Enhancing Resilience Through Traceability

Insights from Lithium and Nickel Supply Chains in Latin America and Southeast Asia

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BETTER POLICIES FOR BETTER LIVES

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Preface

Critical minerals are a key pillar of our economic growth and security. They drive digital innovation, underpin advanced manufacturing and power renewable energy technologies. Governments and businesses need to work together to meet growing demand for these minerals, while ensuring supply chains are reliable, resilient and responsible.

High levels of supply chain concentration and rising trade restrictions are limiting investment and creating real vulnerabilities in critical mineral supplies. While efforts to diversify sources are gathering pace, investment still falls short of what is needed to keep up with demand. In parallel, the operational and governance risks that come with mining and processing activities need to be managed more effectively; otherwise, they can delay projects, erode trust, and cause future disruptions.

Responsible business conduct standards, transparency and traceability are important tools to address these challenges. When applied in a targeted and pragmatic way, traceability can strengthen resilience, de-risk investment, and support responsible sourcing. By improving visibility across supply chains, traceability helps identify dependencies, verify responsible practices and target interventions where risks persist. Traceability can also inform and strengthen economic security measures by providing verified information on origin, ownership and production conditions.

This report draws on a joint OECD-International Energy Agency survey of 90 companies covering all major critical minerals, producing and refining regions and supply chain segments. The survey was complemented with stakeholder interviews and field visits in Argentina, Chile, Indonesia and the Philippines.

It shows that the adoption of traceability systems is expanding across critical mineral supply chains with three-quarters of surveyed companies planning to scale up investments in the near-term to improve traceability. Realising its full potential, however, will require addressing persistent challenges including fragmented traceability systems, concerns over sharing commercially sensitive data and limited transparency over ownership structures that obscure who owns or controls key mineral assets.

By looking at lithium and nickel supply chains in Latin America and Southeast Asia, the report highlights the importance of a tailored approach. In Latin America's lithium sector, high refining concentration creates opportunities for targeted interventions, while in Southeast Asia's nickel sector, complex ownership structures make traceability more challenging, even as transparency initiatives gain traction.

The report provides a practical roadmap for policymakers to address these gaps. In the near term, it recommends making better use of existing tools, including trade data, supplier mapping and existing audit programmes. There is also scope to strengthen responsible business conduct and transparency standards in bilateral minerals agreements. In the medium-term, policy efforts should focus on closing data gaps by strengthening beneficial ownership transparency and improving mineral tracking. In the long term, international co-operation could focus on developing more integrated solutions, including through interoperable data platforms and digital product passports.

Ongoing international efforts, including the G7 Leaders' Declaration on Securing Supply Chains for Critical Minerals, provide a strong foundation for advancing these policies and translating the recommendations of this report into concrete actions. The OECD will continue to support these efforts by providing the evidence, analysis and policy tools, and by fostering dialogue among governments, industry and other partners to strengthen transparency, build trust, and ultimately enhance the resilience of critical mineral supply chains.

Mathias Cormann,

OECD Secretary-General

Foreword

The OECD Critical Minerals Initiative brings together the Organisation's expertise across a range of topics including investment, responsible business conduct, trade, taxation, development and the environment to help governments navigate one of the defining policy challenges of the coming decades. To this end, the Initiative provides comparative analysis and a platform for sustained dialogue between mineral-producing and mineral-consuming economies.

This publication forms part of the Initiative's work on supply chain transparency, traceability and resilience. The purpose of the report is to give policymakers, industry and multilateral initiatives a grounded understanding of how traceability works in practice, where it adds value and where its limits lie, and to offer recommendations that can be taken forward through national policy and international cooperation. In doing so, it seeks to serve producing and consuming countries alike, connecting supply chain transparency with responsible sourcing, revenue mobilisation and good governance.

The OECD wishes to thank the Government of Japan for its generous support and the government officials, companies and stakeholders in Argentina, Chile, Indonesia and the Philippines whose engagement made the research possible.

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The report was co-ordinated by James Hermanson, Advisor, GRC Director's Office. The principal authors of this report include James Hermanson, Advisor (with contributions from Audrey Verbist) (GRC); Benjamin Katz, Sector Lead, Luca Maiotti, Policy Analyst, and Konstantin Mann, Junior Policy Analyst (DAF); Katarina Svatikova, Environmental Policy Analyst, and Rose Mba Mébiame, Statistician (ENV); Andrew Viola, Senior Advisor, and Kalale Mambwe, Project Manager (CTPA); and, Andrés Sanabria, Policy Analyst/Economist, and Bridget Donovan, Policy Analyst (CFE). Angélique Dartagnan, Administrator, Sophie Elliott, Communications Officer, Julie Whitelock, Office Manager, and Magdalena Kaczmarczyk-Kozluk and Elma Lopes, Resource Management Advisors, provided essential administrative, logistical and editorial support throughout the project. Caterina Barucci, Javier Gonzalez, Vukan Jokic, and Leonardo Valent played integral roles developing visuals for the report.

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Above all, the OECD would like to express deep appreciation for the financial support received from the Government of Japan for this work.

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Executive summary

Reliable access to critical minerals has become central to economic security and competitiveness. Increasing global demand is intensifying pressure on highly concentrated and strained supply chains. Market concentration of processing, smelting and refining is particularly acute, while investment is lagging behind demand and operational and governance risks persist. This threatens to undermine the reliable supply of these resources and resilience of industries that use them.

National and multilateral initiatives to enhance economic security by developing more resilient and diversified critical mineral supply chains will require supply chain transparency to be fully implementable. Reliable supply chain data is at the core of traceability systems. Price floors and similar trade-related measures need verified information on origin and production conditions to direct support toward trusted and responsible producers. Stockpiling programmes need provenance, grade and ownership data for acquired commodities. Finally, preferential procurement initiatives require chain of custody data to exclude entities of concern.

Traceability can bolster the integrity and credibility of supply chain due diligence. Traceability has emerged as a tool for policymakers and industry to enhance the resilience of mineral supply chains as policy and market demand increasingly drive companies' adoption of responsible business conduct practices.

This report assesses the uptake, drivers and limitations of traceability in critical mineral supply chains, focusing on lithium in Argentina and Chile, and nickel in Indonesia and the Philippines. It draws on an OECD-IEA survey of 90 leading companies across critical minerals value chains. The survey was complemented by stakeholder interviews and site visits.

Key findings

Uptake of traceability

In practice, a combination of supply chain mapping, mass balance and auditing, often as part of wider due diligence efforts, already supports partial visibility without end-to-end traceability. Current traceability systems remain fragmented. Hybrid, government-led platforms, such as Indonesia's SIMBARA, alongside industry and multi-stakeholder responsible sourcing systems, provide a foundation that targeted policy measures could strengthen.

Uptake of traceability by the private sector is growing but uneven. Notably, most traceability systems are being developed within individual companies using proprietary tools with limited public disclosure. Uptake is strongest among traders, who report the highest implementation rates, and weakest among miners. Over 60% of respondents identify brand reputation or customer demand as primary drivers, with regulatory compliance a close second.

Barriers to traceability

There are substantial barriers to the uptake of traceability. More than half of survey respondents identify costs and lack of interoperability as barriers to setting up traceability systems. The operation of such systems is further constrained by confidentiality concerns, supplier leverage and data quality concerns. **Half of survey respondents rank regulatory consistency as the top priority for scaling traceability, with a similar share citing shared data infrastructure.**

Ownership opacity is a significant blind spot. Complex and layered corporate structures obscure who ultimately controls key mineral assets, particularly along nickel supply chains. This matters for both responsible sourcing and economic security.

Despite these challenges, industry adoption of traceability is growing at pace. Nearly three-quarters of respondents plan to increase investment in traceability, but most report that it is too early to identify tangible benefits. The absence of price premia, for example, remains a persistent disincentive.

Policy recommendations

A targeted approach to traceability, calibrated to the risk profile and strategic sensitivity of each material and end use, is both more practical and more effective than uniform requirements across all supply chains. This report **presents a roadmap for policymakers to promote traceability over the near to long term**. It recommends a phased, risk-based approach in which traceability intensity narrows in scope and deepens in rigour in accordance with risk and strategic sensitivities.

- **In the near term, governments can leverage what is already in place**. Trade data and supplier mapping can be used to monitor processing dependencies. Existing audit programmes can strengthen country-of-origin disclosure for smelters and refiners. Bilateral mineral agreements and development financing can embed RBC standards and transparency.
- **In the medium term, governments should work to close data gaps.** This requires deepening engagement with midstream actors such as traders, exchanges and smelters. They should strengthen beneficial ownership transparency, especially for complex joint ownership structures. Independent mineral testing as part of tracking the physical evolution of minerals and tracking of recycled content should be introduced.
- **In the longer term, governments should address measures that require international co-operation.** Interoperable data platforms will secure traceability data across borders. Systems should adopt identity preservation for the most sensitive materials. Governments should also adopt expanded digital product passports, aligned with international standards, for batteries and high-impact products.

The recommendations in this report are designed to be operationalised through existing frameworks, including the G7 Critical Minerals Action Plan and Roadmap to Promote Standards-based Markets, FORGE, RESourceEU and bilateral critical mineral agreements, and have informed wider international discussions, including the G7 Leaders' Declaration on Securing Supply Chains for Critical Minerals.

Applying a targeted approach to lithium and nickel

Lithium and nickel are essential for the green transition, defence and industrial applications. Both have been identified by OECD Members and across G7 frameworks as priorities for investment, diversification and governance improvement.

For lithium sourcing from Argentina and Chile, significant processing dependencies in China are well captured by existing trade data and supplier mapping. Enhanced ownership transparency could help address the presence of foreign entities of concern in the upstream supply chain.

The nickel supply chain in Indonesia and the Philippines is more complex, including exposure to elaborate, transnational ownership structures. Existing systems such as SIMBARA and the London Metal Exchange responsible sourcing requirements provide a strong basis for supply chain transparency, in addition to mines in both countries increasingly participating in sustainability initiatives and audits. Building on these approaches can address outstanding gaps.

Co-operation among the G7, OECD, IEA and trade partners can serve as a platform, including through multi-stakeholder engagement, to operationalise these recommendations. A priority for this co-operation should be aligning minimum traceability requirements across economic security instruments so that data collected for one purpose, such as price floor eligibility, can also serve others, such as defence procurement or stockpiling, avoiding duplication and ensuring that the economic security toolkit rests on a common, interoperable data foundation.

1 Overview

This chapter presents an overview of the growing global demand for critical minerals, the resulting pressures on highly concentrated supply chains and recent policy efforts to secure access to these minerals. It highlights the importance of responsible business conduct standards and traceability systems in managing operational and governance risks and their potential to contribute to economic security. The section also summarises the key findings and policy recommendations of the report.

This report was developed as part of the OECD Critical Minerals Initiative to provide a more systematic evaluation of approaches to traceability and how it can contribute to the management of operational and governance risks in critical mineral supply chains. In this work, **traceability is defined as the collection of reliable data on origin, geographic path, the sequence of entities that held ownership or control over the product and its physical evolution** (IEA-OECD, 2025[1]). The report takes a global perspective with case studies on lithium in Latin America and nickel in Southeast Asia, namely in Argentina, Chile, Indonesia and the Philippines. Drawing on survey data collected as part of this study, stakeholder interviews and site visits (see Annex 1.A. for methodology), this report analyses how responsible business conduct (RBC) and traceability initiatives are being implemented in practice across the entire mineral supply chain, including production, processing, manufacturing and recycling. Ultimately, this report aims to better understand the incentives, constraints, and operational realities shaping responsible production methods and traceability adoption across different segments of the supply chain.

Chapters 2 through 4 provide the evidence base, Chapter 5 analyses enablers and obstacles across the full survey sample, and Chapter 6 sets out phased policy recommendations with mineral-specific application for lithium and nickel.

1.1. Growing global demand for critical minerals is intensifying supply chain pressures

Sharp increases in global demand for critical minerals are being driven by expanding industries such as advanced manufacturing, including of electric vehicles (EVs), digital technologies and clean energy. It will be necessary to increase production of critical minerals such as cobalt, copper, graphite, lithium, manganese, nickel and rare earths, which are essential inputs for electronics, batteries, power systems, defence and other vital products. The scale is considerable: the current mine project pipeline is expected to fall short by more than 30% of the required supply to meet net-zero pathways by 2040 (IEA, 2025[2]). Increasingly, reliable access to critical minerals is pivotal to maintaining overall economic security and competitiveness, as well as energy security.

Production and processing of many critical minerals remain geographically concentrated, including in jurisdictions with challenging operational environments and perceived governance risks, which in turn poses risks for energy and economic security (IRENA, 2023[3]). The average market share of the top three mining countries for key energy minerals rose from 73% in 2020 to 77% in 2024 (IEA, 2025[2]). Concentration is even more pronounced in processing, with the People's Republic of China (hereafter "China") expected to supply more than 60% of refined lithium and cobalt and around 80% of battery-grade graphite and rare earth elements by 2035 (IEA, 2025[2]). Supply chains are also increasingly affected by trade restrictions, as export control measures on industrial raw materials[1] have increased more than five-fold over the past decade, with around 14% of global exports now affected, potentially undermining global supply resilience (OECD, 2025[4]). These structural features make critical mineral supply chains vulnerable to supply disruptions, underscoring the importance of securing reliable and responsibly sourced minerals.

Despite soaring demand projections, investment into critical mineral mining and processing is lagging behind what is needed to meet expected consumption. Meeting the copper, nickel, lithium, and cobalt demand alone is estimated to require USD 500 billion in additional capital investment for mining between 2025 and 2040 (IEA, 2025[2]; Scheyder, 2024[5]). This underinvestment reflects long project lead times, volatile commodity prices and reputational risk that characterise many mining and processing operations. Investment into exploration activity plateaued in 2024, before dropping 43% year-over-year in 2025 due to oversupply, weakening prices and tighter financing conditions (S&P Global, 2026[6]). Compounded by declining ore grades, this underinvestment risks contributing to production shortfalls in the future.

As such, increasing and diversifying investment is imperative, but requires comprehensive measures to de-risk investment. This will entail taking steps to address the operational and governance risks facing projects along critical mineral supply chains, such as aligning activity with OECD guidance on due diligence and responsible business conduct, as well as enhancing circularity and secondary material production.

1.2. Efforts to boost resilience are intensifying but more is needed

Governments have taken increasingly assertive action to develop more resilient mineral supply chains. At the national level, countries have sought to increase domestic production through streamlined permitting and regulatory processes, expanding public financing and supporting domestic processing and recycling capacity. Many have also introduced due diligence, disclosure and supply chain traceability requirements to identify and minimise exposure to operational and governance risks that can translate into investment delays, supply disruptions and reputational costs for downstream buyers, and align mineral sourcing with broader industrial and economic security objectives.

These economic security measures have also taken the form of collective approaches such as the European Union's Critical Raw Materials Act, the Forum on Resource Geostrategic Engagement (FORGE), as well as the 2025 G7 Critical Minerals Action Plan and Roadmap to Promote Standards-based Markets for Critical Minerals. The G7 has centred its response to these challenges around a set of high-level frameworks designed to improve security of supply, diversify value chains, and promote high operational and governance performance. These efforts emerged from the initial G7 Five-Point Plan for Critical Minerals Security that was developed during the Japanese G7 presidency. This was reaffirmed and operationalised by subsequent Italian, Canadian and French G7 presidencies. On the whole, G7 efforts have aimed to operationalise commitments to promote diversified and resilient supply chains, support recycling and circularity, and encourage greater innovation and mineral substitution. They identify implementation of the OECD Due Diligence Guidance for Responsible Mineral Supply Chains (OECD Minerals Guidance) as one of the criteria to support the development of credible, standards-based markets for critical minerals (G7, 2025[7]; G7, 2025[8]).

Most of these economic security measures share a reliance on data as a common operational requirement. Trade-related measures such as price floors require verified information on origin and production conditions to ensure that price support reaches responsible producers in partner countries rather than generating windfalls for non-compliant material. Stockpiling programmes need to know the provenance, grade and ownership history of acquired material. Preferential procurement under bilateral mineral agreements or defence sourcing rules requires verified chain of custody to exclude entities of concern. Without sufficient traceability, these instruments risk being either unenforceable or indiscriminate.

Lithium and nickel sit at the centre of this report's analysis. Both are essential inputs for EV batteries and, in the case of nickel, for stainless steel and defence applications. Both have been identified by OECD Members and across G7 frameworks as priorities for investment, diversification and governance improvement. Several OECD member countries have pursued bilateral agreements and strategic partnerships with key producing countries in Latin America and Southeast Asia, covering trade, investment and sustainable mining provisions, and have designated strategic projects targeting both minerals with growing emphasis on diversifying processing capacity.

Furthermore, lithium and nickel provide complementary illustrations of the structural challenges and risk profiles that make traceability simultaneously valuable and difficult. In both supply chains, a handful of jurisdictions and actors exert considerable influence over global supply. This concentration means that operational and governance outcomes in Argentina, Chile, Indonesia and the Philippines reverberate across battery supply chains worldwide. Yet their supply chain structures, governance frameworks and risk profiles differ considerably, making them complementary case studies for this report.

For both minerals, unresolved operational and governance risks can translate into investment delays, supply disruptions and reputational costs for downstream buyers. Addressing these risks at source to enable stable mining and processing sectors along reliable and transparent supply is consequently a shared interest for producing and importing countries.

1.3. A whole-of-supply chain approach to standards-based, responsible production and traceability could help fill this gap

Standards-based markets are key to these objectives as they help to create a level playing field across jurisdictions and among companies. Without common expectations and verification mechanisms for responsible performance and governance, companies that invest into stronger community engagement, environmental safeguards and traceability systems may face higher operating costs than competitors operating with weaker standards or diminished oversight. This can distort competition and discourage responsible investment as production shifts to lower-standard environments. Aligning market access, public finance and procurement with common benchmarks for operational and governance performance, standards-based approaches reduce the risk of distorted competition and reward responsible actors, all while providing greater certainty to investors and buyers.

RBC standards, supply chain transparency and, where relevant, traceability can help differentiate responsibly produced minerals, support investment and financing, and ultimately strengthen supply chain resilience. They enable access to markets and, in some circumstances, better financing terms, especially as public and blended finance play greater roles in driving investment into critical mineral supply chains. These benefits extend beyond the private sector and stronger operational and governance standards along critical mineral supply chains can meaningfully improve outcomes for host communities and countries.

OECD standards on RBC set out a process for risk-based due diligence for enterprises to identify, prevent and mitigate actual and potential adverse impacts that they may be causing, contributing to, or directly linked to through their operations or business relationships, including in the minerals sector. Multi-stakeholder and industry initiatives on RBC have, in turn, emerged to facilitate or verify (e.g. through auditing) implementation of due diligence or other activities to improve operational and governance performance typically in scope of OECD standards on RBC.

Traceability, by collecting reliable data on material origin, geographic path, chain of custody and physical evolution, can support due diligence processes but also distinguish and, in some cases, reward responsible business conduct. Traceability may overlap, but does not equate to, transparency, as transparency can mean both supply chain visibility and disclosure. It is part of a broader set of transparency measures available to companies and governments that increase supply chain visibility, but collected data through traceability may not lead to enhanced disclosure. Strengthening traceability and addressing these risks across the supply chain is therefore not only a matter of responsible sourcing, but also increasingly central to supply chain resilience and development for mineral-importing and mineral-producing countries alike.

Policies targeting end-of-life of critical minerals are also gaining traction as waste collection and recycling of minerals-rich end-of-life products is becoming increasingly important. E-waste is one of the fastest growing waste streams and EV batteries are expected to reach end-of-life at large scale in the 2030s. Recycling provides a valuable secondary source of raw materials that lessens dependence on primary mineral supply and strengthens supply security, especially for mineral-importing countries. In the future, recyclers may become key suppliers of critical minerals, operating alongside other upstream players. Strengthening their integration into standards-based mineral markets will hence become essential.

