the hands of a few, leading to disparities in wealth distribution.[361] Miners working in illegal mines are also vulnerable to various negative health hazards. In illegal mines in some parts of Africa, generators are often used to power drills, which can lead to fumes accumulating in the underground tunnels due to insufficient ventilation and compliance with safety regulations. These high concentrations of poisonous gases can cause workers to experience dizziness and faint, with significant risks of fatalities.[362, 363] People who illegally mine also use explosives in underground tunnels, facing the constant threat of the mine collapsing, as seen in South Africa.[364] It can be deduced that miners working in illegal mining sites are likely to face greater risks and more dangerous working conditions due to the lack of proper equipment, exposures to hazardous substances, inadequate safety measures and the absence of emergency response protocols.

As shown in Ghana, mining operations may exploit vulnerable populations, such as undocumented workers or children, who can be subjected to unsafe working conditions, minimal wages, and lack of legal protections, further perpetuating the cycle of exploitation and poverty.[365] In South Africa, a study found that in 2019 the large majority of those arrested for illegal mining were undocumented migrants.[366] These companies reduce labour costs and increase profitability by employing those who do not have the right to work, further incentivizing their involvement in illegal mining activities. In Ghana, thousands of children work in artisanal and small-scale gold mines in hazardous conditions, despite both national and international laws prohibiting hazardous child labour.[367] In two small studies in India, research shows that child labour has increased in recent years and occurs mainly due to the lack of regulation of the sector and the scarcity of alternative income opportunities for adults.[368, 369] Child labour, especially in ASM operations, is a global issue. According to a 2019 ILO publication, over than 1 million children are engaged in mining activities worldwide.[370]

Additionally, children, including girls and boys, and women are particularly vulnerable to sexual exploitation near illegal mining areas in various regions.[371] Several studies indicate that illegal mining zones are male-dominated areas and significant hubs for sex trafficking. This is largely due to the high demand for sexual services in these areas, which predominantly employ men who create a market for sex workers.[372, 373] In Peru, one study illustrates how the exploitation of men in artisanal and small-scale gold mining is closely linked with the sexual exploitation of women. These intertwined economies create mutual dependencies. Women are often recruited to work in bars near mining sites, where bar owners act as their guardians. These women are forced to sell alcohol and sexual services to the miners while being coerced into alcohol consumption themselves. This leads to addiction and further exploitation, as the miners spend their wages on alcohol and sex services, perpetuating the cycle of exploitation.[374]

Overview of policy responses

Increasing transparency and data production

Illegal gold mining is mostly enabled by systemic weaknesses in transparency, governance and enforcement. While some progress has been made through international frameworks and corporate due diligence programmes, these efforts remain fragmented and inconsistently implemented across jurisdictions.

One key vulnerability in the gold supply chain is the lack of transparency and data on mining operations. This limits the ability of downstream actors, including exporters and manufacturers, to verify whether their suppliers are sourcing gold legally.[375] Poor traceability, limited data on corruption (including bribery and fraud), and weak enforcement further obstruct efforts to address these crimes effectively.

Several policy responses have been encouraged to address these vulnerabilities. Firstly, facilitating experience-sharing and exchanges at regional or international levels can support reform processes, fostering intra-governmental coordination, and improving information exchange among relevant stakeholders.[376] This should include non-state actors such as civil society organizations, local communities, and the private sector. Engaging the local population is essential, through targeted awareness-raising, the establishment of whistle-blowing systems with protection mechanisms and the integration of a gender perspective. Empowering women in decision-making and supporting their economic inclusion through access to credit, capacity-building programmes and resources for transition to alternative sources of income, are crucial to ensure sustainable and inclusive progress.

Secondly, anti-corruption instruments play a crucial role in promoting accountability and integrity. Strengthening transparency in beneficial ownership helps prevent the misuse of anonymous entities to facilitate illicit financial activities. Greater transparency in business operations, corruption risk assessments and the implementation of risk management strategies are key to reducing vulnerabilities. The involvement of local communities in oversight mechanism is also crucial, helping to promote a culture of accountability and combat corruption at all levels.