Upholding verifiable responsible mineral production and processing can channel demand and capital towards responsible actors, both suppliers and downstream buyers. This serves to reinforce G7 aims to secure critical minerals without compromising RBC or bringing about a regulatory race to the bottom. In the process, responsible business conduct can also help manage risks that sometimes lead to disruption and higher costs stemming from conflict, corruption, political risk and community opposition. Some traceability platforms can also help collect data on operational and governance risks, actions taken to address them, and support certification or assurance based on operational and governance performance or responsible sourcing criteria. Though achieving stronger corporate governance and mitigating operational risks may impose additional upfront costs on companies, industry analyses indicate that companies failing to meet regulatory requirements and investor expectations face constrained market access and higher costs of capital (PwC, 2021[9]; BCG, 2023[10]). A level playing field for RBC and related environmental, labour and governance expectations is nonetheless necessary to avoid putting companies that meet such expectations at a disadvantage.

Traceability systems can create aligned incentives across stakeholders in mineral supply chains: they support producing countries in strengthening revenue mobilisation and governance, enable importing countries to secure more resilient and transparent supply chains, and allow companies to demonstrate responsible practices and maintain access to international markets. By improving transparency over production, pricing and other related-party transactions, traceability systems help curb BEPS practices and protect public revenues in producing countries. This, in turn, supports the social contract surrounding mineral extraction, reducing the likelihood of community opposition, fiscal instability or abrupt regulatory changes. By addressing these Base Erosion and Profit Shifting (BEPS) practices, companies are better positioned to maintain stable operations, thereby contributing to more reliable and resilient supply chains.

1.4. Standards-based responsible practices and traceability can therefore serve complementary policy objectives

- **Responsible investment and resilient supply chains**: Investors increasingly consider operational and governance risks in supply chains, particularly in high-risk sectors such as mining.
- **Tax policy and financial integrity**: Reliable, auditable data on mineral origin, production volumes, grade, transport routes, ownership, and trade flows strengthens governments' ability to enforce tax rules effectively. Integrated traceability systems enable cross-checks between operational and financial data, supporting risk assessment, improving transfer pricing oversight, and reducing reliance on company self-reporting. Such visibility enables tax authorities to verify quantities, pricing adjustments, and related-party arrangements against objective market benchmark prices, to ensure that the producing countries achieve an appropriate price for the mineral.
- **Environmental policy and circular economy**: Traceability enables tracking of material composition, easing recyclability and mineral recovery and supporting other circularity strategies such as repurposing and remanufacturing. It also helps policymakers implement and enforce environmental regulations, reducing waste and the ecological footprint of mineral supply chains.
- **Economic security and competitiveness:** Integrating strong due diligence into critical mineral production and processing offers an opportunity to gain enhanced visibility of supply chain bottlenecks and opportunities for diversification, and anticipate and manage shocks caused by operational and governance risks.
- **Community development and social acceptance for projects:** Responsible projects can become drivers of local development and support governments in addressing local development needs, enhance community and Indigenous Peoples participation in mining decision-making processes, and improve the transparency of information shared locally.

1.5. Key findings

This section summarises the report's principal findings on the uptake, drivers and limitations of traceability in critical mineral supply chains, drawing on the evidence base presented in Chapters 2 through 5.

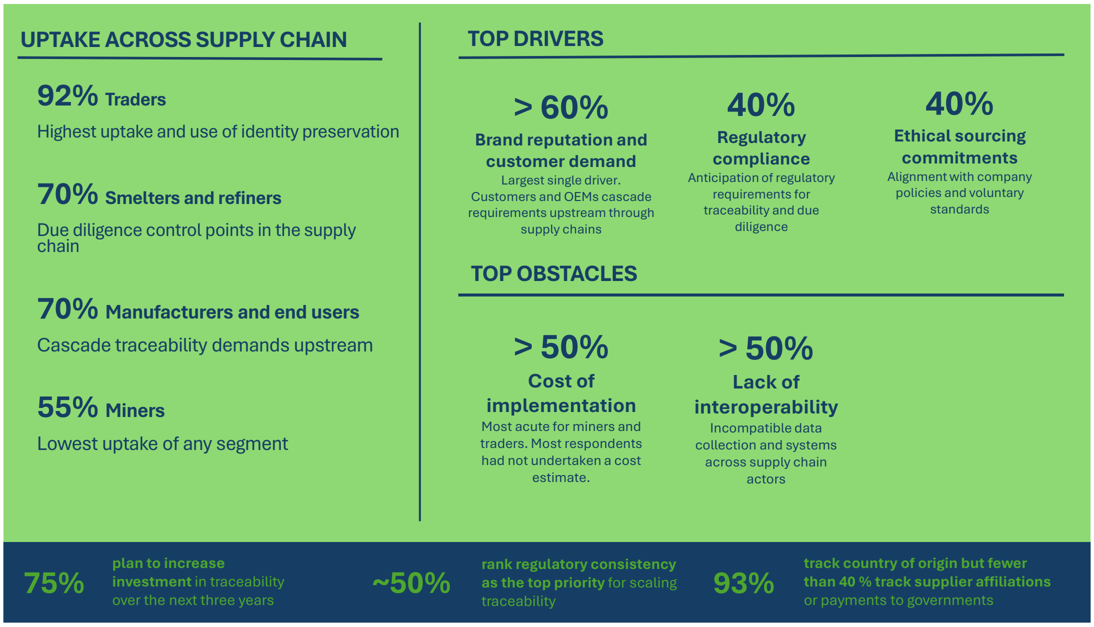
Traceability uptake across critical mineral supply chains is growing but remains uneven and fragmented. Drawing on an OECD-IEA survey of 90 companies, stakeholder interviews and site visits in Argentina, Chile, Indonesia and the Philippines, this report finds that a combination of supply chain mapping, mass balance and due diligence auditing already supports partial visibility without end-to-end traceability. Uptake is strongest among traders, who report the highest implementation rates of any segment of the supply chain, though much of the information collected is not publicly disclosed, and weakest among miners. Most systems rely on mass balance and supplier mapping rather than identity preservation, which fewer than 30% of smelters use.

Most traceability systems are being developed within individual companies using proprietary tools with limited public disclosure. These traceability measures could be further adapted to risk, as nearly half of respondents report that their systems collect the same information regardless of risk level. Companies participating in multi-stakeholder and industry initiatives on responsible business conduct more frequently report having traceability systems, suggesting that existing initiatives provide a practical entry point for scaling uptake.

There is a mismatch between what traceability systems currently track and what economic security and governance objectives require. Most systems are driven by customer demand and brand reputation rather than by proactive risk management. This is reflected in their design: origin data is widely collected, but information on ownership structures, supplier affiliations, payments to governments and the physical characteristics of minerals remains inconsistent. Closing these gaps for high-risk and sensitive minerals is essential if traceability is to support emerging policy instruments and trade related measures such as price floors, stockpiling and preferential procurement. At the same time, one third of respondents already trace recycled content, suggesting an emerging foundation for circularity-related traceability ahead of mandatory requirements.

Nearly three quarters of surveyed companies plan to increase investment in traceability even though most report it is too early to identify tangible benefits. Cost, interoperability and fragmented regulation are the principal barriers. This represents a window for policy action, in which targeted intervention can shape how traceability systems develop before they consolidate around incompatible standards.

Figure 1.1. Key findings



1.6. Key policy recommendations

Traceability can support policy objectives such as supply chain diversification, responsible business conduct and circularity, among others, all of which are key to improving economic security. The following recommendations are organised by the policy objective that traceability systems can support. While addressed to policymakers, companies have a crucial role to play and may consider this approach to prioritise where to invest in more extensive traceability. Figure 1.2. sequences these recommendations by implementation phase, from near-term measures that leverage existing tools through to longer-term actions requiring international cooperation, and tags each by the policy objective it serves.

1.6.1. Supply chain diversification

Expanding trade data analysis to cover multi-tiered mineral processing, strengthening supplier mapping and improving country-of-origin disclosure for smelters and refiners would better track dependencies without requiring full traceability. For example, the EU Critical Raw Materials Act now requires large companies in strategic sectors to conduct supply chain risk assessments using supplier mapping.

For the most sensitive materials, joint public-private off-taking from certified smelters can incentivise diversification, with identity preservation reserved for cases where other approaches inadequately address security of supply risks. Governments developing trade related measures, such as price floors and stockpiling programmes could specify minimum traceability requirements at the design stage to ensure that support flows to the supply chains these instruments are designed to strengthen.

1.6.2. Responsible business conduct and due diligence

Policymakers can encourage use of common protocols for data sharing and trusted platforms that transmit secure data for select materials. Midstream actors, particularly traders, warrant deeper engagement given their leverage and market access motivations. Indeed, traders – who report the highest traceability uptake of any supply chain segment to date – cite cost and confidentiality as persistent constraints that targeted policy engagement might help overcome. Smelters and refiners serve as due diligence control points where harmonised disclosure expectations can have the greatest impact. For example, the London Metal Exchange's responsible sourcing requirements, aligned with the OECD Minerals Guidance, provides a blueprint to operationalise shared expectations. Finally, bilateral critical mineral agreements offer a way to embed RBC standards and strong supply chain transparency where risks are greatest, while anchoring a common approach to due diligence expectations.

1.6.3. Circularity and resource efficiency

Traceability efforts focused on midstream operations, recycling and product design may be most impactful. Strengthening traceability at smelters and refiners, the critical junction between primary and secondary supply chains, can provide essential data on recycled material production and its role in supply chain resilience. Recyclers are mineral suppliers and should be considered as such in traceability frameworks. One third of survey respondents already trace recycled content, suggesting an emerging foundation on which policy measures can build. Recycled content requirements, such as those introduced under the EU Battery Regulation for lithium, nickel, cobalt and lead from 2028, and digital product passports can further incentivise traceability adoption and secondary mineral market development.

1.6.4. Sustainable development in mining regions

Subnational governments should develop region-specific frameworks for environmental management, community engagement and local development. Site visits in Salta, Argentina demonstrated what this can look like in practice, with social working groups linking community priorities to mining projects, the University of Salta providing independent environmental monitoring, and an Indigenous Chamber of Commerce supporting local suppliers. Traceability can track performance against locally agreed standards, helping governments understand mining's contribution to local economies. Governments should ensure meaningful community participation throughout impact assessments and strengthen disclosure frameworks to provide disaggregated, accessible information.

1.6.5. Revenue mobilisation

Traceability systems can reduce information asymmetries between companies and tax administrations that BEPS practices exploit, supporting greater revenue capture. Physical evolution of mineral products is the least tracked traceability category in the survey, yet it is central to accurate valuation. Millions of tonnes of nickel exports from Indonesia, which the SIMBARA platform was developed in part to address, illustrate how gaps in reconciling production and processing data directly impact revenue mobilisation. Enhanced transparency on the physical evolution of mineral products, through disclosures and regulatory spot checks including mineral testing, is particularly relevant to address under-valuation risks in lithium and nickel supply chains and other practices that could lead to revenue losses, such as smuggling.

Figure 1.2. A phased approach to promoting traceability for lithium and nickel

Phase	Recommendation	Policy Example and Evidence	Objective
Near-term	Use existing trade data and supplier mapping to monitor processing dependencies. Expand analysis to multi-tiered beneficiation.	*Chile's mining registry already generates site-level data that, combined with trade statistics, can track processing dependencies without new infrastructure.*	Diversification
	Strengthen country-of-origin disclosure by smelters/refiners through existing audit programmes. Harmonise expectations across programmes for consistency and a level playing field.	*Harmonised disclosure expectations built on existing audit programmes could close gaps. While the information exists, audit programmes often fall short of relevant expectations of the OECD Minerals Guidance. This could be promoted across OECD Members or in the context of the G7.*	RBC Diversification
	Embed RBC standards and transparency as conditions for blended/development finance and bilateral mineral agreements.	*The G7 Roadmap includes the OECD Minerals Guidance as a criterion for standards-based markets. Linking finance to strong RBC implementation at project level will strengthen de-risking of projects in complex jurisdictions and crowd in private finance.*	RBC De-risking
	Promote participation in credible industry and multi-stakeholder RBC initiatives with strong public or supply chain disclosure without encouraging overreliance or shifting responsibility for due diligence	*Survey: 54% of respondents already review suppliers' RBC disclosure through initiatives; 51% use initiative data to strengthen risk assessments.*	RBC
	When using policy measures that link third-party assessments to market access or public finance, promote credibility of assessment programmes and data disclosure for tailoring to financial risk management frameworks	*Audits on lithium producers by IRMA have provided the first independently verified assessments for operational and governance performance. The Forthcoming OECD Fitness Framework for Sustainability Initiatives Supporting Due Diligence can be a reference.*	RBC De-risking
	Encourage companies to target traceability based on the significance of supply chain risks, prioritizing high-risk supply chains.	*Survey: smelters/refiners (31%) and traders (45%) most frequently report risk-differentiated systems, but nearly half still collect the same information regardless of risk level. The EU Critical Raw Materials Act uses a risk-based approach to calibrate compliance obligations.*	RBC De-risking
Medium-term	Deepen engagement with midstream actors (traders, exchanges, smelters). Leverage traders' high identity-preservation use; explore joint public-private procurement from certified smelters.	*According to the survey, traders report highest traceability uptake and >80% interest in RBC initiatives for market access. LME's proposed ≤20t CO_2/t nickel threshold shows exchange rules can shift incentives. The EU Critical Raw Materials Act further requires supply chain risk assessments.*	RBC Diversification Circularity
	Enhance transparency on physical evolution of minerals (volume, grade, form) via regulatory spot checks and material testing to address BEPS and under-valuation risks.	*Indonesia's SIMBARA tracks flows across six ministries but lacks mine-to-smelter reconciliation. Adding independent assay with split-sampling would close key revenue leakage gaps.*	Tax
	Offer expenditure-based tax incentives (accelerated depreciation, asset write-offs) for investment in traceability systems and infrastructure, favoured over income-based incentives.	*Chile's accelerated depreciation rules for capital-intensive mining provide a model. Expenditure-based incentives are more resilient under the Global Minimum Tax than income-based tax holidays.*	Tax RBC
	Promote recycled content requirements to enhance traceability; integrate recyclers as mineral suppliers in traceability frameworks.	*EU Battery Regulation mandates recycled content disclosure for Li, Ni, Co, Pb from August 2028 (expected). Already one third of survey respondents trace recycled content.*	Circularity Diversification
	Encourage adoption of practical, low-cost methods for verifying recycled content (information sharing, paper trail analysis, chain of custody) where advanced techniques are cost-prohibitive.	*Among respondents already tracing recycled content, information collection and paper trail analysis are the most commonly used methods. Advanced techniques (geochemical fingerprinting, AI) remain rare.*	Circularity
	Strengthen beneficial ownership transparency, especially where complex joint venture structures obscure entities of concern or politically exposed persons.	*Research has found significant shares of smelter ownership untraceable due to multi-layered corporate structures, affecting downstream portfolio and sourcing decisions. The OECD is developing detailed analysis of these ownership dynamics.*	RBC Governance
Long-term	Develop interoperable data infrastructure and common protocols for secure traceability data sharing across jurisdictions. Consider a tailored trusted platform building on existing interoperability work for sensitive materials.	*UNECE-ISO Digital Product Passport initiative aims to create a decentralised standard. EU Battery Passport (active from 2027) and GBA pilots show feasibility.*	All objectives
	Use identity preservation for security-sensitive materials only when other transparency approaches prove insufficient, targeting new mines and processing facilities backed by blended finance for smoother adoption.	*Survey: <30% of smelters use identity preservation due to cost. Reserve for defence procurement or acute security-of-supply scenarios.*	National security
	Consider expanding digital product passports beyond EU for batteries and high-impact products. Align with emerging international standards.	*Broader G7/trade-partner adoption would harmonise global data practices and level the playing field for responsible producers.*	Circularity RBC

Notes

[1] The OECD Inventory on Export Restrictions on Industrial Raw Materials covers 65 industrial commodities, including 58 minerals and metals, six wood products, and all metallic waste and scrap from minerals and metals covered in the Inventory

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2 Understanding responsible business conduct and traceability

This chapter examines the global state of play for implementation of responsible business conduct standards and related uptake of traceability and other transparency measures in mineral supply chains. This includes an overview of RBC initiatives with traceability and transparency features. Through an analysis of survey data and global implementation, the chapter examines key trends in RBC and traceability in mineral supply chains and different implementation models.

This chapter examines responsible business conduct standards in mineral supply chains, as well as the landscape of traceability systems to help address operational and governance risks. It provides an overview of the key frameworks, initiatives, and regulatory developments shaping responsible sourcing expectations, before turning to evidence from the survey on how traceability is being implemented in practice across the private sector. The aim is to showcase current company due diligence practices that already produce relevant information on mineral supply chains. Lithium and nickel specific risks and standards-based and traceability approaches to address these are discussed in chapters 3 and 4, respectively.

2.1. Operational and governance risks threaten already strained supply chains

As demand accelerates, the rapid expansion of mining and processing activity may increase operational and governance risks. Such risks may be environmental, social or governance-related. If unaddressed, these can propagate through supply chains, disrupting production, trade and overall supply chain resilience, in addition to the potential economic benefits for communities and countries along the value chain. For example, isolated instances of corruption, regulatory non-compliance, labour disputes and community opposition can impose lengthy and costly delays to projects. Major mining projects have been cancelled due to conflict and the loss of social licence to operate, demonstrating how short-term gains from bypassing governance risks can translate into substantial long-term costs, including investment delays, environmental harm and supply disruptions (Financial Times, 2025[1]; Bloomberg News, 2024[2]; OECD, 2023[3]). Such delays can be costly. At the same time, materials from jurisdictions and sites with differing risk profiles are often blended along the value chain, reinforcing the importance of traceability systems to verify, and potentially reward, responsible production practices.

Risks related to BEPS,[1] tax avoidance, and other practices that lead to revenue loss occur along the critical mineral's value chain. They are present from extraction through to the point of delivery, where pricing, valuation and related-party transactions determine the allocation of profits. BEPS occurs when multinationals shift profits to low or no-tax locations where they have little or no economic activity or erode tax bases through deductible payments like interest, services or royalties. BEPS in the mining sector is estimated to cost Sub-Saharan governments between USD 470 million and USD 730 million annually in lost revenue (IMF, 2021[4]).

Weak governance and limited traceability create multiple points along the value chain where revenues may be eroded, undermining the social contract around resource extraction in producing countries. These pressures may lead to frequent fiscal reforms, creating uncertainty for investors and affecting the stability of supply chains. In turn, fiscal governance, traceability systems and exchange-of-information mechanisms play a critical role in reducing information asymmetries, enabling verification of production, mineral quality and transaction conditions. **These dynamics are evident in both lithium and nickel supply chains.** For both minerals, unaddressed operational and governance risks have contributed to investment delays, legal challenges and divestment by major institutional investors. In some cases, projects with existing permits and government backing have been suspended where operational and governance safeguards were found to be lacking (OECD, 2023[3]). Both minerals are also characterised by vertically integrated value chains and extensive related-party transactions, which means that these risks may arise at several stages, including the reporting of production volumes, determination of mineral quality and grade, mineral pricing of the cross-border sale, logistics and insurance arrangements, intra-group service charges, capital investment and financing structures. Mitigating these risks and improving the verification of strong operational and governance performance through robust traceability mechanisms is therefore a precondition to derisking investment and achieving greater supply chain resilience and diversification.

Figure 2.1. BEPS risks along the supply chain

Stage of the mining value chain	Typical BEPS risk	Fiscal impact	Role of traceability and transparency systems
Extraction / production reporting	Underreporting of production volumes through manipulation of measurement systems or reliance on company-declared data	Reduced royalty revenues and production-based taxes	Independent monitoring of production volumes using calibrated measurement systems, digital reporting tools, and cross-verification of production data across regulatory and tax authorities
Mineral grade and quality determination	Manipulation of mineral grade, purity, moisture or impurity levels through selective sampling or testing in affiliated laboratories	Lower reference prices used for royalty and income tax calculations	Standardised sampling procedures, split-sample testing, and use of accredited laboratories to ensure independent verification of mineral quality and grade
First cross-border sale / marketing arrangements	Underpricing of minerals sold to related-party marketing hubs or trading entities	Profit shifting to low-tax jurisdictions and reduced taxable income in producing countries	Linking production, shipment and sales data to verify whether transfer prices reflect observable market benchmarks and arm's length conditions
Transport and logistics services	Inflated freight charges, captive insurance arrangements, and bundled logistics services routed through low-tax jurisdictions	Artificial reduction of taxable profits through deductible logistics costs	Recording shipment volumes, transport routes and logistics providers to benchmark freight and insurance charges against comparable market conditions
Intra-group services	Overstated technical, management or feasibility fees charged within multinational groups	Erosion of the tax base through excessive service deductions	Transparency over operational activities and mineral flows to assess whether intra-group services correspond to real economic activities
Capital investment and asset transfers	Overvaluation of second-hand equipment or related-party asset transfers leading to excessive depreciation deductions	Rapid erosion of taxable profits through inflated capital allowance claims	Monitoring project development and operational capacity to assess whether reported capital expenditures align with actual mining operations
Financing structures	Thin capitalisation and excessive intra-group interest deductions	Profit shifting through interest payments to related financing entities	Improved transparency over ownership structures and financial arrangements combined with interest limitation rules to detect excessive leverage

2.2. Responsible business conduct standards to address operational and governance risks in mineral supply chains

OECD RBC standards provide a framework to address risks spanning human rights, conflict, labour, corruption, environment and tax. These include the OECD Guidelines for Multinational Enterprises for RBC and related Guidance, such as the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas (OECD Minerals Guidance) and the Handbook on Environmental Due Diligence in Mineral Supply Chains (OECD, 2016[5]; OECD, 2017[6]; OECD, 2023[7]). Under these government-backed standards, companies are expected to undertake risk-based due diligence to identify, prevent, mitigate and account for how they address actual and potential adverse impacts in their own operations and supply chains. OECD RBC due diligence expectations currently cover 15 mineral supply chains. They have been integrated into regulations in mineral producing (Democratic Republic of the Congo, Rwanda, Tanzania), processing (Türkiye, United Arab Emirates) and importing (United States, European Union) jurisdictions. Market makers and commodity exchanges, such as the London Metal Exchange, have made OECD standards a requirement for doing business for their members.

The OECD Due Diligence Guidance for Responsible Mineral Supply Chains expects companies to set up a system of supply chain controls and transparency. Of these systems, traceability is the most detailed and intensive, but is expected to be used through a risk-based approach. A system of controls and transparency, including traceability where relevant, should in turn be a starting point for companies' due diligence, ultimately identifying and addressing risks and adverse impacts linked to the supply chain.

The OECD Minerals Guidance also supports the implementation of the Extractive Industries Transparency Initiative (EITI). The EITI is a multi-stakeholder initiative that promotes transparency, accountability and open management in the oil, gas and mining sector; the Voluntary Principles on Security and Human Rights, which seek to manage risks associated with private and public security in the extractive sector; and the 40 Recommendations of the Financial Action Task Force, which are the key set of expectations to combat money laundering, terrorist financing and financing of weapons of mass destruction.

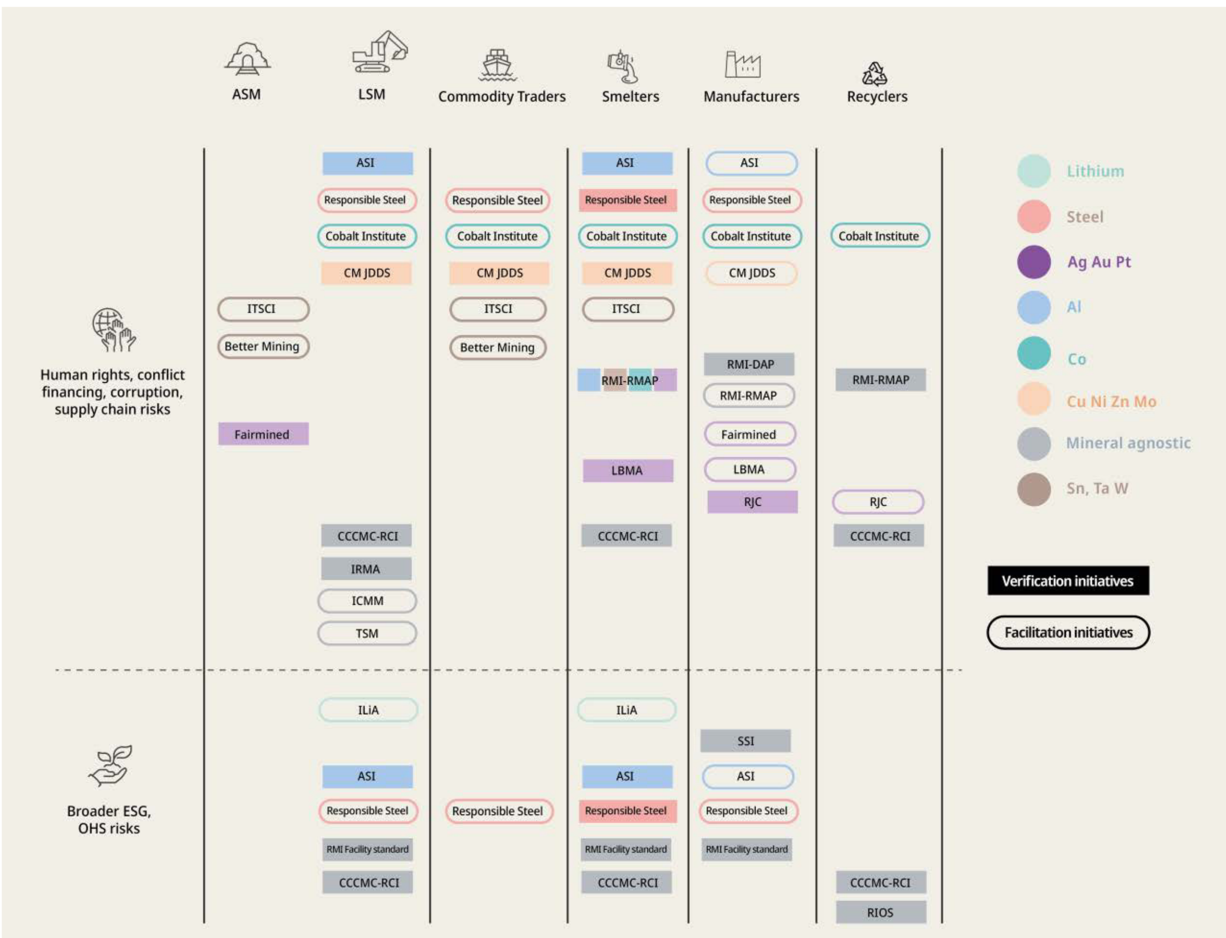
2.3. Multi-stakeholder and industry initiatives as tools to drive supply chain due diligence and transparency

While individual companies retain the responsibility to conduct due diligence, they also use a variety of multistakeholder or industry-led initiatives to demonstrate responsible business conduct in economic activities or promote collaborative efforts to assess and manage risks. If well designed and governed, these initiatives can drive supply chain transparency, help companies manage supply chain risks, pool knowledge, reduce cost and scale effective due diligence. It is important to note that they differ from national or international legislation as they are voluntary in nature (OECD/ITC, 2024[8]).

Figure 1.2 maps selected multi-stakeholder and industry initiatives against their supply chain tier, thematic and mineral coverage, distinguishing between verification initiatives, which assess or audit RBC and due diligence activities, and facilitation initiatives, which support companies' implementation of such activities. It shows that coverage varies across the three dimensions with some initiatives appearing across multiple supply chain stages and mineral types while others are more narrowly targeted at specific segments or commodities. Initiatives covering upstream stages, particularly mining and smelting, are more numerous than those focused on downstream processing or manufacturing, reflecting the concentration of due diligence requirements, including through legislation, earlier in the supply chain where many of the operational and governance risks are taking place. In terms of mineral coverage, several initiatives are mineral-agnostic, while others are tailored to specific commodities such as lithium, cobalt, or tin, tantalum and tungsten, highlighting the fragmented nature of the current landscape and the gaps that remain for certain minerals and supply chain stages. The thematic scope of some of these initiatives addresses the most severe risks in the OECD Minerals Guidance, while others go beyond to include broader risks such as occupational health and safety, environmental and broader governance risks. Recent work on voluntary sustainability initiatives in the minerals space points to similar conclusions (Chenhui Zhang, 2026[9]; Programme, 2025[10])

Chapters 3 and 4 provide greater detail on private-sector uptake of multi-stakeholder and industry initiatives on RBC along lithium and nickel value chains in Argentina, Chile, Indonesia and the Philippines.

Figure 2.2. Overview of supply chain and thematic coverage of selected multi-stakeholder and industry initiatives on RBC in mineral supply chains



Note: ASI: Aluminium Stewardship Initiative; CM JDDS: CopperMark Joint Due Diligence Standard; ITSCI: International Tin Supply Chain Initiative; RMI: Responsible Minerals Initiative; RMAP: Responsible Mineral Assurance Process; RMI DAP Downstream Assessment Program; LBMA: London Bullion Market Association; RJC Responsible Jewellery Council; CCCMC – RCI: China Chamber of Commerce of Metals, Minerals and Chemicals Importers and Exporters – Responsible Critical Mineral Initiative; IRMA: Initiative for Responsible Mining Assurance; ICMM: International Council on Mining and Metals; TSM: Towards Sustainable Mining Initiative; ILiA: International Lithium Association; SSI: Solar Stewardship Initiative; RIOS: Recycling Industry Operating Standard. Verification and facilitation initiatives are two kinds of joint RBC initiatives, with those conducting verification involved in checking due diligence or other RBC functions, often through assessments or audits, while facilitation initiatives provide tools, guidance, or other joint activities that help facilitate companies' RBC and due diligence activities (OECD/ITC, 2024[8]).

Multi-stakeholder and industry initiatives on RBC are a key source of information for companies' due diligence, as also evidenced by the survey conducted as part of this study**.** Nearly three in four respondents report using information provided through multi-stakeholder and industry initiatives in some way. Among the most common uses, 54% declare reviewing suppliers' RBC disclosure gathered through initiatives, while 51% use it to strengthen their risk assessments, for example by reviewing geographic and sectoral risk reports or alerts provided by the initiative. When it comes to risk mitigation, nearly one-third of respondents report using industry initiatives to access individual suppliers' action plans and update lists of suppliers that have been de-listed. One out of five respondents declare not using multi-stakeholder and industry initiatives as a source of information for due diligence.

Beyond participating in multi-stakeholder and industry initiatives on RBC, individual companies may rely on external providers for activities that require specialised expertise. For example, drafting of RBC reports (33%) and supporting environmental calculations and/or disclosure (32%) are among the functions that are reported as being the most frequently outsourced in the survey. On the other hand, many companies rely entirely on internal capacity for due diligence processes. A third of respondents state they do not use external consultants for RBC-related activities.

Beyond collective industry programmes, companies also undertake activities intended to improve engagement and well-being of local stakeholders. In some cases, these may stem from national or sub-national legal frameworks, which establish specific environmental and social obligations for mining companies towards local stakeholders. In others, as part of the consultation and project approval process, companies agree on specific commitments with local communities. These may involve one-off investments or ongoing support in response to specific local needs. Particularly where mining takes place on Indigenous lands in countries where Indigenous Peoples have recognised land rights and/or the country has ratified the principle of Free, Prior and Informed Consent (FPIC), companies may enter into formal agreements with Indigenous communities. These can include benefit-sharing agreements, service provision and employment agreements, or more advanced co-ownership arrangements.

2.4. Traceability as a tool for responsible mineral supply chains

Traceability of a product is the capacity to establish and verify with a sufficient degree of confidence the origin, geographic path, the sequence of entities that held ownership or control and its physical evolution or transformation. Traceability systems can be used for material and product differentiation and to support better operational performance and governance outcomes, though traceability alone is not sufficient to do this (IEA-OECD, 2025[11]). While the vast majority of traceability systems are implemented by the private sector (often in-house), and rely on private infrastructure, other government-led regulatory measures explicitly establish traceability initiatives for minerals based on government infrastructure. Governments may also decide not to develop and run traceability systems themselves, but to incentivise their uptake in the private sector through dedicated regulations.

Traceability may overlap with, but does not equate to, transparency. Transparency means both supply chain visibility and disclosure. A product may be traceable, increasing supply chain visibility, but traceability information regarding that product may not necessarily be disclosed either publicly or down the supply chain. A company may set up an internal traceability system for its own commercial purposes without communicating the information recorded under this system to its customers or to the public – for example, for business confidentiality reasons. Similarly, a company may be highly transparent when passing on traceability information to its business relationships but may choose not to disclose any traceability information to the public. Also, companies' claims may choose to focus on certain areas of success and not cover the full spectrum of responsible business conduct expectations where progress may be more limited. Individual companies' practices may be less visible when they are not transparent or are not monitored by multi-stakeholder and industry initiatives.

Where full traceability is technically not feasible or cost-prohibitive, companies and governments can adopt alternative approaches to prioritise oversight and manage supply chain risks. These include chain of custody, upstream mapping and trade analysis to prioritise high-risk supply chains and allocate resources for traceability accordingly. Such systems enable companies and governments to identify where minerals are produced, processed and traded in order to assess the operational and/or governance risks, and potential anomalies that warrant further investigation or action. While these approaches cannot substitute for direct traceability at the transaction level, they can provide a high-level view of supply chain structure and risk exposure, thus supporting further monitoring of risk as well as diversification objectives. The uptake and choice of traceability models is further investigated below.

To increase consistency and interoperability among many individual companies' traceability systems, certain certification bodies, multi-stakeholder or industry initiatives and international organisations have sought to introduce chain of custody protocols. These provide a framework for documenting material transfers in supply chains and verifying claims regarding mineral origin. These chain of custody standards typically provide the framework for documenting material transfers in supply chains and verifying claims regarding mineral origin. Some chain of custody standards go beyond traceability information by integrating some information on operational risks and corporate governance at the mine of origin or due diligence practices at processing. For example, these include the Solar Stewardship Initiative's Supply Chain Traceability Standard, The CopperMark's Chain of Custody Standard and Initiative for Responsible Mining Assurance's (IRMA) Chain of Custody Standard for Responsible Mined Materials, and the Responsible Mica's initiative traceability platform.

Multilateral and multi-stakeholder initiatives can complement private-sector led initiatives. These include the Global Battery Alliance as well as the digital product passport standard being jointly developed by the United Nations Economic Commission for Europe (UNECE) and the International Organization for Standardization (ISO) (see Box 2.1). Such product passport initiatives are emerging as there is increasing demand from manufacturers for supply chain transparency solutions due to regulatory requirements requiring transparent information on the environmental and social impacts of products.

Box 2.1. Examples of multilateral initiatives on product passports

The Global Battery Alliance's Battery Passport

The GBA battery passport defines a measurement framework for site and facility level performance and sets rules for how data related to GHG emissions, child labour, environmental and human rights, biodiversity, circular design, forced labour and Indigenous Peoples' rights is passed between entities from mining to manufacturing. The battery passport uses assurance of companies' site-level management systems (e.g. adherence to other commitments in policies and processes as validated by a third-party certifier) as a proxy for their performance on these issues.

The GBA has conducted ten pilot studies to demonstrate the feasibility of the battery passport concept throughout certain EV battery value chain in countries such as Australia, Chile and China. In these pilots, externally validated information on the functionality and characteristics of the EV battery (e.g. model, battery chemistry, rated capacity) as well as on the origin of raw material inputs (e.g. lithium and nickel) is reported where available.

UNECE and ISO's joint initiative on Digital Product Passport

The United Nations Economic Commission for Europe (UNECE) and the International Organization for Standardization (ISO) have launched a joint initiative to develop a global framework for Digital Product

Passports (DPPs), aimed at improving sustainability, traceability, and circularity across supply chains. Announced in April 2025, the initiative seeks to overcome longstanding challenges such as data standardisation and interoperability, which have hindered cross-sector adoption of traceability systems. The DPP is envisioned as a decentralised digital "language" that records essential lifecycle information such as product origin, material composition, environmental impacts, and compliance with sustainability standards, while allowing data to remain with its owner and be linked through existing business systems. This work builds on UNECE's prior traceability efforts, including blockchain pilots and the UN Transparency Protocol, and is being formalised under the new international standard ISO/PWI 25534-1: Digital Product Passport – Overview and Fundamental Principles.

Note: As part of the pilot studies, not all information has been made publicly available.
Source: (Global Battery Alliance, 2024[12]; Global Battery Alliance, 2024[13]; Global Battery Alliance, 2026[14]); (UNECE, 2025[15]; UNECE, 2025[16])

Table 2.1 summarises the current state of coverage across the four traceability dimensions, drawing on survey data and site visits, to identify where systems are in place, where gaps are most pronounced and what a targeted response could look like for each. This diagnostic underpins the policy recommendations provided in Chapter 6.

Table 2.1. Dimensions of traceability

Coverage is uneven across core traceability dimensions, with distinct gaps visible for each

Dimension	Systems in place	Gaps	Way forward
Origin data	93% of survey respondents collect country of origin; 82% track mine location.	Coverage is concentrated at mining and refining and drops off at manufacturing and recycling.	Extend origin tracking to recycling feedstock
	Government registries such as Chile's public mining site registry centralise site-level production data.	Recycling-stage origin tracking is limited, creating a blind spot as secondary supply grows.	Combine existing registries with trade data to monitor dependencies
	Sustainability initiative audits verify mine-of-origin claims at upstream facilities.		Require origin disclosure as a condition for development finance
Geographic path	63% of respondents track locations of consolidation, trade and processing. SIMBARA monitors mineral flows across six ministries.	Transportation routes are among the least tracked data points.	Strengthen logistics tracking at key transit points (ports, consolidation hubs). Co-ordinate customs, mining and trade authorities
	Traders collect geographic path data as a core business function with the highest traceability uptake of any segment.	In the Philippines, use of private shipping intermediaries obscures mine to smelter paths.	Engage traders as partners given existing expertise.
		Non-disclosure agreements in nickel supply chains further limit visibility.	
Chain of custody	70% track upstream actors who handled the product.	About 30% of smelter ownership in Indonesia is untraceable	Strengthen beneficial ownership transparency through registries and disclosure requirements, particularly in jurisdictions with complex joint venture structures.
	Mass balance is the most widely used model across all segments, reconciling input and output volumes while allowing blending.	Only 30% of smelters collect data on political affiliation of suppliers	Harmonise audit expectations across existing programmes
	LME requires OECD-aligned responsible sourcing for listed brands.	LME covers about 15% of global nickel flows; stainless steel is largely outside coverage.	Explore expanding exchange-level responsible sourcing requirements to intermediate mineral forms.

Dimension	Systems in place	Gaps	Way forward
Physical evolution	58% of respondents track method of extraction.	Least collected traceability category across all supply chain segments, despite being central to accurate valuation.	Introduce spot checks with independent assay and split-sampling
	Some companies collect data on mineral grade, purity and chemical form through existing quality control processes.	SIMBARA lacks mechanisms to reconcile mineral quality data between mines and smelters.	Require enhanced disclosure on product characteristics alongside volume tracking in government-led platforms.
	EU Battery Passport (from 2027) and UNECE-ISO DPP will require lifecycle data.	Without this, under-valuation and BEPS risks are difficult to detect.	Prioritise for policy attention given direct link to revenue mobilisation in producing countries.

Examples of government-led traceability efforts

Some mineral producing and processing countries have set up government-run traceability systems to improve oversight over the supply chain from extraction until export and ensure proper tax collection. For example, Zambia's Mineral Output Statistical Evaluation System ("MOSES") tracks minerals from extraction to export. It monitors companies' declared monthly production and compares them with customs' documentation and export declarations. The system generates automated alerts for anomalies or suspicious patterns to ensure timely data sharing with law enforcement. Colombia's National Mining Agency is setting up a Mineral Traceability Platform with similar aims, integrating information from the unified registry of minerals traders with document compliance at production level. Indonesia's Sistem Informasi Mineral dan Batubara (SIMBARA) that integrates ten tracking systems across six ministries to monitor mineral flows through a unified supervision framework (see chapter 4 for more information). China's rare earth traceability system requires companies along the whole supply chain to report product flows and integrate information across mining, smelting and manufacturing with the aim of strengthening oversight of the rare earth sector (See Box 2.3 for more information). The Brazilian government's traceability project analyses gold's geochemical, morphological and isotopic signatures to verify document-based chain of custody.