Thirdly, minerals crimes are often committed across multiple jurisdictions along the supply chain. Establishing a minimum framework for the gold supply chain across regions is essential to tackling illegal activities more effectively. Such a framework would address regulatory gaps that allow unsustainable and illegal practices to persist, while enabling stronger investigation and prosecution. It should be based on an assessment of existing regulatory, control, and enforcement mechanisms in different countries, providing the foundation for more coherent policy responses. Specialized training for prosecutors is also needed to enhance their ability to pursue cases across the supply chain and improve international judicial cooperation.[377] Expert group consultations involving national and international specialists can support data collection, analysis, and risk assessments, and contribute to the development of national enforcement strategies.[378]

Finally, the need for standardized data reporting and improved transparency in mining is critical, particularly in regions where corruption and poor oversight distort available information. Standardization would allow for more accurate assessments of legal and illegal mining activity and support evidence-based

policymaking and enforcement. It should be accompanied by a strong commitment to transparency, ensuring that mining data is not only available, but also reliable and consistent across regions and mining operations.[379]

Reinforcing legal and policy frameworks

A key vulnerability in the mining supply chain lies in weak legal and regulatory frameworks and their poor implementation, despite growing recognition of the need for robust policies to secure sustainable and stable mineral resources. National legislation plays a crucial role in regulating ownership, safety, and environmental standards in mining activities. UNODC has developed a legislative guide to support policymakers in strengthening national laws in line with the UN Convention against Transnational Organized Crime (UNTOC) and the UN Convention against Corruption (UNCAC).[380] Additionally, as outlined in the first part of this *Global Analysis on Crimes that Affect the Environment*, the Landscape of Criminalization, UNODC found that 124 out of 193 UN Member States criminalize violations of mining-related laws, with 54 applying penalties that meet the UNTOC threshold of serious crime (a maximum deprivation of liberty of at least four years or a more serious penalty). Among the five global sub-regions, Africa shows the highest level of criminalization, although critical data gaps remain, particularly in Western Africa. By contrast, several Central Asian countries lack legal provisions to criminalize mining-related offences, exposing significant regulatory gaps.[381]

BOX 7: DUE DILIGENCE AND THE IMPACT OF THE US DODD-FRANK ACT

Over the last decade, due diligence frameworks, such as Section 1502 of Dodd-Frank Act, implemented by the United States administration in 2010, have contributed to strengthening transparency in mineral supply chains. Section 1502 requires companies to disclose their use of conflict minerals sourced from the Democratic Republic of the Congo and neighbouring countries, aiming to prevent the financing of armed groups. These frameworks have helped companies better identify smelters and refiners and leverage more consistent international trade data.[382]

The UN Group of Experts on the Democratic Republic of the Congo reported to the President of the Security Council in 2020 that due diligence programmes, initially established in response to the US Dodd-Frank Act,[383] have improved transparency in the tin, tungsten, and tantalum (3T) sector in the Great Lakes Region of Africa.[384] A 2020 study in the Democratic Republic of the Congo found that, in areas where due diligence programmes were implemented, military interference in mining decreased by 27 per cent, alongside by a 58 per cent increase in tax collection and service provision.[385] Another study from the same region highlights that companies began distancing themselves from conflict-linked mineral sourcing in Dodd-Frank-covered countries, driven by public scrutiny and reputational risk.[386] This responsible sourcing approach suggests that mining regions in Dodd-Frank-covered countries may be more effectively regulated compared to those in non-covered countries, leading to improved mineral origin declarations, reduced intra-regional smuggling and more accurate chain of custody documentation resulting.[387]

However, the Dodd-Frank Act has notable limitations in its design.[388] Studies suggest that politically-motivated organized crime groups in eastern Democratic Republic of the Congo relocated from 3T mining to unregulated gold mining areas following the enactment of Section 1502 of the Dodd-Frank Act.[389, 390] A 2017 study using georeferenced data found that violence escalated in gold-mining areas, with armed actors engaging in more frequent battles, looting and attacks on civilians. This change has also attracted artisanal miners to the gold mines, creating new security risks and exacerbating instability.[391]

Additionally, challenges remain in corporate sustainability reporting, as most disclosures occur at the corporate level rather than providing transparency at individual sites.[392, 393] Furthermore, while due diligence measures have helped restrict the illegal financing of politically-motivated organized crime groups, their implementation has been inconsistent and not fully effective.[394, 395]

At the international level, tools such as the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas sets international standards for responsible sourcing and transparency in mineral supply chains.[396] This framework has been integrated into law in multiple producing, processing, and importing countries. Another example is the launch of the IEA's Critical Minerals Policy Tracker in 2022,[397] collecting over 400 policies related to critical minerals from more than 35 countries. This tool is designed to assist governments in analysing existing policies and support their national strategies. Regulatory interventions in the mining sector from countries can also affect trade and investment. Some countries have introduced measures to regulate the import or export of metals and minerals. According to the OECD, global restrictions on the export of critical raw materials have increased fivefold since 2009,[398] reflecting a growing trend toward securing domestic supply chains and resources.