Mineral importing countries introduced traceability requirements to reach specific policy objectives. For example, China's Interim Provisions on the Traceability and Recycling of Power Batteries for New Energy Vehicles (2018) establish a standardised tracking system for the full lifecycle of a battery, supporting material recovery (see Box 2.3 for more information). The United States CHIPS and Science Act aims to reduce reliance on strategic competitors in semiconductor and advanced manufacturing supply chains, which requires reinforced origin tracing. The European Union included requirements to map the supply chains of lithium, nickel and other critical minerals such as cobalt and graphite in the 2024 Critical Raw Materials Act. The 2023 EU Battery Regulation further requires companies to establish and operate chain of custody or traceability systems and identify upstream actors in the supply chain (European Union, 2023[17]). The regulation introduced a digital battery passport that will become active in 2027 which contains detailed information on battery composition and provenance, including mineral sourcing. Several pilot projects are actively testing traceability systems aligned with European Union regulations.

Box 2.2. Supporting technical solutions to traceability: the MaDiTraCe Project

Launched in 2023, MaDiTraCe is a project funded by the European Union aimed at strengthening traceability, transparency and sustainability for critical mineral supply chains. The 42-month initiative is coordinated by French Geological Survey BRGM and brings together a consortium of 14 partners with geological surveys, universities and industry partners from seven European countries.

The project aimed to develop mineral traceability methodologies based on material fingerprinting and artificial tagging, targeting cobalt, lithium, natural graphite and rare earth elements. Its work spans three pillars: technological solutions for traceability and tagging, the integration of traceability registers into Digital Product Passports (DPPs), and association with certification systems at product, chain of custody or site level.

For **material fingerprinting**, samples from the main deposits worldwide were analysed using laboratory techniques (e.g. trace element composition, elemental mapping and isotopes) to determine a fingerprint for each deposit. For certain commodities, particularly lithium and neodymium, isotopic signatures were found to persist through processing and manufacturing, potentially enabling traceability from the geological resource to downstream products. For **artificial tagging**, the project developed solutions such as mineral-based taggants and 3D-printed QR codes in small particles. Both methods were validated under laboratory conditions, with further work required to support cost-effective deployment at scale.

The project also aimed to combine these physical methods with **digital traceability tools**, including blockchain, decentralised identifiers (DIDs), verified credentials, digital wallets and smart contracts, to support secure and auditable traceability across the value chain. The project tested the CERA4in1 certification scheme, which integrates four standards covering mining exploration readiness, industry performance across mining, refining and smelting, chain of custody, and product level.

MaDiTraCe illustrates the role that policymakers can play in facilitating the development of technical solutions to traceability. The project's results indicate that material fingerprinting and artificial tagging are feasible under laboratory conditions, and further research may extend the range of minerals to which these methods can be applied. Deployment at scale would require additional work, in particular to reduce costs and to integrate physical and digital traceability tools into systems suited to industry use. Continued collaboration between governments, research institutions and industry will be important in taking these solutions from validation towards wider application.

Introduced so far under the EU Ecodesign for Sustainable Products Regulation, the digital product passports (DPP) will improve access to information on product origin, material composition, environmental impacts, and end-of-life options for nearly all products sold in the EU. The EU Battery Regulation has already begun reshaping battery industry practices, requiring detailed traceability and lifecycle data through mandatory battery passports from 2027 onward (CEPS, 2024[18]).

Box 2.3. China's rare earth management regulation and traceability system

China's Interim Provisions on the Traceability and Recycling of Power Batteries for New Energy Vehicles, implemented in 2018, establishes a standardised tracking system, covering every stage of the battery lifecycle from production to recycling. Vehicle manufacturers must set up recycling service networks and information platforms to trace batteries, while battery producers are required to provide unique codes and technical specifications for each unit. Detailed protocols govern collection, storage, transport, dismantling, and recycling processes to maximise resource recovery.

China's Rare Earth Management Regulations, effective 1 October 2024, consists of a product tracing system for the rare earth sector. Companies engaged in mining, smelting and separation, metal processing, use, and export are required to establish product flow record systems and input data into a national traceability platform. The Ministry of Industry and Information Technology released draft interim measures to strengthen oversight of the rare earth sector in 2025, including a dedicated framework for product information traceability. The proposed system would require companies in the rare earth supply chain to register and report product flow data monthly. Authorities at national and local levels would have access to integrated data from mining quotas, export permits, customs declarations, and taxation records.

Source: (IEA, 2025[19]) (Pan, 2024[20]) (China, 2024[21]) (Shanghai Metal Market, 2025[22])

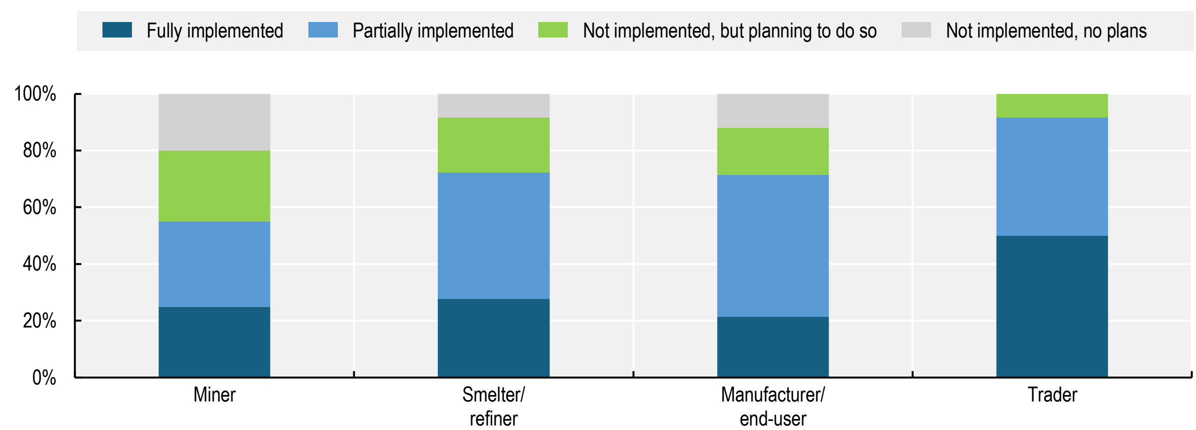
2.5. Traceability in the private sector: diverse approaches

There is no single model for traceability systems. They vary in terms of the information that must be recorded, the technology used to track and communicate this information, and the policy objectives they aim to achieve (IEA-OECD, 2025[11]). Furthermore, how these systems are being adopted in practice across the private sector has remained relatively underexplored. Unlike the landscape of industry-led RBC initiatives, traceability adoption by the private sector does not lend itself to equivalent mapping at the moment. The majority of traceability systems are implemented within individual firms using proprietary tools or internal processes that are not typically publicly disclosed. Similarly, the market for external providers and platforms remains nascent. As such, this section leverages data collected from the survey to identify how traceability systems are currently being adopted by the private sector in practice.

The survey indicates that traceability systems are widespread, but that significant gaps remain. As further explained in chapter 5, the primary drivers for adopting traceability systems are consumer demand, brand reputation, and regulatory compliance rather than proactive risk management. This is reflected in what systems track in practice, with most respondents collecting data on country of origin and mine location compared to far less consistent tracking of physical transformation of minerals, tax payments and ownership structures. Similarly, the level of scrutiny does not appear to respond to the risk profile of a given mineral supply chain. Coverage remains strongest at upstream stages of mining and refining but declines downstream, with manufacturing and recycling less commonly included. This is an important consideration as several critical mineral-rich products start to reach end-of-life at scale in the coming decade and their recycling gains importance. Finally, full end-to-end traceability was largely absent in practice, as most companies rely primarily on a combination of less resource-intensive transparency approaches such as mass balance, chain of custody protocols, supplier mapping and trade data analysis. Each of these dimensions is examined in detail below.

Implementation of traceability systems varies markedly across the four supply chain segments covered by the survey. As shown in Figure 2.3, traders report the highest overall uptake, with the largest share of respondents indicating full implementation and virtually no respondents reporting an absence of systems or plans to adopt one. Smelters/refiners and manufacturers/end-users occupy the middle of the distribution, with partial implementation dominant in both segments, full implementation accounting for a smaller share and a meaningful minority still at the planning stage. Miners show the lowest level of uptake, with fully implemented systems representing only a modest share of responses and the highest proportion of respondents reporting neither a system in place nor plans to adopt one. These differences in baseline implementation should be borne in mind when interpreting subsequent figures in this chapter, as patterns in what is tracked, how, and with what information will in part reflect the varying depth of traceability adoption across the four segments of the supply chain.

Figure 2.3. Status of traceability system implementation in mineral supply chains



Note: This figure presents responses to survey Question 7 ("Does your company currently use, or participate in, any traceability system?"). Based on a subsample of 40 miners, 36 smelters/refiners, 42 manufacturers/end-users and 12 traders. Recyclers and transporters are excluded; manufacturers and end-users are grouped into a single category. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

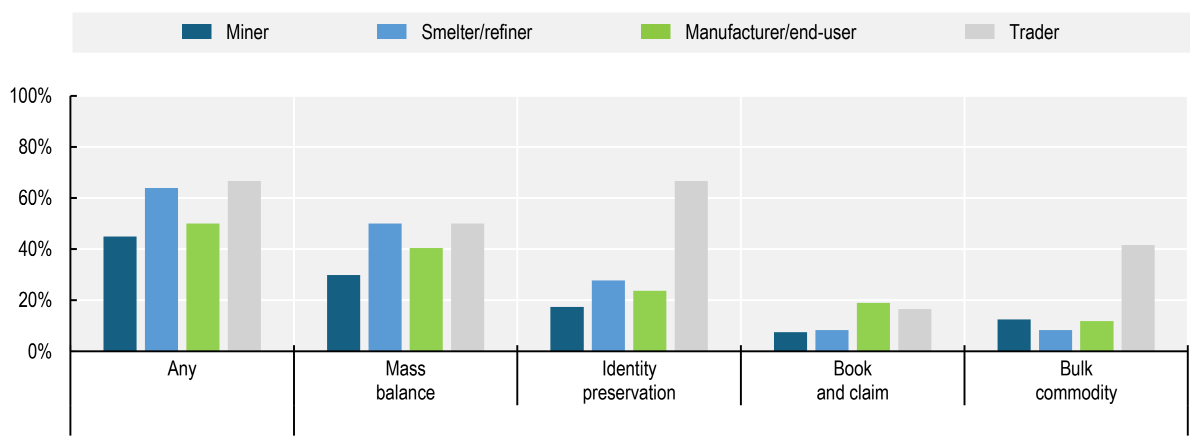
2.5.1. Diversity in traceability models

While full traceability consists of tracking minerals' origin, geographic path, chain of custody and physical evolution, the term is also used as shorthand for a range of supply chain transparency approaches that may track some, though not all, of these criteria.

The survey shows that mass balance is the most widely used traceability model across supply chain segments. Under this approach, the volume of material entering an operation is reconciled with the volume leaving it, accounting for conversion and losses along the way. It allows for blending of different materials but requires the operator to make claims that correspond to the volume of responsible material that was used as an input. It strikes a practical middle ground: more rigorous than simple document-based systems, but less costly and infrastructure-intensive than identity preservation, which physically segregates material from specific sources throughout the supply chain. Identity preservation comes closest to complete traceability, but its high cost means it is rarely applied at the processing stage unless clients are willing to pay a premium for it — fewer than 30% of smelters in the survey report using it. At the other end of the spectrum, bulk commodity systems, which track certified or geographic origins in aggregate while allowing significant mixing of material from different sources, appear to be seldom used among respondents. Book and claim - completely decoupling physical supply from origin and performance through credits system – is reported to be rarely used.

The uptake and choice of traceability models vary markedly across supply chain segments. Traders stand out as the industry segment most frequently reporting implementation of some form of traceability in mineral supply chains (see Figure 2.4). While typically outside the scope of regulations incentivising traceability, commodity traders' function is to match clients' geographic, mineral grade and time needs. As they base their business model on arbitrage and hedging risks along these dimensions of transport, blending/processing and storage, it is likely that they need to collect traceability information on origin, geographic path, supply chain actors and mineral form (Trafigura, 2018[23]). The biggest traders are also vertically integrated into other supply chain stages, which may expose them to regulatory requirements in the countries of production or export.

Figure 2.4. Traceability models used in critical mineral supply chains



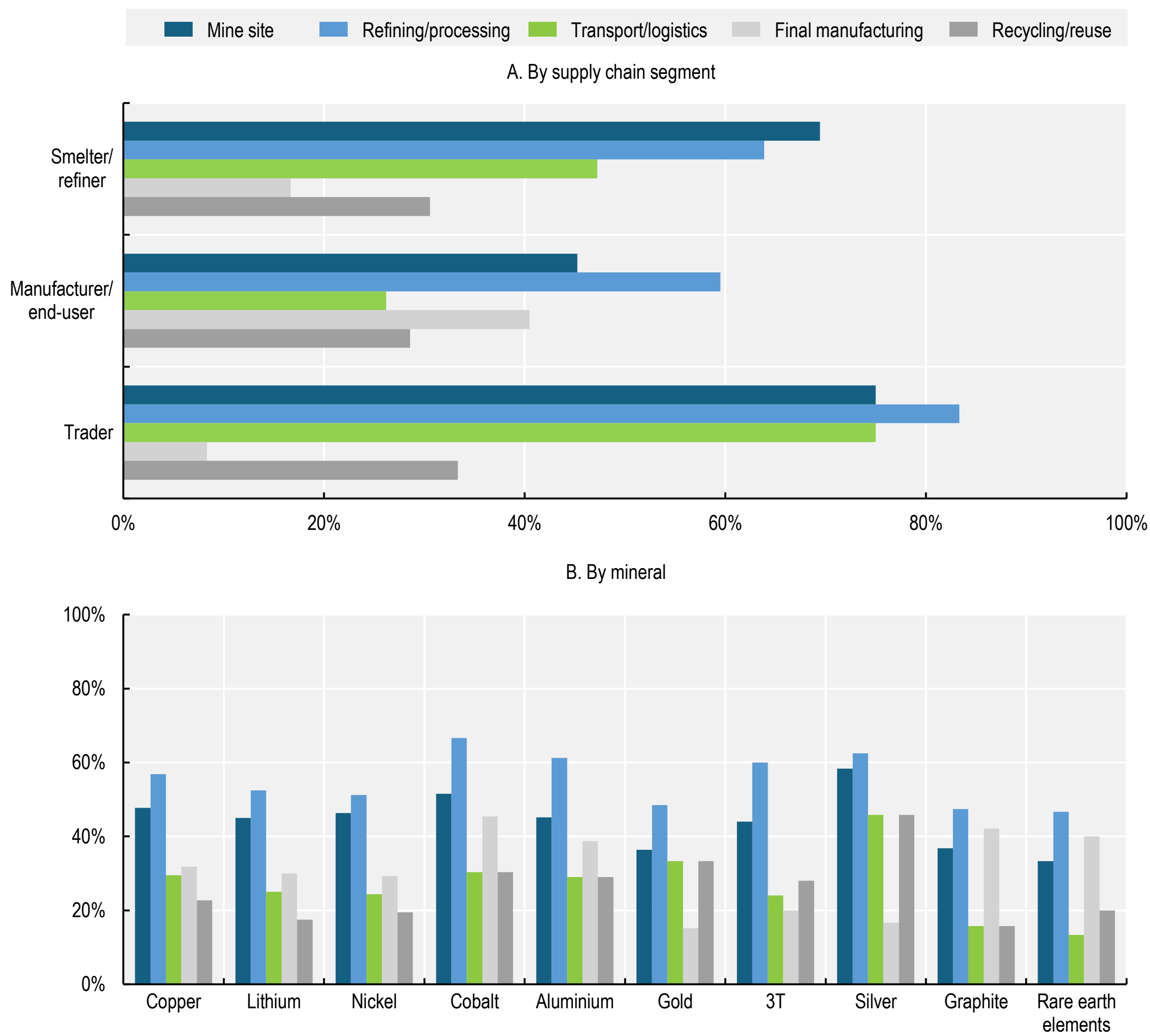
Note: This figure presents responses to survey Question 12 ("What traceability model does the system use?"). Based on a subsample of 40 miners, 36 smelters/refiners, 42 manufacturers/end-users and 12 traders, irrespective of whether they reported implementing a traceability system. Recyclers and transporters are excluded; manufacturers and end-users are grouped into a single category. "None" and "Other" response options are not shown in the figure. Respondents could select multiple traceability models; therefore, percentages may sum to more than 100%. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

2.5.2. Diversity in supply chain coverage

Traceability systems' supply chain coverage may vary widely. Traceability systems can cover the entire mineral supply chain from manufacturing to mining and recycling, or only cover selected segments of the supply chain to respond to the needs of a specific tier or group of companies in an industry association. Insights from the survey suggest that upstream segments of the mineral supply chains, namely mining and refining, are more commonly covered by existing traceability systems (Figure 2.4). This is consistent with industry practice, whereby downstream companies cascade traceability demands up the supply chain to cover information about origin, geographic path, chain of custody, transformation and conditions of extraction and trade. Downstream tiers in the supply chain are therefore less frequently covered. While typically providing rather than requesting traceability information, companies at the mining stage still have a supply chain for mining equipment, as well as chemical and energy inputs they may track both further upstream (procurement) and downstream (reselling) as in certain regions these may be used in illegal operations. Survey results indicate that, although the majority of respondents performing recycling/reusing activities have at least a partial traceability system in place, the majority of them also report that their traceability system primarily addresses upstream operations, but not the recycling/reuse tier of the supply chain. It is also noteworthy that all survey respondents performing recycling/reusing activities operate in at least one additional supply chain tier.

Figure 2.4. Supply chain tiers covered by respondents' traceability systems

Upstream segments are most commonly covered by traceability systems, while downstream stages such as final manufacturing and recycling are tracked less frequently, with notable differences across company types and minerals.



Note: This figure presents responses to survey Question 9 ("Which supply chain tier(s) are covered by the traceability system that you implement or participate in? Select all that apply"). Multiple responses were permitted. The response option "We do not track beyond tier-1 suppliers" (selected exclusively by four manufacturers) is not shown in the figure. Based on a subsample of 36 smelters/refiners, 42 manufacturers/end-users and 12 traders, irrespective of whether they reported implementing a traceability system. Miners, recyclers and transporters are excluded; manufacturers and end-users are grouped into a single category. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

Traceability systems vary not only in their design and supply chain coverage, but also in the proportion of a company's mineral inputs they actually track. Among survey respondents with traceability systems in place, coverage varies widely: while almost 40% trace more than 90% of their mineral input, the remaining majority trace significantly less, with roughly half of all respondents covering less than 60% of their mineral input.

Complete, end-to-end traceability and verification of material origin for all mineral input may not be fully achievable, nor necessarily desirable. Manufacturing companies may have several thousand suppliers across their supply chains, and tens of different raw materials (Murphy, 2022[24]; Abel Ortego, 2020[25]). Upstream companies, including small-scale producers, may face difficulties in setting up traceability systems and passing on verifiable information without adequate support.

Under OECD RBC standards, the scope and level of detail of information collected through traceability systems should be proportionate to the risk profile of the supply chain. The higher the risks, the more detailed and structured the traceability system is expected to be. However, survey results point to another dynamic: nearly half of respondents with existing traceability systems reported that their systems collect the same information regardless of risk level. The remainder indicated some degree of differentiation, either by covering additional tiers or risks for high-risk areas (25%), or entailed some additional verification measures (18%), such as field assessments and audits. The share of respondents reporting risk-differentiated systems is higher for supply chain segments located in the middle of the supply chain (recyclers and traders with 50% and 45%, but with a smaller sample size) and those that have been more exposed to supply chain requirements, such as smelters and refiners (31%).

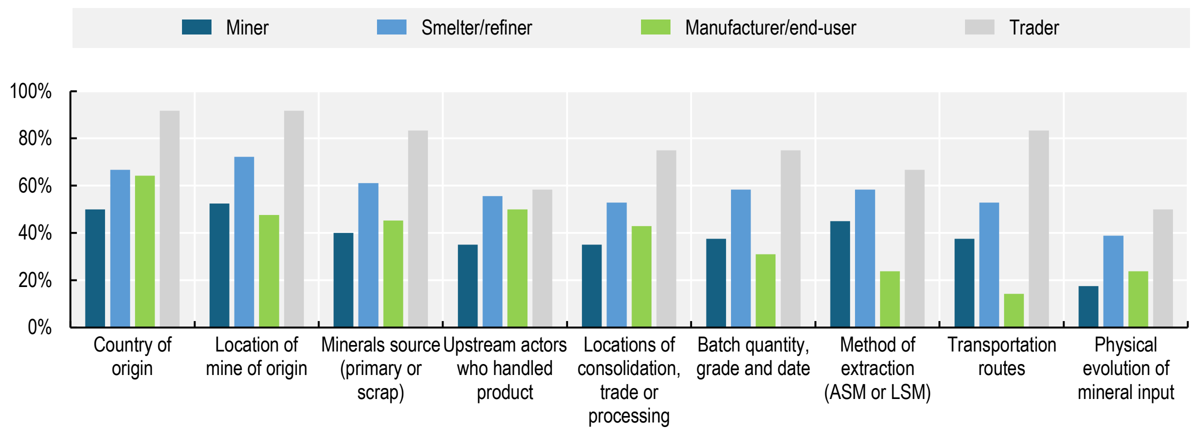
2.5.3. Diversity in information collected by traceability systems

Traceability systems capture more than material origin data. Beyond core country of origin data, most respondents collect a broad range of information on environment, governance, and human and labour rights through their traceability systems, largely driven by existing due diligence and compliance processes. However, as shown in the four graphs below, collection of information such as forced labour risks, tax payments, and supplier affiliations remains inconsistent.

While the majority of respondents report collecting basic types of traceability information such as the country of origin (93%), location of mine of origin (82%), upstream actors who handled the product (70%) and locations of consolidation, trade and processing (63%), information on the source of mineral - whether primary or scrap (72%) and method of extraction (58%) also tends to be collected (Figure 2.5). Physical evolution of mineral input is the least collected type of information across the different segment groups.

Figure 2.5. Types of information collected through traceability systems in mineral supply chains

Information on the country and mine of origin is most commonly collected, while data on transportation routes and the physical transformation of minerals is reported less frequently.



Note: This figure presents responses to survey Question 13 ("What information is collected under the traceability system that your company uses?"). Percentages refer to the share of respondents selecting each category (multiple responses permitted). Based on a subsample of 40 miners, 36 smelters/refiners, 42 manufacturers/end-users and 12 traders, irrespective of whether they reported implementing a traceability system. Recyclers and transporters are excluded; manufacturers and end-users are grouped into a single category. "Other" response options are not shown in the figure. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

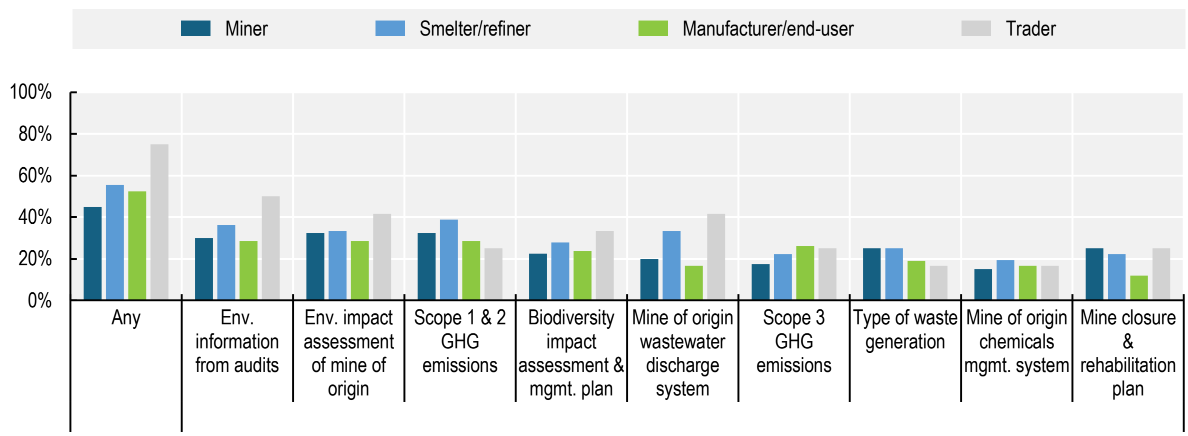
Survey responses also indicate that close to 80% of companies with at least a partial traceability system in place collect some kind of environmental information. Only a small share report they do not collect any environmental information at all. This trend is consistent for different supply chain segments. The most commonly collected information across company types includes:

- Environmental information from audits;
- Environmental impact assessment of the mine of origin;
- Scope 1 and 2 GHG emissions.

This result is unsurprising, as such information is typically gathered through existing due diligence processes, audits of operational and governance risks, or compliance requirements, making it relatively straightforward for companies to have such information readily available and report it.

Figure 2.6. Environment related information collected through existing traceability systems

Environment-related information is collected by the majority of respondents.



Note: This figure presents responses to survey Question 14 ("What environment-related information (if any) is collected under the traceability system that your company uses?"). Based on a subsample of 40 miners, 36 smelters/refiners, 42 manufacturers/end-users and 12 traders, irrespective of whether they reported implementing a traceability system. Recyclers and transporters are excluded; manufacturers and end-users are grouped into a single category. Respondents could select multiple response options; therefore, percentages may sum to more than 100%. "Any" refers to respondents selecting at least one type of environment-related information collected under their traceability system. "Other" response options are not shown in the figure. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

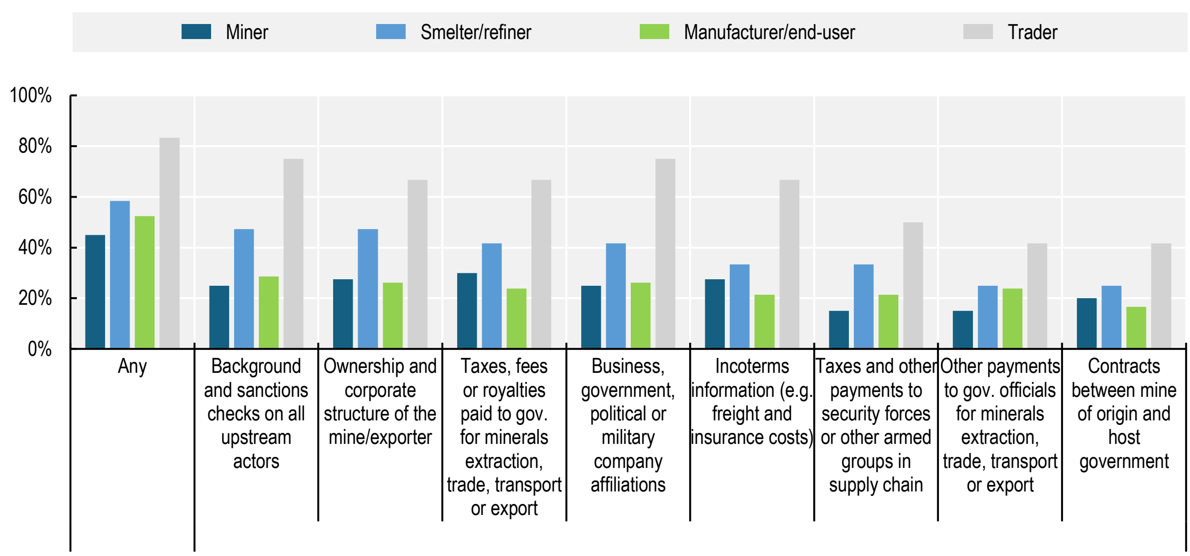
In contrast, information related to mine closure and rehabilitation plans, chemicals management systems at the mine of origin, and REACH/RoHS compliance is collected less frequently. This highlights the role of robust due diligence and operational practices as well as environmental legislation in enabling and strengthening traceability.

Additionally, about a third of respondents report tracing the share of recycled materials in products and material feedstock, i.e. their recycled content. Those reporting not tracing the recycled content either do not have a traceability system in place or do not track this information, likely because they do not handle recycled materials or products with established recycled content requirements. Unsurprisingly, miners largely report not tracking this type of information compared to other types of companies. This is a relatively high share given that the EU's mandatory recycled content requirements for minerals, which set a minimum share of recycled metals in batteries and permanent magnets, are not yet in force. These requirements aim to facilitate the development of markets for secondary materials.

Survey respondents employ a range of methods to trace recycled content, with simpler approaches far outweighing advanced techniques in adoption. Regarding methods used to trace recycled content, information collection, recording and sharing with direct customers and suppliers is most common, followed by the use of a chain of custody method. The use of recycled content certification schemes appears to be the least commonly used method. To verify information related to recycled/scrap material, among respondents tracing such information, most common approach seems to be simple methods such as analysing digital information or document paper trails. Advanced methods such as geochemical tracking or mineral fingerprinting to compare with mine of origin mineral data, X-ray fluorescence (XRF) or laboratory assay of a randomised sample of minerals from the batch, or smart contracts to identify inconsistencies are very rarely used. The use of artificial intelligence and machine learning to identify inconsistencies is also rare but slightly more common.

Regarding governance-related data, as shown in Figure 2.7, more than half of respondents collect such type of information. The information reported the most through traceability systems are background and sanctions checks on all upstream actors, as well as the ownership and the corporate structure of the mine/exporter. This is not surprising, as this covers basic information typically collected when opening a business relationship. Information related to supply chain due diligence, such as political or military affiliation of suppliers, taxes and other payments to security forces or any other armed groups, or to governments is collected by only 40% of the smelters, whose management and data collection systems are typically audited on an annual basis. Contracts between the mine of origin and the host governments are not commonly reported as collected through traceability systems, despite global efforts led by the EITI (EITI, 2026[26]). The use of traceability systems to track the collection and payment of taxes appears to be low for mineral production and downstream entities. Miners report lower rates of traceability as they are the supply chain segment which usually discloses information rather than collecting it. Downstream companies may not have the systems in place to directly track the extracted minerals to tax ultimately paid.

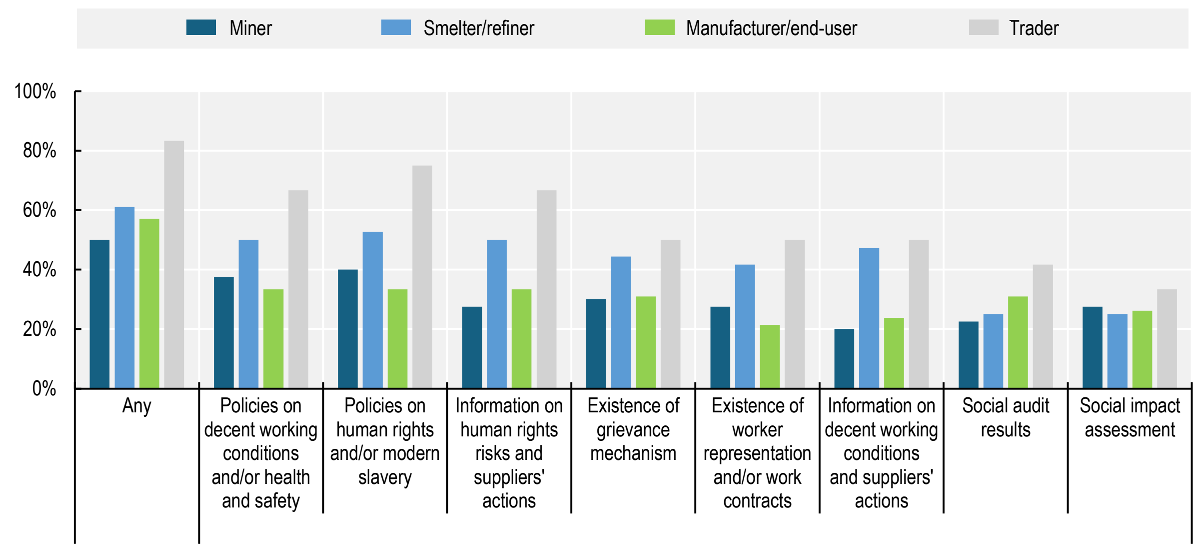
Figure 2.7. Governance related information collected through traceability systems



Note: This figure presents responses to survey Question 16 ("What governance-related information (if any) is collected under the traceability system that your company uses?"). Based on a subsample of 40 miners, 36 smelters/refiners, 42 manufacturers/end-users and 12 traders, irrespective of whether they reported implementing a traceability system. Recyclers and transporters are excluded; manufacturers and end-users are grouped into a single category. Respondents could select multiple response options; therefore, percentages may sum to more than 100%. "Any" refers to respondents selecting at least one type of governance-related information collected under their traceability system. "Other" response options are not shown in the figure. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

Similarly, as shown in Figure 2.8, around 60% of respondents collect at least some human and labour rights information, with traders reporting the highest overall uptake (the sample is composed of 12 respondents). With regards to information related to human and labour rights, most of the respondents focus on policies on decent working conditions, health and safety, human rights and modern slavery. Despite the emergence of legislation requiring companies in key importing markets to publish annual statements on forced labour and modern slavery, only around one-third of manufacturers in the survey sample report collecting this type of information through their traceability systems. Smelters are typically subject to human rights supply chain due diligence through both government regulations and market makers expectations, but only half of surveyed smelters report they collect information on human rights risks and suppliers' actions to identify and mitigate these risks through traceability systems.

Figure 2.8. Human and labour rights information collected through traceability systems



Note: This figure presents responses to survey Question 15 ("What information related to human and labour rights (if any) is collected under the traceability system that your company uses?"). Based on a subsample of 40 miners, 36 smelters/refiners, 42 manufacturers/end-users and 12 traders, irrespective of whether they reported implementing a traceability system. Recyclers and transporters are excluded; manufacturers and end-users are grouped into a single category. Respondents could select multiple response options; therefore, percentages may sum to more than 100%. "Any" refers to respondents selecting at least one type of human or labour rights-related information collected under their traceability system. "Other" response options are not shown in the figure. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

The patterns identified in this chapter play out differently across mineral supply chains and producing regions, shaped by the specific governance frameworks, ownership structures and operational contexts of each. Chapters 3 and 4 examine how these dynamics manifest in practice for lithium in Argentina and Chile and nickel in Indonesia and the Philippines respectively. In lithium supply chains, relatively formal production structures and concentrated upstream ownership create conditions that are comparatively amenable to traceability, though midstream concentration in China and data gaps remain significant constraints. In nickel, complex and often opaque ownership structures, diverse processing pathways and significant operational and governance risks present a more demanding environment, where the gap between traceability ambition and implementation is wider and the stakes of inaction higher.

Annex 2.A. Base Erosion and Profit Shifting

Base Erosion and Profit Shifting (BEPS) refers to strategies used by multinational enterprises (MNEs) to exploit gaps and mismatches in tax rules to:

- Shift profits to low- or no-tax jurisdictions;
- Erode the tax base of countries where real economic activity occurs.

The OECD/G20 BEPS Project introduced 15 Actions to address these risks by aligning taxation with value creation, improving transparency, and strengthening international coherence of tax systems.

BEPS Action 4 – Limiting Base Erosion via Interest Deductions

BEPS Action 4 introduces rules to restrict excessive interest deductions, a common profit-shifting mechanism in the extractive sector. Multinational groups frequently capitalise local subsidiaries in resource-rich countries with high levels of intra-group debt, allowing profits to be shifted through excessive interest payments. Effective enforcement of these rules requires visibility over intra-group financing arrangements, reinforcing the importance of integrated data systems that can track financial flows alongside operational activity.

BEPS Actions 8-10 – Aligning Transfer Pricing Outcomes with Value Creation

BEPS Actions 8–10 form the core of the BEPS framework for the extractive sector, ensuring that transfer pricing outcomes reflect the location of real economic activity and value creation. These actions are particularly critical for commodity transactions, where pricing can be manipulated through under-pricing of exports, inappropriate comparables, or the use of marketing hubs. The OECD Transfer Pricing Guidelines[2] emphasise the use of the Comparable Uncontrolled Price (CUP) method and accurate delineation of transactions when pricing commodities. However, effective application depends heavily on access to reliable data on production volumes, quality, transport, and sales. This is where traceability systems become essential, as they enable tax authorities to verify the integrity of transactions across the value chain.

Action 13 – Transfer Pricing Documentation and Country-by-Country Reporting (CbCR)

BEPS Action 13 contains revised standards for transfer pricing documentation incorporating a master file, local file and a template for CbCR. CbCR is a tool to enhance transparency by requiring multinational enterprises to report on revenue, profits, taxes paid, and certain measures of economic activity. For tax administrations, CbCR provides a high-level risk assessment tool to identify discrepancies between where profits are reported and where substantive activities occur. Importantly, CbCR can be understood as a form of macro-level traceability of profits, complementing physical traceability systems that track minerals and transactions along the value chain. Both are necessary: while CbCR identifies risk patterns, traceability systems provide the granular data needed to investigate and enforce.

Tax Incentives and the Global Minimum Tax

The Global Minimum Tax (GMT), applies to multinational enterprise (MNE) groups with consolidated annual revenues of EUR 750 million or more. Its core objective is to ensure that such groups are subject to a minimum effective tax rate (ETR) of 15% in every jurisdiction in which they operate. By doing so, the rules aim to reduce harmful tax competition, limit the “race to the bottom” in corporate income taxation, and encourage investment decisions based on real economic substance rather than tax differentials.

Under the GMT rules, when the ETR in a jurisdiction falls below 15%, a top-up tax may be imposed, either by the source jurisdiction or by other jurisdictions within the MNE group. Therefore the implementation of the GMT will have a pronounced impact on the effectiveness of tax incentives (particularly those that are income based). Tax incentives that are successful at attracting economic substance, such as investment in people and tangible assets, are less likely to be affected by the GMT than income-based tax incentives such as corporate income tax holidays, exemptions or reduced rates, when they are not tied to economic substance, which often do not provide value for money in terms of investment generated per dollar of tax cost. This distinction is critical when assessing national investment regimes that are designed to attract large-scale capital-intensive projects, including in the mining sector and in particular traceability systems.

The central policy question is whether tax incentives can be economically effective to promote certain activities across the mining value chain. For Nickel and Lithium producing countries, income-based incentives that directly reduce the ETR below 15% in their jurisdiction are the most exposed. Incentives linked to real investment, tangible assets and employment are more consistent with the policy direction encouraged by the OECD.

The strategic value of tax incentives more broadly especially in the mining sector must now be assessed considering the GMT rules. Jurisdictions relying heavily on income-based tax incentives may have to review the effectiveness of their tax incentives. To support the development of traceability systems by MNEs, countries could consider expenditure-based incentives that reduce the cost of developing these systems and encourage companies to invest in traceability systems across the mining value chain.

Notes

[1] Domestic tax base erosion and profit shifting (BEPS) relates to tax planning strategies that multinational enterprises use to exploit loopholes in tax rules to artificially shift profits to low or no-tax locations as a way to avoid paying tax. The OECD/G20 BEPS Project equips governments with rules and instruments to address tax avoidance, ensuring that profits are taxed where economic activities generating them take place and where value is created.

[2] OECD Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations 2022 | OECD

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3 Lithium

This chapter examines the structure and dynamics underpinning the global lithium supply chain. It identifies key challenges to responsible production and processing, as well as tracing lithium products along value chains. It then outlines the regulatory and operational environment, as well as associated risks, in Argentina and Chile.

Lithium is among the most strategically important critical minerals for economic and energy security. Latin America's Lithium Triangle holds more than half of global lithium resources, meaning that operational and governance performance in the region will significantly shape investment dynamics and the reliability of global battery supply chains. Addressing operational and governance risks while improving traceability is therefore a priority for policymakers seeking to de-risk investment and support responsible sourcing along lithium supply chains.