Efforts to address minerals crime must also target corruption and collusion within state institutions. Strengthening law enforcement, regulatory oversight, and political will are essential.[399] However, policy responses must avoid criminalizing the most vulnerable – particularly artisanal and small-scale miners who often operate informally due to limited livelihood alternatives.[400, 401, 402] Involving civil society and mining communities, improving access to income-generating opportunities, and integrating a gender dimension into reform processes are central to long-term impact.[403, 404] This is especially urgent in climate-stressed regions such as the Sahel, where environmental degradation is pushing communities toward gold mining as a coping strategy. Legal frameworks should include safe channels for reporting wrongdoing and protections for whistle-blowers.[405]

Inadequate regulation and oversight enable illegal mining operations across both ASM and LSM, as well as among traders. Weak enforcement allows violations of environmental, labour, and community rights to go unchecked.[406]

Comprehensive assessments of national legislative and institutional frameworks are needed to identify gaps in standards, monitoring, investigation, and prosecution. These should be accompanied by inclusive national and regional stakeholder consultations, engaging civil society, unions, women miners, and industry representatives, to inform and support legislative reform. Involving national and international experts helps reinforce state ownership and alignment with international standards.

Inconsistent tax regimes across regions also fuel smuggling activities. Harmonizing tax and regulatory frameworks and promoting responsible sourcing can reduce incentives for illegal trade and help stabilize mineral supply chains.[407, 408] Importantly, a "follow the money" approach is vital. Tracing illicit financial flows, including money laundering schemes, can dismantle the financial infrastructure that sustains illegal mining. By disrupting these networks, authorities can seize illicit assets and reduce the profitability of these operations.

Additionally, the process of formalization and regularization plays a vital role in transitioning illegal mining operations into legally recognized ones. Favourable conditions for formalization, such as simplified licensing procedures, incentives for small businesses, low-interest loans, and access to training and equipment, can facilitate this transition.[409] Formalization interventions aim to bring the ASM sector into the formal economy, with clearly defined land and mineral rights, established laws and regulations, validated mine sites, and legal supply chains.[410]

Finally, importing countries must adopt and enforce strong legal and regulatory frameworks. Ensuring that all subsidiaries and subcontractors comply with international and domestic standards – particularly on labour, human rights, and environmental protection – is essential. These standards must also align with exporting countries' legislation to close enforcement gaps and promote accountability throughout the supply chain.[411]

Bridging capacity gaps and leveraging technology to detect and monitor illegal mining

Detecting and monitoring illegal mining remains particularly challenging in remote and hard-to-access areas, limiting the effective enforcement of legal and regulatory frameworks.[412] Thus, risk analysis and evidence-based enforcement planning is often missing because of its resource-intensiveness. The establishment and implementation of effective regulatory frameworks can be hindered by various factors, in-

cluding insufficient financial resources among others. In exporting countries, a notable challenge emerges in ensuring that labour inspectors and other institutions have the necessary resources and capacity to safeguard, address, and rehabilitate victims of labour exploitation. For instance in Mozambique, the government frequently faces difficulties in allocating adequate funding to agencies tasked with regulating the mining sector, resulting in insufficient monitoring and enforcement capabilities.[413] In some countries in Latin America, it has been reported that there is a lack of a dedicated body responsible for reviewing and approving detailed environmental impact studies for projects involving public, private, or mixed investments.[414] Furthermore, the complexity of these studies, which often require specialized knowledge that many countries may lack, likely exacerbates the challenge of effective oversight.

Formalization efforts are also hampered by limited investments in technology, training, and administrative systems, making it difficult to delineate mining concessions or enforce environmental standards. Governments often struggle to exert control over distant territories, limiting their ability to address the environmental and social consequences of mining.

Implementing overly punitive measures for informal miners can further strain the relationship between miners and authorities. In Ghana, such measures have been shown to exacerbate tensions undermining trust and cooperation, which can lead to the opposite of the desired outcome by encouraging continued involvement in informal mining activities.[415] Formalization of ASM should be seen as a gradual process and tailored to the unique circumstances of each country, with States offering incentives and support for responsible mining practices. Additionally, the approach should consider the ownership and rights associated with land and minerals, the degree of organization and mechanization present in the ASM sector, and potential disruptions in the supply chain caused by corruption among officials or interference from politically-motivated organized crime groups.

To address these vulnerabilities, both human and technical capacities must be strengthened. Site inspections require specialized knowledge and operational readiness. Training for inspection authorities should include:

- Verifying the validity of the permit;
- Confirming the exact areas of mining activities as well as the quantity of the metals and minerals extracted;
- Reviewing the documentation of the miners, including their immigration status
- Assessing the legality of the machinery in use, as well as chemical products, fuel and explosives utilized, focusing specifically on detecting document fraud.[416]

Monitoring illegal mining hotspots also requires specialized tools, given their remote and often hazardous locations. Forensic tools can assist in detecting substances like mercury on-site, while forensic laboratories can support police investigations and assess environmental damage caused by on-site mercury.[417] Risk assessments are essential to ensure the safety of inspectors operating in dangerous environments.[418]

Providing law enforcement with adequate logistical and technological tools is critical. This includes drones, satellite imagery, all-terrain vehicles, and surveillance equipment, alongside dedicated personnel with expertise in illegal mining, environmental crimes, and serious organized crime.[419] Financial investigations are also crucial to identify key actors and dismantle networks. Officials need training to understand the dynamics of the mining sector, including its linkages with other illicit activities and its broader socioeconomic and environmental impacts.

While not all technologies are universally applicable or affordable, several promising tools have been tested and deployed in different contexts:

- **Remote sensing techniques & satellite imagery**: Utilizing satellite data, smartphone sensors and unmanned aerial vehicles can supplement traditional data sources. Certain technologies already used in mining include tools for monitoring land subsidence and assessing the impact of mine sites on the environment.[420] For example, satellite imagery is already being used in some countries to detect and monitor areas affected, or potentially

affected, by illegal mining activities. This includes tracking deforestation and changes in forest areas, as well as using spectral indexes from satellite images to detect mines by analysing the reflectance of water caused by pollution.[421]

- **Artificial intelligence (AI)**: Researchers are developing AI to automatically detect mine components, although challenges in data collection and model training remain. Researchers are progressing in using AI to automatically detect key features of mines, such as tailings and open pits. Nonetheless, these AI techniques are mainly used in established mining regions, and it is difficult to expand their usage since an enormous amount of training data is needed.
- **Mobile equipment for mercury detection:** Various types of mobile equipment may be used to detect mercury and mercury compounds in different situations. For the detection of mercury in fluids and solids, Raman spectrometers and X-ray fluorescence spectrometers have been found to be effective.[422] Similar tools can also be used to detect mercury vapour in the air.
- **Blockchain:** Experts also discuss the possible use of blockchain technology in support of greater transparency in the legal supply chain of the mining sector. The adoption of platforms based on blockchain technology could help in tracing mining products from the extraction, through processing up to the delivery to the final customer and final payment.[423] Several blockchain tests have been undertaken in different countries.[424] Nonetheless, experts caution that many challenges are present, including the costs and complexity of implementing a blockchain-based system, particularly for smaller mining companies.

In addition to these efforts, consumer awareness campaigns can play an important role in educating the public and addressing the demand for more ethically sourced metals and minerals. By informing the public about the origin of gold and minerals, these campaigns can highlight issues such as illegal mining, human rights abuses, and environmental impacts. This increased awareness may lead to a higher demand for ethically sourced products, which can, in turn, promote corporate accountability and encourage companies to adopt more responsible practices throughout their supply chains.