3.1. Overview of the supply chain

Lithium is a critical input for EVs, electronics and energy storage, with demand rising faster than any other energy-transition mineral (IEA, 2024[1]; Ahmad, 2020[2]) (Ngoy et al., 2025[3])**.** Widely used for consumer electronics and EVs, lithium demand is expected to more than double between 2025 and 2030 as EV production increases (Jaber, 2025[4]; OECD & IGF, 2023[5]). EVs and battery storage are projected to account for over 90% of total lithium demand by 2030 (IEA, 2024[1]). Mined lithium (from mineral ores or brines) is further refined into chemical compounds, such as lithium carbonate, lithium chloride and lithium hydroxide. Lithium carbonate and lithium hydroxide are typically used for lithium battery manufacturing for EVs and storage systems. Lithium carbonate is used in multiple battery chemistries as well as other uses such as ceramics and glass, as well as steel and iron casting. Lithium hydroxide is a key element in nickel-rich batteries, but also in lubricants and glasses (Brady, 2022[6]).

Lithium production remains highly concentrated. In 2024, the top three producing countries – Australia (36.7%), Chile (20.4%) and China (17.1%) – accounted for nearly 75% of global lithium mining output (USGS, 2025[7]). Brine-based production is highly concentrated in the Andean salars[1] found in Latin America's 'Lithium Triangle', with smaller operations also present in China and the United States. Chile's Salar de Atacama is the world's most productive brine deposit due to high lithium concentrations and favourable climate conditions (Cubillos et al., 2018[8]). Chile holds more than twice the lithium reserves of Argentina (9.3 Mt and 4 Mt respectively), producing roughly three times as much (USGS, 2025[7]). Australia's hard-rock spodumene lithium mining consists of large, open pit mining operations such as those that use conventional mining approaches to produce spodumene concentrate. As with brine operations, hard-rock lithium production can be used to produce both lithium carbonate and lithium hydroxide. Hard-rock projects can quickly increase production relative to brine-based equivalents, but typically operate with higher capital and energy intensity (Wood Mackenzie, 2025[9]). The vast majority of lithium concentrate produced in Australia is exported to China (96% of Australia's total domestic output was exported to China in 2022) for refining (Australian Institute of International Affairs, 2023[10]), while Argentina and Chile refine a greater share of the production output locally into technical and battery grade lithium chemicals.

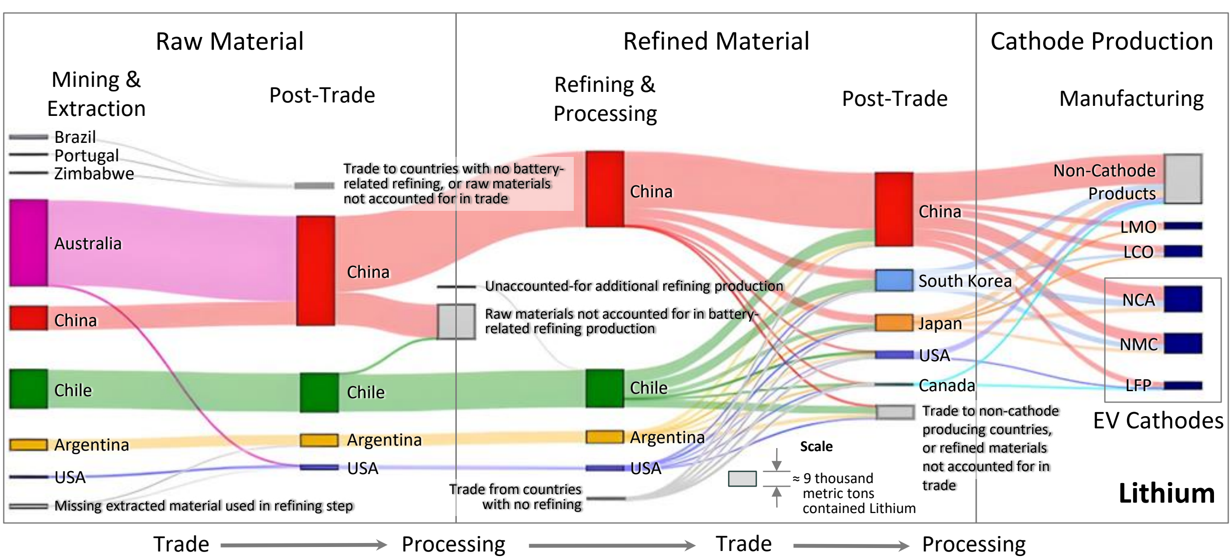
Processing is further concentrated, with China accounting for 70% of total processing worldwide, and up to 95% of lithium sources from hard-rock ores (IEA, 2025[11]) (Australian Institute of International Affairs, 2023[10]). Brine and hard-rock lithium require distinct, multi-stage refining processes to produce lithium carbonate or hydroxide (IEA-OECD, 2025[12]). Notably, the initial processing of lithium-rich brines typically takes place near their production sites and is therefore more geographically distributed than other types of production. As of 2020, Chile and Argentina were the second and third largest producers of refined lithium, accounting for 17% and 7% respectively of global LCE output (JRC, 2023[13]). Hard-rock production is more geographically diverse, with production taking place in Australia and China. Africa accounted for roughly 30% of new lithium mining output in 2024, with countries such as Zimbabwe, Nigeria and Mali increasing production (IEA, 2025[11]). While some diversification efforts are underway, with several refineries somewhat increasing production in Germany, Indonesia, Japan and the United States in 2024, these developments have not yet materially reduced geographically concentrated processing (IEA, 2025[11]).

Existing trade data and supplier mapping already capture these dependencies well, making continued monitoring a low-burden step towards verifying the material impact of diversification efforts. For example, should the nascent refinery activity in Germany, Japan and the United States expand, this monitoring could provide policymakers with the necessary baseline to assess progress without requiring new data collection infrastructure.

Lithium can also be sourced from secondary sources through recycling. Key feedstock for lithium recycling includes battery manufacturing scrap and end-of-life lithium-ion batteries, in particular from electric vehicles (EV). Lithium recycling rates have been historically low. Lithium is one of the least recycled metals owing to its high reactivity, solubility, and low abundance (Yan, Sattar and Li, 2023[14]). Its recovery is technologically difficult and often uneconomical mainly due to a lack of economies of scale and volatile lithium prices. Recycling is currently estimated to contribute to just 3% of supply, with China currently leading the sector with more than 80% of global EV battery recycling capacity (IEA, 2024[15]). Recycling rates are expected to grow significantly in the next decade as more EV batteries reach their end-of-life. However, major obstacles such as complexity and economic viability of lithium recycling must first be overcome.

Figure 3.1. Visualising lithium trade flows

A Sankey diagram for global flows of lithium that available data suggest are involved in battery material supply chains.



Source: (Cheng et al., 2024[16])

3.2. Operational and governance risks

3.2.1. Water use and environmental impacts

Typically concentrated in arid regions, water use is perhaps the most prominent environmental concern. Water consumption estimates per unit of lithium produced from brines are difficult to measure and can vary significantly depending on life cycle assessment method used, as well as the brine concentration and grade. For example, recent research estimates that for an average brine concentration of 0.17wt% lithium content, approximately 220 m^3 of water per tonne of lithium carbonate needs to be evaporated to produce a 6wt% brine for the refining step, while if the brine grade decreases to 0.02wt%, this number approximately increases to 1 900 m^3 per tonne (Gallagher et al., 2025[17]). Brine pumping may also disrupt groundwater levels by potentially drawing potable water toward extraction wells (Souza et al., 2025[18]) (OECD, 2024[19]) (Vera, 2023[20]). Since lithium production is not the only economic activity in the region that generates impacts on water, their cumulative impacts are especially concerning. At the same time, brine-based extraction has a relatively low carbon footprint relative to other types of lithium production due to its reliance on solar energy (Souza et al., 2025[18]).

3.2.2. Social impacts and community engagement

Social impacts in areas with brine-based lithium production are predominantly related to Indigenous rights, community participation and the capacity to leverage mining wealth to address communities' needs, including quality access to healthcare, education or drinkable water (OECD, 2023[21]). Consultation with local communities and Indigenous Peoples is another shared challenge. Despite formal provisions for free, prior and informed consent (FPIC), communities in both countries have criticised consultation processes as inadequate, which has instigated public opposition and protests in some cases. These tensions have, in some cases, created uncertainty for project continuity, and reflect asymmetries in negotiation processes in which some parties have limited access to information.

3.2.3. Emerging risks

These risks are likely to evolve as lithium production expands to new countries and different modes of production. Unlike many other critical minerals, lithium saw production diversify to new producing countries such as Zimbabwe, Nigeria and Mali in recent years. As production is increasing rapidly, ASM is estimated to have accounted for almost two-thirds of African supply in 2023. This volume alone was nearly equivalent to the global lithium market surplus in 2023, highlighting the significance of these operations to the battery value chain (CRU, 2024[22]). Past experience in other mineral supply chains shows that challenges related to ASM differ from those associated with large-scale mining and therefore require an adaptation of responsible sourcing and traceability frameworks. Given the often informal nature of the ASM sector, this may involve tailored engagement with producers to establish realistic and progressive milestones for improvement, combined with economic and market incentives and support to formalisation. Local buyers and concentrators, often linked by commercial relationships to traders and processors, play a key role in integrating ASM production into formal supply chains. As such, they require particular attention in terms of engagement and due diligence.

3.2.4. Battery manufacturing and recycling risks

Lithium-ion battery manufacturing and recycling also pose risks. Lithium-ion battery manufacturing generates significant environmental impacts associated with material and energy consumption. Battery production also consists of energy intensive processes, including cell production, formation/aging, and cell assembly (Yuan et al., 2017[23]). The source of electricity used in manufacturing plays a crucial role in the amount of GHG emissions, depending on plant location and its access to renewable energy. If used incorrectly or damaged, lithium-ion batteries can pose significant fire risks. The treatment of end-of-life batteries requires adherence to strict environmental and safety standards along the entire recycling route from collection, transport to recycling facilities, discharging, dismantling and recycling. Poorly managed battery recycling, and especially disposal practices such as landfilling, can result in fire risks but also leakage of toxins and heavy metals into the environment, creating local environmental and health risks.

Informal recycling processes of batteries can also involve the release of various chemicals, and sometimes the use of child labour in certain countries (World Health Organization, 2024[24]).

Despite stronger regulations, few battery manufacturers disclose their actual corporate governance and operational risk profile, sometimes overstating achievements to attract investors or downplaying problems to protect their reputation (Zhao et al., 2025[25]). Additionally, existing research rarely considers operational and governance standards within battery recycling supply chains. This may need to change as secondary lithium supply chains are expected to become critical post 2030s when end-of-life battery feedstock will become available for repurposing or recycling at large scale.

3.2.5. Lithium pricing and other related party transactions

Mispricing of mineral transactions is a widely observed risk in countries endowed with critical mineral resources. Mineral pricing plays a central role in revenue mobilisation, as key fiscal instruments, including corporate income tax, royalties and withholding taxes, are directly or indirectly linked to the value of mineral transactions. Where minerals are sold to related parties at below market value and subsequently on-sold at market prices, profits may be shifted out of the producing jurisdiction, eroding the domestic tax base. Safeguarding fiscal revenues therefore depends on the accurate determination of the price at which minerals are sold.

Lithium pricing presents specific challenges due to the diversity of product forms, the absence of transparent exchange-based pricing, and the importance of quality and processing characteristics in determining value. Lithium pricing is highly dependent on the chemical form of the product, including spodumene concentrate, lithium carbonate and lithium hydroxide, as well as its purity and contaminant profile. Battery-grade products typically command a premium over technical-grade outputs. Unlike exchange-traded commodities, lithium prices can be derived from price-reporting agencies (PRAs) and negotiated contracts, requiring robust comparability adjustments.

As outlined in the general pricing framework in Annex 3.A., determining the price of a mineral requires careful consideration of all the comparability factors. These include product characteristics, contractual terms, functional profile of the parties, business strategies and market conditions. These factors are particularly complex in lithium value chains. Key pricing considerations relate to product quality, including lithium content, moisture levels and impurities. Lithium concentrate is typically priced based on lithium content on a dry basis, although variations in contaminant profiles and physical characteristics, such as particle size, may influence pricing. A recent publication provides a framework to identify the primary economic factors that can influence the pricing of lithium brines and lithium minerals (OECD/IGF, 2024[26]).

Logistics-related factors, including freight and insurance costs, further influence pricing depending on Incoterms, transport routes and destination markets. BEPS risks arise where these pricing elements, particularly in early-stage exports of concentrate, are not aligned with observable market conditions or are insufficiently substantiated. As outlined in Annex 3.A., excessive debt levels and interest rates linked to intercompany loans may result in excessive interest deductions, while mispricing of logistics, procurement and marketing services may further erode the tax base in producing countries.

Addressing these risks requires both accurate pricing and the effective application of domestic legal frameworks, including transfer pricing rules, interest limitation provisions and documentation requirements. In this context, traceability systems play a critical role by providing reliable data on production volumes, mineral quality, shipment routes and transaction conditions. This strengthens the ability of tax administrations to apply these legal tools and verify whether reported transactions reflect economic reality.

The following sections examine how these risks manifest in Argentina and Chile, the two largest brine-based lithium producers and the focus of this report's site visits and stakeholder consultations.

3.3. Argentina

3.3.1. Argentina: lithium production and processing

Most lithium production in Argentina is concentrated in the northwestern Puna region, which spans the provinces of Catamarca, Jujuy and Salta. A number of new projects have come online in recent years, leading Argentina to more than double its national lithium production between 2023 and 2024 (USGS, 2025[7]). As of 2025, there were six brine operations active in Argentina with five sites under construction and ten undergoing (pre)feasibility or preliminary economic assessments (Ministry of Economy, 2025[27]).

Argentina's decentralised approach to mining has contributed to a largely concession-based and investor-driven model for lithium production in which private mining companies hold controlling stakes in project companies, with a handful of provincial SOEs holding small equity stakes in some operations. This approach facilitates the entry of new investors but can lead to varied environmental, social and governance outcomes across different provinces. Though lithium production in Argentina remains modest compared to Australia and Chile, a number of major mining companies such as Eramet, Ganfeng Lithium, Lithium Argentina, and Rio Tinto, among others, are quickly scaling up production as well as some domestic processing. Often, foreign companies provide capital and technology while provincial SOEs leverage minority stakes to secure information and revenue sharing. As outlined below, the sector is underpinned by foreign capital originating from Chinese, American, Anglo-Australian, French, Japanese and Korean investors. Argentina has notably developed export taxes on lithium, which have helped raise tax revenue but may have reduced overall exports (Andrenelli et al., 2025[28]).

Some regional governments operate companies involved in lithium development. Since 2008, four provinces have established companies active in the minerals sector: Jujuy Energia y Mineria Sociedad del Estado (JEMSE), Recursos Energéticos y Mineros de Salta (REMSa), Catamarca Minera y Energética (CAMYEN), and Energía y Minerales Sociedad del Estado (EMSE) in Rioja (Deberdt et al., 2026[29]; Shale24, 2026[30]).

Joint ownership of lithium projects by investors from OECD and non-OECD member countries is relatively common in Argentina. A prominent example is the Cauchari-Olaroz project: operated by Minera Exar in Jujuy, the project features co-ownership by Chinese (Ganfeng), Swiss (Lithium Argentina) and Argentine (JEMSE) companies in a single project company. Similarly, stakeholder consultations held in Salta, Argentina revealed that Eramet's Centenario-Ratones operation was initially launched as a joint partnership with Tsingshan Holding Group before Eramet bought out Tsingshan's 49.9% stake to become sole owner in 2024.

Table 3.1. Lithium operations in Argentina

Project	Region	Output (LCE)	Operator	Ownership
Cauchari-Olaroz	Jujuy	32 000	Minera Exar S.A.	Ganfeng Lithium (46.66%; CHN), Lithium Argentina (44.84%; CHE), Jujuy Energía y Minería (8.5%; ARG)
Centenario-Ratones	Salta	5 000	Eramine Sudamerica S.A.	Eramet (100%; FRA)
Fénix (Hombre Muerto)	Catamarca / Salta	30 000	Minera Altiplano S.A.	Rio Tinto (100%; GBR, AUS)
Mariana	Salta	5 000	Litio Minera Argentina	Ganfeng Lithium (100%; CHN)
Olaroz	Jujuy	17 500	Sales de Jujuy S.A.	Rio Tinto (66.5%; GBR, AUS), Toyota Tsusho (25%; JPN), Jujuy Energía y Minería (8.5%; ARG)
Rincón	Salta	1 000	Rio Tinto	Rio Tinto (100%; GBR, AUS)
Sal de los Ángeles	Salta	2 000	Potasio y Litio Argentina S.A.	Revotech Asia (46%; HKG), Tibet Summit Resources (45%; CHN) Leading Resources Global (9%; HKG)
Tres Quebradas	Catamarca	1 000	LIEX S.A.	Zijin Mining Company (100%; CHN)

Source: Benchmark Mineral Intelligence

3.3.2. Argentina: Regulatory environment

Regulations in Argentina are set by both national and provincial legal frameworks and government bodies, which can lead to a somewhat fragmented regulatory environment. Broadly speaking, the national government sets broad investment and environmental guidelines while provincial governments manage issues related to mineral rights and developing sub-national regulations (Deberdt et al., 2026[29]). Provincial authorities establish procedures to grant exploration permits, collect royalties and other fees and allocate concessions (Arias Mahiques et al., 2024[31]). Furthermore, in addition to playing a frontline role managing environmental and social regulations, regional governments play an important role negotiating directly with investors.

General environmental regulations are established at the federal level, which sets baseline standards for issues such as environmental protection or public consultation. The General Law of the Environment is a key piece of federal legislation that outlines procedures for environmental impact assessments as well as mandatory public consultation processes. To obtain an exploration or exploitation permit, a mining company must carry out an Environmental Impact Assessment (EIA), comprising, among other components, an Environmental Impact Report and a public consultation process, which must be approved by the public authority (Arias Mahiques et al., 2024[31]). However, although public consultation is mandatory, the company is neither required to obtain public consent nor forced to address the observations or concerns raised during the public hearings (Kramarz et al., 2024[32]). This is further supplemented by the Environmental Protection Law for Mining Activity and the Mining Code, which include mining-specific environmental regulations (Kramarz et al., 2024[33]).

In June 2024, Argentina adopted the Large-Scale Investment Incentive Scheme (RIGI), which is an investment promotion regime that provides 30-year tax, trade and foreign exchange benefits for projects valued over USD 200 million (Secretaria de Minería, 2024[34]). The RIGI provides a combination of income-based and expenditure-based incentives such as reduced corporate income tax rate and dividend withholding as well as stabilisation provisions and accelerated depreciation and amortisation for qualifying assets. The initiative covers eight sectors, including mining, but may be inconsistently applied across the country depending on subsequent decisions by provincial legislatures to ratify RIGI or not.

Tax incentive design should limit unnecessary costs and distortions and their impact should be evaluated regularly (IMF-OECD-WB-UN, 2025[35]; OECD, forthcoming 2026[36]). Tax incentives should only be used when their expected benefits outweigh their costs, with a preference for incentives tied to expenditures (e.g. investment, employment), such as accelerated depreciation, or enhanced deductions and credits, as they are expected to deliver more *additional* investment per unit of revenue foregone than income-based incentives.

Income-based tax incentives, such as the tax holidays or income exemptions provided under Argentina's RIGI regime will reduce a multinational enterprise (MNE)'s effective tax rate, and this could give rise to potential top-up taxes under the Global Minimum Tax ('GMT') which reduces the benefit of those incentives. Expenditure-based tax incentives which are directly tied to payroll, or investments in tangible assets in the jurisdiction will be less affected by the GMT. Such incentives may also be more resilient and more consistent with the direction of international tax reform (IMF-OECD-WB-UN, 2025[35]; OECD, forthcoming 2026[36]). Further details are in Annex 2.A.

Beyond the GMT and tax incentives, Argentina has implemented key OECD BEPS measures that are particularly relevant to mitigating mining-related BEPS risks, notably Action 4 (Limitation on Interest Deductions) and Actions 8-10 (Aligning Transfer Pricing Outcomes with Value Creation) and Action 13 (Transfer Pricing Documentation) (OECD, 2026[37]). This enhanced transparency and traceability strengthens Argentina's audit capacity and risk assessment in the mining sector, particularly for lithium given the opaque publicly available quoted prices.