Strengthening enforcement mechanisms

Another potential risk emerges from weak enforcement mechanisms along the mining supply chain. Indeed, illegal mining tends to flourish in areas that do not represent a priority for law enforcement actors, and where national institutions have a limited presence and lack sufficient human and technical resources for enforcement.[425] There are also logistical issues in monitoring remote sites or enforcing laws in conflict zones, which further complicate the situation. Decreasing the attractiveness of illegal mining can be achieved by increasing the risks associated with enforcement, reducing impunity, and enhancing the advantages of participating in legitimate supply chains. This shift in the cost-benefit analysis can favour legal, traceable supply chains. However, the detection and enforcement of illegal mining are often challenged by weak coordination and information sharing between central and regional authorities and the blurred lines between ASM and illegal mining.[426] Also, trends in the illegal trade of precious metals are constantly evolving, and the illegal actors and groups involved are adapting their modus operandi to avoid detection and investigation by customs, law enforcement agencies and prosecutors.[427]

To mitigate this lack of enforcement, compliance and enforcement actors should also be empowered in the assessment of illegal mining and related crimes. Indeed, to effectively investigate serious and organized illegal mining, it is necessary to establish synergies between all actors in the compliance and enforcement chain, including environmental and labour inspectors, police, customs agencies, anti-corruption bodies and financial institutions. This involves organizing tailored multi-agency capacity-building sessions targeted to enforcement authorities focusing on monitoring of illegal mining and crime convergence with other serious and organized crimes, and the development of risk assessments and evidence-based multi-agency enforcement plans. Given the complexity of the crime and the technical knowledge required, collaboration among entities is crucial. In particular, the sophistication of illegal mining syndicates requires an exponential increase in cooperation and collaboration:

- between relevant agencies with the individual country and across borders to secure the integrity

of the metals and minerals supply chain to share information and best practices;

- between the public and private sectors, especially in proactive information-sharing between companies and financial institutions with law enforcement investigating illegal mining and connected serious crimes;
- between countries, in strengthening legal frameworks and capacities, as well as in investigations and prosecution of the offenders;
- between law enforcement agencies in support of international investigations and prosecutions;
- with local civil society representatives and community-based organizations reporting crimes that affect the environment linked to illegal mining.[428]

In addition to training, providing law enforcement with adequate logistical and technological resources is vital. This includes all-terrain vehicles, cameras, drones, or satellite imageries – as well as specialized law enforcement units or staff with expertise on illegal mining or crimes that affect the environment and on serious and organized crime activities.[429] Specific expertise is required to carry out dedicated financial investigations to gain a thorough understanding of the actors involved across the metals and minerals supply chain. Officials should therefore be supported to ensure they have an accurate understanding of mining dynamics, linkages with other criminal activities, and multidimensional impacts.

Lastly, the need for standardization in mining data reporting and enhanced transparency is critical, especially in regions where data availability is compounded by corruption and lax oversight. Standardized data reporting would enable more accurate assessments of both legal and illegal mining activities and facilitate more effective policy development and enforcement. Such standardization should be accompanied by a commitment to transparency, ensuring that mining data is not only available but also reliable and consistent across different regions and mining operations.

Strengthening corporate governance

Addressing the challenge of illegal mining requires a dual approach that emphasizes both national and international responsibilities, ensuring strengthened corporate governance within the industrial mining sector. While companies can contribute to the facilitation of illegal mining activities, it is important to acknowledge their potential to actively prevent and counter such practices. Through strategic due diligence measures, collaboration with stakeholders, and adherence to ethical standards, companies have the capacity to play a key role in combating illegal mining.

One crucial way for private sector corporations to contribute to the prevention of illegal mining is by adhering to the rules and legal frameworks set forth by regulatory authorities. This includes compliance with both upstream and downstream mining operations, aligning with national and international legislation to promote the use of sustainable mining practices. A critical node between upstream and downstream activities is the refining sectors. This sector is particularly vulnerable to illegal activities, where illegally mined metals and minerals can enter the formal supply chain. Therefore, the private sector must ensure that all segments of the supply chain share transparent information about the source of the metals or minerals and the suppliers, not just the immediate previous tier. Enforcing regulatory compliance upstream (extraction, trading and transportation) involves conducting risk assessments and audits to determine the risk of sourcing metals from certain refineries and suppliers. This information should be made available to all actors involved to enable the traceability of suppliers along the whole supply chain.[430] Additionally, corporations can implement safeguards such as monitoring mechanisms to track the extraction and transportation of metals and minerals or safeguards to protect the environment and ensure the safety and rights of workers. Larger corporations, with their greater resources and capacity, are better positioned to monitor and enforce compliance with these standards and regulations. Thus, they have the responsibility to mitigate the risk of illegal mining practices within their operations.[431]

Furthermore, downstream companies (international traders and final manufacturers) can implement robust due diligence procedures within their supply chains to verify the legitimacy of suppliers and ensure compliance with relevant laws and regulations. As defined in the OECD Due Diligence Guidance for Responsible Business Conduct, "due diligence is the process enterprises should carry out to identify, prevent, mitigate and account for how they address actual and potential adverse impacts in their own operations, their supply chain and other business relationships."[432] Effective due diligence should be supported by efforts to integrate responsible business conduct into company policies and management systems. This approach ensures that businesses can effectively address and remedy any negative impacts they cause or contribute to.

Moreover, companies can promote transparency and due diligence in their supply chains to deter illegal mining activities. A key starting point is the adoption of a responsible sourcing policy within companies, which outlines how sourcing practices will be verified both internally and through the use of external standards and certifications. By doing so, companies can ensure accountability and demonstrate their commitment to responsible sourcing by providing stakeholders with visibility into the source of metals and minerals. Responsible sourcing should encompass social but also environmental and economic considerations.[433] In addition to adhering to these standards, it is essential for companies to include responsible sourcing policy adherence in their corporate reporting, a practice that is increasingly becoming a legal requirement in some jurisdictions. For instance, the European Union (EU) has implemented several key regulations to promote responsible business practices. The 2022 EU law on due diligence mandates companies to disclose their efforts to ensure sustainable and ethical supply chains.[434] Additionally, the 2023 EU Batteries Regulation establishes requirements for the collection, recycling, and sustainable sourcing of metals used in batteries.[435] Furthermore, the EU 2017/821 regulation on conflict minerals (3T) sets due diligence requirements for companies sourcing these minerals from conflict-affected areas.[436] By following these standards and guidelines, companies contribute to the prevention of illegal mining and the promotion of responsible resource extraction.

Additionally, private sector companies can invest in community development projects and initiatives in mining regions to address the root causes of illegal mining. By supporting education, skills training, infrastructure development, and alternative livelihood programmes, companies empower local communities and reduce their reliance on illegal mining activities for survival. Collaboration with government agencies, law enforcement authorities, and civil society organizations is also essential in strengthening regulatory enforcement, improving governance practices, and combating illegal mining. By sharing information/data, resources, and expertise, companies can enhance monitoring and enforcement regulations/efforts, prosecute illegal mining operators, and disrupt criminal actors involved in illegal activities.

In parallel to existing laws and emerging legislation, the private sector is also increasing efforts to adopt sustainable mining measures through the work of self-regulatory bodies such as London Bullion Market Association (LBMA) or the London Metal Exchange (LME). Other industry schemes, such as the Responsible Minerals Initiative (RMI), CopperMark, Responsible Coal, Aluminum Standard Initiative (IRMA), Just Gold (IMPACT Africa Canada), or CRAFT/Fairmined (ARM) are playing a significant role in enhancing the management of global metals and minerals supply chains. Its key initiatives include the Responsible Minerals Assurance Process for third-party audits of smelters and refiners, a separate third-party audit scheme, as well as two facilitating documents, namely the Conflict Minerals Reporting Template for supply chain transparency and extensive due diligence guidance.

Sustainable natural resources management, strengthened public and corporate governance, transparency, and accountability are at the core of the Extractive Industries Transparency Initiative (EITI),[437] encompassing 50 countries worldwide that have committed to implementing the so-called EITI Standards.[438] These countries are also assessed for their progress in meeting such requirements. Civil society groups have also played a significant role in encouraging businesses and governments to prioritize responsible metal and mineral sourcing.

Conclusion

Mining is crucial activity in the context of current economic development and the triple planetary crisis. The demand for minerals needed for renewable energy technologies is rising and will continue to grow, especially after governments at the United Nations Climate Change Conference (COP28) in Dubai agreed to triple the rollout of renewable energy and double energy efficiency by 2030. The IAE estimated that the demand for metals and minerals will continue to grow rapidly, potentially doubling by 2030 and tripling by 2050.[439] The 2024 report from the UN Secretary-General's Panel on Critical Energy Transition Minerals highlights the need to accelerate the energy transition while ensuring that justice and equity underpin mineral value chains.[440] Therefore, ensuring a responsible and ethical supply of metals and minerals is crucial for supporting this transition.