3.3.3. Argentina: Operational and governance risks

The increase in overall output as well as the number of lithium operations across Argentina has raised additional challenges. These are primarily related to water scarcity, environmental protection and impacts on local communities, including Indigenous Peoples. Indeed, evaporative methods employed to extract lithium from brines often necessitate substantial quantities of water to further concentrate the brines (Baspineiro, Franco and Flexer, 2020[38]). These practices may compete with local agricultural communities for freshwater resources, especially in dryland areas where wetlands are scarce and serve as vital sources for both biodiversity and human activities—an example typical of the Andean plateau ecosystem (Marconi, Arengo and Clark, 2022[39]). As all economic activities in a region generate certain environmental impacts, their individual as well as cumulative impacts need to be better understood. Reported direct effects of lithium mining on wetlands are habitat loss, soil and water salinisation, contamination, changes in water flow, and land subsidence, impacting local plants and animals such as the altiplano's flamingos (Marconi, Arengo and Clark, 2022[39]; Kaunda, 2020[40]). Lithium mining also impacts human activities, including pastoral activities for local communities, tourism and recreation (Marconi, Arengo and Clark, 2022[39]).

Driven by the federal structure of mining governance in the country, researchers have highlighted the risks of inconsistent application of environmental and social standards across regions (Kramarz et al., 2024[32]). While lower standards are sometimes attributed to competition for investment, there is also evidence that high turnover in provincial governments and varied institutional capacity in regions can pose challenges to the effective design, monitoring and enforcement of lithium-related policy frameworks (Deberdt et al., 2026[29]). Argentina's federal structure introduces additional challenges for public regulations applicable to the mining sector, as these are determined by the interplay of national and provincial regulations. This results in heterogeneity across provinces regarding the expectations imposed on companies, and failure to leverage mining projects for skills development and co-ordination on infrastructure investment (see Box 3.1).

Box 3.1. Site visits in la Puna: challenges to leverage mining companies' activities for local development

Salta's lithium production began in 2015, when the Rincón Project (now owned by Rio Tinto) and the Mariana Project (Ganfeng) entered the construction phase. By 2026, the region had around six approved lithium projects (five producing lithium carbonate and one producing lithium chloride), and dozens in advanced exploration.

Despite the advances in policy and governance frameworks, regional authorities and institutional actors have identified ongoing challenges in la Puna to translate mining activity into long-term local development. These can be grouped into four main areas:

- Transport infrastructure for goods and people. The Puna region, where many mines are located, is a high-altitude area reaching up to 4 000 metres. Roads are narrow and steep, and there is limited rail infrastructure. Transport infrastructure remains a major constraint for moving products competitively vis-à-vis neighbouring economies and enabling workforce mobility. Site visits indicated that this has inhibited the development of locally-owned companies and employment opportunities.
- Provincial and local government capacity. Rapid growth in mining activity has increased demand for skilled public servants, leading to high staff turnover and difficulties in recruiting and retaining specialised personnel for planning and monitoring.
- Local skills and workforce development. While lithium mining has generated significant employment, especially during the construction phase, local workers often lack the specialised skills required for operational roles. Managing expectations is also important, as construction phases can employ up to six times more workers than operations and many workers join during construction phases, but now struggle to find jobs with comparable pay.
- Governance to link lithium mining with local development. Unlike employment, lithium mining has generated limited opportunities for local business development. Many suppliers remain specialised companies from outside the region, including neighbouring mining areas in Chile. In addition, Indigenous communities near mining sites continue to face structural well-being challenges, particularly in access to public health services, mental health support, and addiction care.
- Companies' local community engagement activities and related reporting are not always visible or adequately integrated in local policy making nor in community governance. This creates missed opportunities in gaining scale in efforts to improve operational and governance performance, as well as to improve monitoring of the impact of mining.

Source: Government of Salta Province. (2023). Plan de Desarrollo Minero Sustentable 2030.

Some Indigenous communities in northern Argentina have mobilised against lithium extraction projects, arguing that large-scale brine pumping threatens scarce water resources, fragile salt-flat ecosystems and ancestral land rights, with claims that consultation processes have been inadequate (Reventós, 2023[41]). For example, in Jujuy, constitutional reforms designed to facilitate resource extraction were perceived to weaken environmental assessments and protection safeguards, triggering mass demonstrations, with reports of excessive police force, injuries and intimidation against protesters opposing lithium expansion and restrictions on the right to protest (Barber, 2024[42]) (COP de Cambio Climático, 2025[43]). Indeed, despite provisions for public consultations related to mining projects at both the federal and provincial level, studies have reported gaps in the regulation of public participation at the national and provincial levels, as well as lack of guidelines to implement FPIC, when operations affect Indigenous territories (Arias Mahiques et al., 2024[31]).

The limitations of the current regulatory environment to consistently address operational and governance risks, as well as concerns by communities located in mining regions not only creates risks of environmental and social harm, but has created reputational risks and other sources of uncertainty for companies operating in the country. For example, in 2025, Galan Lithium secured approval under Argentina's RIGI initiative, granting long-term fiscal and regulatory incentives, and obtained financial backing from the Clean Elements Fund to support construction, with initial output scheduled for 2026 (Galan Lithium, 2025[44]). These developments followed a significant legal development in 2024, in which a Catamarca court ordered the suspension of new lithium projects in the Hombre Muerto Salar pending updated environmental assessments and community consultation (Aida Americas, 2024[45]). The injunction highlights that projects with existing permits and support from the central government may face risks to operational continuity if environmental and social safeguards are found lacking. As such, while strategic projects may proceed under supportive national policies, unresolved environmental and social impacts could delay output and impact investment and purchasing decisions. Conversely, the precedent created by this ruling may help to strengthen the sector's resilience should it encourage more rigorous environmental impact assessments and credible community engagement.

Some protests and social unrest towards operations appear to have emerged from gaps in communication and engagement in decision-making around mining, including policy reforms and monitoring systems. Beyond this, there are other structural factors affecting the impact and the credibility of environmental protections and public consultations in local development. They include provincial and municipal government capacity to enforce, monitor and communicate about adoption of responsible mining practices as well as local conditions to leverage community well-being activities and mining projects for relevant development such as skills and coordination on infrastructure investment.

Formal agreements help to improve perceptions of mining. It is worth noting that opposition to lithium production and processing projects varies across all communities in Argentina. For example, stakeholder consultations in Puna region indicated relatively low social opposition towards mining. Some surveys have accounted for more than 70% of the population in La Puna who support mining (Batallánez, 2025[46]). Additionally, the Salta province ranked first among Argentine provinces in the 2024 Fraser Institute survey for mining policy perception and investment attractiveness (Mejía and Aliakbari, 2025[47]).

Argentina, like most Latin American countries, lacks specific regulations for the recycling of lithium-ion batteries, increasing the risks associated with their unsound or no end-of-life management. Consequently, lithium-ion batteries are either exported to countries with more developed recycling systems or are not recycled at all. However, to export end-of-life batteries for recycling, local waste management companies must have the legal capacities to comply with the requirements of the Basel Convention on the Transboundary Movements of Hazardous Waste, which is often not the case in the region (López Hernández et al., 2024[48]). A pilot recycling project has been set up in the province of Mendoza, following the development of a recycling technology by the Scientific and Technical Research National Council (CONICET) and the National University of Cuyo (UNCUYO) (Obaya, López and Pascuini, 2021[49]).

Box 3.2. Site visits in la Puna: leveraging mining companies' activities for local development

The provincial government mining development strategy, adopted in 2011 and updated in 2021, identifies ten areas of action, with particular emphasis on supporting local skills, linking local suppliers to mining projects, and modernising government through improved project information and digitalised permitting processes. Positive aspects of mining governance in Salta include:

- Third party monitoring systems: the University of Salta is responsible for monitoring the implementation of the mining strategy, which supports long-term delivery of strategic goals. There is also a law for community-led environmental monitoring, where the University of Salta provides capacity-building for community participants.
- Policy structures to identify priorities of mining communities and link them with companies' social activities:
- Social working groups meet twice per year to review the priorities of mining communities. These meetings have connected employment needs with job opportunities and identified areas for workforce and local business upskilling.
- A database on local mining value chains, including information on suppliers, the share of local workers in mining projects, and the origin of non-local workers.
- A resolution allowing the government to require cumulative impact assessments from companies.
- The only Indigenous Chamber of Commerce in Argentina. The Chamber of Mining and Tourism Service Providers of the Argentine Puna (CAPROSEMITP) works to develop and strengthen local providers for mining and tourism, providing capacity building on areas of quality, safety, and environmental responsibility. It helps to create economies of scale among providers, connect new companies with industry needs and incentivises entrepreneurship among Indigenous peoples.

Source: Government of Salta Province. (2023). Plan de Desarrollo Minero Sustentable 2030. https://cessalta.org.ar/files/biblioteca/plan-desarrollo-minero-sustentable-2030.pdf

3.4. Chile

3.4.1. Chile: lithium production and processing

Lithium production is concentrated in the northern province of Antofagasta. The region hosts Chile's two active lithium mines, both of which are located on the Salar de Atacama, in addition to lithium processing facilities located in Antofagasta city (OECD, 2023[21]). An OECD Member since 2010, Chile enjoys the lowest lithium production costs worldwide (OECD, 2025[50]). The mining sector forms a key pillar of the Chilean economy**,** accounting on average for 10.9% of national employment and 10.5% of GDP over the past decade, approximately 58% of total exports, and around 6–8% of fiscal revenues (EY, 2025[51]). In 2024, Chile was the largest producer of copper and second largest producer of lithium worldwide (USGS, 2025[7]). While copper accounts for roughly 50% of all exports by value, Chilean lithium production has trebled since 2015, and exports of lithium grew from 0.9% of total exports of goods in 2020 to 7.1% in 2023 (Bednarski, 2021[52]) (OECD, 2025[50]). As such, lithium has emerged as a significant export commodity for Chile and an increasingly important driver of growth and fiscal revenues, particularly during periods of elevated lithium prices.

Chile has developed a distinctive governance framework for lithium. Lithium is categorised as a strategic mineral in Chile's Constitutional Organic Law of Mining Concessions, which states that lithium can only be exploited by government entities, SOEs, which may establish lease-based agreements or via Special Lithium Operation Contracts (CEOLs) with private operators that enforce production quotas, royalties, and environmental standards. This state-centric regime has slowed the development of new projects, resulting in a highly concentrated production structure. Currently, only two companies, Albemarle and SQM, are commercially producing lithium in Chile, with a few other projects under development (OECD, 2025[50]).

In 2023, Chile developed a National Lithium Strategy intended to increase lithium production through state-led public-private partnerships (National Lithium Strategy, 2023[53]). While the Strategy preserves legacy contracts with SQM and Albemarle, it mandates majority state ownership in new projects via Codelco, ENAMI or a proposed National Lithium Company and doubled the number of exploitable sites (National Lithium Strategy, 2023[53]).

SQM operates in the Salar de Atacama under a 1993 lease agreement with CORFO, valid through 2030, which grants rights to extract and commercialise lithium and potassium from brines (SQM, 2022[54]). As the 2030 expiration approached, SQM and state-owned Codelco renegotiated the framework for continued operations, culminating in a 2024 Partnership Agreement aligned with Chile's National Lithium Strategy and the establishment of Nova Andino Litio SpA, or Novandino. Under the new structure, Codelco holds 50% plus one share, ensuring majority state control, while SQM retains the remaining stake. SQM will manage operations until 2030, after which Codelco will assume operational leadership (SQM, 2024[55]). This arrangement marks a transition from SQM's prior fully controlled operating model under CORFO lease terms to a majority state-owned partnership structure with expanded fiscal and governance participation by the Chilean state. **The second major leaseholder in Chile's lithium sector, Albemarle**, **holds concessions in the Salar de Atacama** with contractual rights extending to approximately 2043 (Villegas and Scheyder, 2023[56]). Unlike SQM, Albemarle has not been incorporated into a new majority state-owned joint venture; its exploration and production activities continue under its existing concession framework, although they remain subject to the broader policy direction of Chile's National Lithium Strategy.

Beyond the Atacama salt flat, Chile is advancing efforts to diversify production through new state-led partnerships. At the Salar de Maricunga, Rio Tinto has committed roughly USD 900 million to acquire a 49.99% stake in a joint venture with Codelco, which retains majority control (Faulker, 2025[57]). The project, located at one of the world's richest lithium brine deposits, will be majority owned by Codelco (50.01%) and positions Rio Tinto alongside Albemarle and SQM as a key player in Chile's expanding lithium landscape (Financial Times, 2025[58]). Similarly, the Altoandinos project, developed through a partnership between state miner ENAMI and Rio Tinto, is projected to begin production around 2032, with an initial contribution of USD 425 million for project development and securing a 51% stake (Zadeh, 2025[59]). An overview of lithium operations in Chile is displayed in Table 3.2.

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Table 3.2. Lithium operations in Chile

Project	Region	Operator	Ownership
Salar de Atacama (SQM)	Antofagasta	SQM / Nova Andino Litio	SQM (49%; CHL), Codelco (51%; CHL)
Salar de Atacama (Albemarle)	Antofagasta	Albemarle	Albemarle (100%; USA)
Salar de Maricunga (in development)	Atacama	Codelco / Rio Tinto	Codelco (50.01%; CHL); Rio Tinto (49.99%; GBR, AUS)
Salares Altoandinos (in development)	Atacama	Rio Tinto / ENAMI	Rio Tinto (51%; GBR, AUS); ENAMI (49%; CHL)

Source: (SQM, 2024[55]; Albemarle, 2023[60]; Rio Tinto, 2025[61]; Codelco, 2025[62])

3.4.2. Chile: Regulatory environment

Chile's **National Critical Minerals Strategy** sets out investment and diversification objectives, as well as a commitment to advancing traceability and alignment with national and global RBC standards (Peña and Zabala, 2026[63]). The 2023 **National Lithium Strategy** notably includes requirements to formalise protection of 30% of salt flats, assess biodiversity and hydrogeology impacts of new projects, reduce water consumption, and enforce ILO 169 consultations with Indigenous communities (National Lithium Strategy, 2023[53]).

Under Chile's general income tax law, mining companies can utilise accelerated depreciation rules particularly for capital-intensive investments. Given the scale of mining projects especially copper and lithium, accelerated depreciation materially reduces taxable income and improves early cash flow in initial years, during the investment payback period. Accelerated depreciation or immediate expensing limits revenue foregone compared to other tax incentives and increases the likelihood of generating additional investment. It can be particularly beneficial for longer-lived assets, projects with high-upfront costs and liquidity-constrained firms. Accelerated depreciation is also treated favourably under the GMT, as the deferred tax mechanisms do not give rise to a top-up tax liability. In Chile, they could promote investment from MNE entities to develop systems and infrastructure that can track and trace the production of minerals along the mining value chain, thus promoting the adoption of traceability systems.

An effective traceability system can complement the legal measures implemented under the BEPS Actions by reducing the information asymmetries that companies might otherwise exploit. The application of the arm's length principle, for example, requires accurate and reliable data on the volume and quality of minerals produced, as well as on the physical form in which those minerals are sold across borders along the mining value chain. To achieve this, Chile has implemented many of the BEPS Actions, such as BEPS Actions 8-10 and Action 13 (See Annex 2.A. for information on transfer pricing documentation requirements).

3.4.3. Chile: Operational and governance risks

In Chile's Atacama region, the expansion of lithium extraction has intensified environmental, water management and governance challenges, particularly in areas inhabited by Indigenous communities (Marchegiani, Hellgren and Gómez, 2019[64]) (OECD, 2024[19]). Similar to Argentina, Chile's brine-based extraction methods require significant volumes of water, adding pressures into an already water-scarce desert ecosystem (OECD, 2023[65]). This has raised concerns about impacts on hydrological systems, wetlands and local livelihoods (Villa, 2025[66]; Leiss, 2025[67]). Research has indicated some correlation between lithium mining operations in the Salar de Atacama of Chile and vegetation decline, increased daytime temperatures, as well as a decreasing trend in soil moisture levels (Liu, Agusdinata and Myint, 2019[68]). Since brines are not considered as a water body in Chilean regulation, companies are not subject to standard reporting requirements for brine water extraction (Kukulis Montes, 2025[69]). Despite this, lithium operations in key areas such as the Salar de Atacama, governed by CORFO-administered lease agreements, establish detailed extraction limits, stringent reporting obligations. Additionally, while consultation processes have been a central component of recent developments in Chile's lithium governance framework, for example the recent consultation led by CORFO on the SQM - Codelco partnership, some stakeholders have questioned whether existing consultation and participation mechanisms adequately safeguard the right to free, prior and informed consent (FPIC) and ensure equitable benefit-sharing under Chile's evolving regulatory framework.

There is also room to further strengthen environmental impact assessments (EIAs) in Chile. Although a full EIA is required where a project may pose significant risks to public health or the environment, most projects undergo the simpler environmental impact declaration (DIA). While DIA can be appropriate in some cases, the underlying issue is that selection of the type of assessment (EIA or DIA) relies on the project owner, rather than an independent party, Oversight of this initial screening and the justification of the selection of assessment remains limited, due to lack of capacity in the government entities. Such a validation process is important to ensure that the screening process is not used as a loophole to avoid a full EIA. NGOs have alerted that EIAs may not be completely insulated from political influence (Marchegiani, Hellgren and Gómez, 2019[64]) (OECD, 2024[19]).

Indigenous organisations have pursued legal remedies, including a request to suspend the community review process for the proposed Codelco-SQM lithium partnership, citing procedural concerns (Daina Beth Solomon, 2025[70])**.** This partnership process has also triggered opposition to lithium operations in some communities, including road blockades near the Salar de Atacama in protest over the nature and timing of Indigenous engagement during negotiations between SQM and Codelco (Reuters, 2024[71]). At the same time, proposed developments like Rio Tinto's Maricunga project have prompted debate over water use, ecosystem impacts and the balance between mineral production and resource management in one of the world's most water-limited regions (Livingstone, 2026[72]).

Box 3.3. Site Visits in Antofagasta: challenges to leverage mining companies' activities for local development

Antofagasta has been at the forefront of efforts to better link lithium mining with long-term local development. This includes the joint development of a regional mining strategy involving the regional government, mining companies, civil society and Indigenous Peoples, which aims at strengthening governance of mining-related investments to improve public services, training opportunities and infrastructure for local communities, while also securing commitments from mining companies to reduce environmental pressures, particularly in lowering continental water consumption and emissions (OECD, 2023[21]).

Despite this progress some challenges persist in the region:

- Economic dependency: The region's economy remains heavily reliant on mining, which contributed 72% of its GDP in 2023, making it highly susceptible to boom-and-bust cycles driven by global commodity price fluctuations. This dependency creates volatility in the local labour market, creating uncertainty for workers and can have ripple effects in communities such as fluctuations in housing prices.
- Persistent inequality: Despite having the highest GDP per capita in Chile, Antofagasta suffers from structural inequalities, including an unemployment rate (9.6%) and income inequality (Gini of 0.51) that both exceed the national averages. Communities lag in some basic quality-of-life dimension against the average of the country, including the lowest life expectancy in the country.
- Environmental pressures and water management: As one of the most arid regions in the world, Antofagasta faces challenges in securing water supplies for residents and industry.
- Governance and trust towards mining: There is a historic lack of trust between local communities (particularly Indigenous peoples) and the private sector, often due to the historically limited management of the negative environmental and social externalities from mining and the inequitable distribution of its economic benefits. This is compounded by an overly centralised and bureaucratic land management and decision-making system that makes it difficult for local governments to obtain land or approvals for community or industrial projects that could improve quality of life or diversify the local economy.

Source: (Government of Antofagasta, 2024[73]); (Albemarle Corporation, 2024[74]); (SQM., 2023[75]).

In terms of **recycling**, Chile has started to develop a draft decree in 2023 under the scope of the Law 20.920 that establishes a Framework for Waste Management, Extended Producer Responsibility and Promotion of Recycling. The objective of this decree is to set goals for the recollection, valuation and other duties related to batteries, including lithium batteries (Ministerio del Medio Ambiente).