With this increase in demand, the pressure on mining operations worldwide will intensify, potentially intensifying existing problems, such as corruption, which plays a key role in facilitating minerals crimes. These crimes not only undermine legitimate businesses, but also fuel other criminal activities, such as trafficking in persons, forced labour and environmental degradation. This study shows that organized criminal groups in different regions are involved in illegal mining activities. Some groups may have diversified their operations to include illegal mining alongside other illegal activities, such as drug trafficking, driven by external factors like rising gold prices. Other criminal actors may have solely turned to illegal mining. In some cases, illegal activities in the metal and mineral supply chain may have been facilitated or driven by non-organized individuals. Particularly in the case of gold, these actors are likely attracted by the high profits, and, in some cases, the perceived lower risks associated with minerals crime compared to other crimes. Additionally, proceeds from illegal extraction often finance other illegal activities, creating a cycle of exploitation and dependency.[441, 442] In this regard, empowering local communities and creating alternative livelihoods are essential strategies to address some of the root causes of minerals crime. These efforts not only provide economic alternatives but also build local resilience against the allure of illegal activities.[443, 444]

Maintaining transparency along the entire metal and minerals supply chain is indispensable, and the transnational nature of this process requires a multifaceted approach. On the one hand, cooperation among various actors, including governments, international organizations, the private sector, and civil society, is essential. On the other hand, standardizing mining data and practices across borders will enhance transparency and accountability. This cooperation can facilitate the sharing of intelligence, best practices, and resources, making it harder for illegal mining operations to proliferate. Additionally, intensifying reliance on information in upstream activities (international trading and final manufacturing) is critical to these efforts. To address organized criminal groups, targeted interventions and stronger enforcement mechanisms are necessary, along with greater collaboration to disrupt their networks and reduce the incentives for illegal mining.

Increasing efforts in these directions can help identify risks within the supply chain and prevent crimes from occurring. Mining is a vital activity for present and future needs, making it imperative to ensure its integrity and sustainability. Addressing the challenges of minerals crime requires comprehensive and coordinated efforts between government, civil society and the private sector to enhance transparency in relevant sectors, target and prevent specific corruption typologies that facilitate crimes, and understanding and dismantling criminal organizations involved along all aspects of the minerals supply chains. Such efforts can contribute to better protection of people and the planet.

Regional Groupings

Africa
Eastern Africa – Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Somalia, South Sudan, Uganda, United Republic of Tanzania, Zambia, Zimbabwe

Middle Africa – Angola, Cameroon, Central African Republic, Chad, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Republic of the Congo, Sao Tome and Principe

Northern Africa – Algeria, Egypt, Libya, Morocco, Sudan, Tunisia

Southern Africa – Botswana, Eswatini, Lesotho, Namibia, South Africa

Western Africa – Benin, Burkina Faso, Cabo Verde, Cote d'Ivoire, Gambia (Republic of The), Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo

Americas
Caribbean – Antigua and Barbuda, Bahamas, Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent the Grenadines, Trinidad and Tobago

Central America – Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama

Northern America – Canada, United States of America

South America – Argentina, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela (Bolivarian Republic of)

Asia
Central Asia – Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan

Eastern Asia – China, Democratic People's Republic of Korea, Japan, Mongolia, Republic of Korea

South-eastern Asia – Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, Viet Nam

Southern Asia – Afghanistan, Bangladesh, Bhutan, India, Iran (Islamic Republic of), Maldives, Nepal, Pakistan, Sri Lanka

Western Asia – Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Türkiye, United Arab Emirates, Yemen

Europe
Eastern Europe – Belarus, Bulgaria, Czechia, Hungary, Poland, Republic of Moldova, Romania, Russian Federation, Slovakia, Ukraine

Northern Europe – Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Lithuania, Norway, Sweden, the United Kingdom of Great Britain and Northern Ireland

Southern Europe – Albania, Andorra, Bosnia and Herzegovina, Croatia, Greece, Italy, Malta, Montenegro, North Macedonia, Portugal, San Marino, Serbia, Slovenia, Spain

Western Europe – Austria, Belgium, France, Germany, Liechtenstein, Luxembourg, Monaco, Netherlands (Kingdom of the), Switzerland

Oceania
Australia and New Zealand – Australia, New Zealand

Melanesia – Fiji, Papua New Guinea, Solomon Islands, Vanuatu

Micronesia – Kirbati, Micronesia (Federated States of), Marshall Islands, Nauru, Palau

Polynesia – Samoa, Tonga, Tuvalu

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