Although there is a lack of large-scale recycling facilities for lithium batteries in Latin America, some companies are carrying out limited lithium-battery-related recycling activities (López Hernández et al., 2024[48]). In addition, some agreements have been made between the mining company SQM and other actors to promote the recycling of batteries and the development of the appropriate infrastructure (López Hernández et al., 2024[48]).

3.5. Uptake of multi-stakeholder and industry initiatives on responsible business conduct

Both Argentina and Chile adhere to EITI, signalling ambitions to improve overall transparency and public oversight for the mining sector. Through regular reporting, adherents to EITI disclose information on revenues generated from the extractive sector as well as on contracts and beneficial ownership, among other disclosure.

In Argentina's lithium sector, third-party benchmarking has been emerging at the level of individual operations and company reporting. The most visible example is Rio Tinto Lithium's Fenix Mine in Catamarca Province, which became the first lithium operation in Argentina to release an audit under IRMA (Kramarz et al., 2024[33]). The Fenix Mine audit results meet the requirements for at least an IRMA 50[2] performance level, and is pending a final assessment of the relevant Free, Prior and Informed Consent provisions (IRMA, 2025[76]). With respect to mineral supply chain due diligence, the Fenix operation is listed in the Responsible Minerals Initiative (RMI) database as having completed a Conformant Assessment under the Responsible Minerals Assurance Process (RMAP) (RMI, 2026[77]). The publication of IRMA audit findings, including community and water management criteria, has potential significant implications for transparency and stakeholder dialogue in such environments where lithium extraction intersects with Indigenous communities and water-scarce ecosystems.

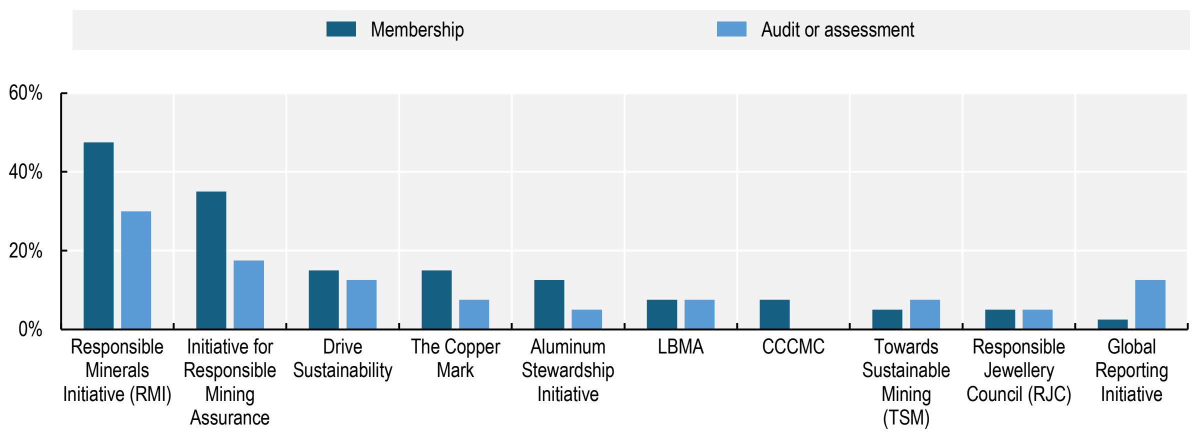
The two principal lithium producers in Chile, SQM and Albemarle, have publicly engaged with external benchmarking through the IRMA. Albemarle's Salar de Atacama lithium brine operation completed an independent IRMA audit and received an IRMA 50 performance rating in June 2023 (Albemarle Corporation, 2023[78]). In 2023, SQM's Salar de Atacama lithium operation completed its own independent IRMA audit and achieved an IRMA 75 performance level, indicating that it met all 'critical requirements' of the standard and at least 75% of applicable criteria (IRMA, 2023[79]). Despite SQM's strong performance in its IRMA audit, a revision of this audit has indicated areas for further improvement in terms of more comprehensive water management indicators, as well as in the implementation of transparency measures under the framework of EITI (Balcázar M. and Argento, 2026[80]). SQM also includes disclosures under frameworks such as the Global Reporting Initiative (GRI) and incorporates SASB performance indicators as part of its annual reporting (SQM, 2025[81]). SQM Salar S.A. (Planta Química Litio Carmen) is also conformant under RMAP for its lithium processing operations in Chile (RMI, 2026[77]).

At the same time, both lithium companies have also implemented individual actions to reduce environmental impacts, especially water consumption, and enhance benefits in local communities. SQM's Salar Futuro Project aims to eliminate consumption of inland water and achieve carbon-neutral lithium by 2030, while Albemarle operates a detailed water-monitoring and early-warning system (PSAH) under Chilean environmental permits. Both companies have also established agreements with Indigenous communities and supported the regional government of Antofagasta in the elaboration and goals of the 2050 mining strategy of Antofagasta. Overall, these findings largely align with the survey data, which indicated strongest overall uptake of RMI and IRMA for companies operating along lithium supply chains, with a prevalence of RMI membership among downstream companies using lithium products in the survey.

Growing uptake of third-party benchmarking in the lithium supply chain is a positive development, although it cannot replace government and community oversight. Ultimately a more systematic assessment is needed to measure any reductions in operational and governance risks on the ground. As noted in Chapter 5, the majority of RBC metrics across major rating products measure company policies and processes rather than direct impacts. Understanding the relationships between initiative participation and actual risk outcomes is an important area for further research, to which the site visit and survey evidence in this report provides a baseline.

Figure 3.2. Participation and membership in key multi-stakeholder and industry initiatives in the lithium supply chain

The Responsible Minerals Initiative is the most commonly cited multi-stakeholder and industry initiative in the lithium supply chain, both in terms of initiative audits and assessments as well as membership.



Note: This figure presents responses to survey Question 32 ("Have you been audited or assessed by one or more of the following sustainability initiatives?") and Question 33 ("Are you a member of one or more of the following sustainability initiatives?"), for key company types and respondents active in the lithium supply chain. Multiple responses were permitted. "Other" write-in responses were reviewed and mapped to standardised initiative categories; one response could be mapped to more than one category where relevant. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

3.6. Uptake of traceability

Despite some favourable conditions for traceability, its uptake remains in early stages among sample countries. Though production is relatively concentrated in a handful of countries, the rest is spread out across a large number of small producers (IEA-OECD, 2025[12]). Similarly, while refining capacity is concentrated in China, and there is a lower number of companies involved in lithium refining, the top three producers account for only 30% of refining (IEA-OECD, 2025[12]). Lithium recycling is also currently highly concentrated in China. Close to 90% of lithium demand came from a single end-use market, batteries (USGS, 2025[7]), which may be advantageous compared to minerals with highly dispersed end-use markets.

Data limitations, in particular with regard to trade and production data in downstream segments of the supply chain could present an obstacle to tracing lithium. Material flows are networked rather than linear, with diversion into non-battery uses, unobserved international flows, and gaps in trade data

(Cheng et al., 2024[16]) (Andrenelli et al., 2025[28]). Cathode and lithium-ion battery manufacturing stages are in particular challenging for accessing data as such data is typically not publicly available and both of these stages are dominated by China, which further complicates data access (British Geological Survey, 2021[82]). Further downstream, the traceability in the recycling segment is constrained by limited data of lithium flows from collection of end-of-life batteries (and other products with lithium content) to recycling processes and secondary uses of recycled lithium.

Consultations undertaken during site visits in Argentina and Chile indicated that the uptake of traceability in lithium supply chains remains in early stages in both countries, but steps have been taken to improve visibility over mineral production. Mine operators were broadly aware of growing interest in traceability systems, but noted that these were driven by customers based in countries that account for a relatively small portion of demand for lithium. Some noted that the uptake of traceability systems largely depend on stronger demand by these jurisdictions or the development of a price premium for responsibly produced lithium. These sentiments were broadly shared with policymakers, who emphasised the need to reward responsible environmental and operational practices through enhanced market access, price premia, or preferential financing. **Moreover, lithium supply chains in Latin America present specific traceability challenges**. **In Argentina, decentralised governance of the mining sector creates challenges for scaling traceability.** Nonetheless, the country has taken important steps to improve overall visibility over mineral production. For example, the federal government developed the Argentina Mining Information System (SIACAM), which is a digital platform designed to centralise information on extractives production and other indicators.

Chile maintains a public registry of permitted mining sites that can potentially be used by third party certifiers as to whether natural resources such as those included in EV batteries come from sanctioned and legal sources (Deberdt et al., 2026[83]). In Chile, SQM partnered with a private sector traceability provider to track physical flow of lithium to battery cells and packs manufacturing (techUK, 2023[84]).

Taken together, the lithium supply chains in Argentina and Chile present favourable conditions for traceability due to formal production structures, concentrated ownership and existing national data systems. Yet uptake remains in early stages, constrained by limited demand from major importing markets and the absence of price premia. The most pressing gaps are in downstream processing and the physical characterisation of exported minerals, where even small differences in grade carry important fiscal implications. For more sensitive end-uses, existing traceability efforts may need to be supplemented by more intensive approaches. In particular, lithium used for energy storage systems used by the defence sector may warrant a stronger response. These findings inform the targeted recommendations for lithium in Chapter 6.

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Annex 3.A. Addressing BEPS Risks and Tax Avoidance

Addressing the under-pricing of lithium and nickel sales

Mispricing of mineral transactions is a widely observed risk in countries endowed with critical mineral resources. Mineral pricing plays a central role in revenue mobilisation, as key fiscal instruments, including corporate income tax, royalties and withholding taxes, are directly or indirectly linked to the value of mineral transactions. Where minerals are sold to related parties at below market value and subsequently on-sold at arm's length prices, profits may be shifted out of the producing jurisdiction, eroding the domestic tax base.

Safeguarding fiscal revenues therefore depends on the accurate determination of the price at which minerals are sold. As highlighted in OECD Transfer Pricing Guidelines (OECD, 2022[211]), both the determination of mineral quality and the pricing of related-party transactions, particularly at the point of the cross-border sale, pose material BEPS risks where prices deviate from arm's length conditions. Ensuring that mineral transactions reflect market-based pricing is thus not only a technical transfer pricing exercise, but a fundamental component of fiscal governance and domestic resource mobilisation in mineral-producing countries.

The OECD Transfer Pricing Guidelines emphasise the application of the arm's length principle, with a preference for the Comparable Uncontrolled Price (CUP) method where reliable data is available. Under this approach, the price of a mineral in a controlled transaction is benchmarked against prices observed in comparable transactions between independent parties, often using publicly quoted prices as a reference point.

Where necessary, adjustments are made to account for differences so that the resulting price approximates the conditions that would have been agreed between independent parties. The application of these principles varies across minerals depending on their physical characteristics, market structure and pricing mechanisms. In particular, lithium and nickel present distinct pricing challenges due to differences in product forms, market transparency and processing stages.

Additional BEPS risks beyond mineral pricing

While mineral pricing represents a primary channel for profit shifting, BEPS risks in the mining sector extend beyond the pricing of the mineral itself. These include:

Mispricing of other related-party transactions associated with the mining activities

In addition to mineral sales, companies may misprice other transactions along the value chain, including freight, offshore services, procurement and marketing arrangements. These transactions may be structured in a way that shifts profits away from producing jurisdictions where value is created, particularly where charges are not aligned with the underlying economic activity or lack sufficient supporting documentation.

Financing structures

Mining and associated infrastructure investments are typically financed through a combination of internally generated funds, debt and equity. From a tax perspective, interest payments on debt are generally deductible, whereas returns on equity are not. Multinational enterprise (MNE) groups may therefore structure financing arrangements to maximise interest deductions.

Where financing is provided by related parties, two key BEPS risks may arise. First, capital that is economically equivalent to equity may be arranged as intercompany debt in order to generate deductible interest payments. Second, such debt may carry non-arm's length terms and conditions designed to increase the level of deductible expenses i.e. an excessive interest rate. Both practices can result in excessive interest deductions in the producing jurisdiction, with profits effectively shifted to the jurisdiction where the lender is located.

To address these risks, the OECD BEPS Action 4 framework recommends limiting net interest deductions by linking them to an entity's level of economic activity, typically through earnings-based rules (e.g. a percentage of Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA)).

Information gaps and enforcement challenges

The effectiveness of measures to address BEPS risks depends critically on the availability of reliable and timely information. In many cases, tax administrations face significant information asymmetries, limiting their ability to identify risks, assess compliance and enforce relevant legislation.

Addressing these challenges requires that tax administrations and other relevant government bodies have access to data that enables them to understand MNE group structures, detect potential non-compliance and verify the economic substance of transactions. In this context, traceability systems and other data collection mechanisms can play an important role by improving visibility over production volumes, mineral quality, transaction flows and supply chain relationships.

Role of transfer pricing documentation and information exchange

Transfer pricing documentation under BEPS Action 13 provides a key tool for addressing information gaps. The Action 13 framework requires MNEs to provide a standardised set of documentation comprising the Country-by-Country (CbC) report, Master File and Local File. Together, these documents provide tax administrations with a comprehensive overview of an MNE's global operations, value chains, transfer pricing policies and allocation of profits. Effective use of this information is further supported by mechanisms for the exchange of information between jurisdictions. These include the Multilateral Convention on Mutual Administrative Assistance in Tax Matters (MAAC), bilateral tax treaties and tax information exchange agreements, which enable jurisdictions to share confidential taxpayer information in a secure manner.

Taken together, improved access to information through transfer pricing documentation, exchange of information frameworks and traceability systems strengthens the ability of governments to identify BEPS risks, apply relevant legal provisions and ensure that profits are taxed where economic activities take place.

Notes

[1] A salar is a high-altitude salt flat formed in a closed basin where ancient lake water evaporated and left concentrated saline deposits. Beneath its hard, white crust lies brine enriched in lithium, which is pumped into shallow evaporation ponds and concentrated by intense solar radiation and low humidity.

[2] The IRMA 50, IRMA 75 and IRMA 100 levels reflect increasingly higher levels of performance across the four sections of the IRMA Standard. At the 50, 75 and 100 levels of achievement, mines must also meet a set of critical requirements, although at IRMA 50 and IRMA 75 some minor non-conformity is allowed as long as there is a corrective action plan to fully meet them by the next 3-year cycle full verification audit. To reach IRMA 100, all of the critical requirements must be fully met.

4 Nickel

This chapter examines the structure and dynamics underpinning the global nickel supply chain. It identifies key challenges to responsible production and processing, as well as tracing nickel products along value chains. It then outlines the regulatory and operational environment, as well as associated risks, in Indonesia and the Philippines.

Nickel is a strategically important critical mineral for industrial production and emerging battery technologies, serving as a key input for stainless steel and electric vehicle batteries. Highly concentrated supply chains, combined with complex ownership structures and significant operational and governance risks in major producing countries, means that a handful of jurisdictions can significantly shape investment dynamics and the reliability of global battery supply chains. Addressing operational and governance risks while improving traceability should therefore be a priority for policymakers seeking to de-risk investment and support responsible sourcing in Indonesia and the Philippines, respectively the mineral's first (65%) and second (10%) producers (Benchmark Mineral Intelligence, 2026[1]).

4.2. Overview of the supply chain

Nickel is primarily used to produce stainless steel and EV batteries. Stainless steel accounted for 64% of global consumption in 2024, batteries for 15%, and the remaining uses included non-ferrous alloys (9%), electroplating (5%) and other (7%) (Natural Resources Canada, 2026[2]). Batteries are the fastest-growing segment and are expected to play an increasingly influential role.

Global nickel demand has expanded steadily over the past two decades, increasing by approximately 112% between 2000 and 2020, with an average annual growth rate of 3.8% (INSG, 2024[3]). Since then, demand rose at around 5% annually, particularly due to China's industrial expansion. Global demand for nickel is projected to rise by approximately 67 to 100% between 2023 and 2040, driven largely by the expansion of clean energy technologies (CRI, 2025[4]). In 2024, Asia accounted for 86% of global nickel demand, with China alone representing over 60% (INSG, 2024[3]). The share of secondary supply (including direct use scrap) in total demand reached 26% in 2023, decreasing from 33% in 2015 despite rising material consumption (IEA, 2024[5]). Although nickel demand is projected to rise over the medium to long term, the market has experienced significant volatility in recent years.

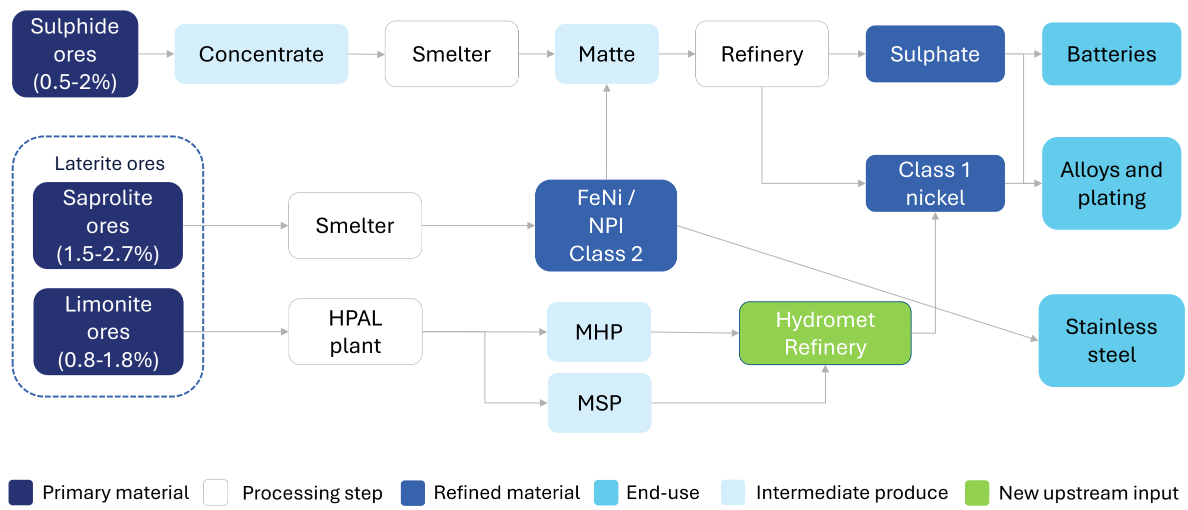
Nickel can be found in various forms, namely laterite ore and sulphide ore, which require specific processing techniques. Laterite ore is primarily found in Australia, Indonesia, New Caledonia and the Philippines whereas sulphide ore is found in Australia, Canada, China and Russia.

Nickel requires specific processing techniques depending on its form. Sulphide ores are typically concentrated, smelted to a matte and then refined to produce metal or high-quality nickel sulphate used for batteries. Laterite ores come in two forms: saprolite and limonite. The former are typically processed through pyrometallurgy in Rotary Kiln Electric Furnace (RKEF) smelters to ferronickel or nickel pig iron and used for stainless steel production, while the latter is often processed through high-pressure acid leaching (HPAL) into mixed hydroxide precipitate (MHP) that can ultimately be refined into battery-grade nickel sulphate. Production of nickel sulphate or other nickel salts has been identified in twelve countries (Fan et al., 2024[6]; Benchmark Mineral Intelligence, 2026[1]).

Primary nickel supply chains are concentrated in terms of origin. In 2025, Indonesia accounted for nearly 65% of total nickel production, followed by the Philippines (10%) and Russia (5%), consistent with previous years' trend (USGS, 2025[7]). Processing is also concentrated in Indonesia (43%), with the majority of smelting focused on nickel pig iron and ferronickel, and increasingly MHP and nickel matte, followed by China (31%) and Japan (3%) (IEA, 2025[8]). Though Indonesia is expanding operations in this respect, lower-grade intermediates are often shipped to China, where nearly 75% of battery-sulphate production is located (IEA-OECD, 2025[9]; Andrenelli et al., 2025[10]).

Despite this geographical concentration, the company-level concentration of nickel production and refining is relatively low. Small companies account for roughly 75% of mining and refining compared to around 16% by the top three companies for both production and refining (IEA-OECD, 2025[9]). While this dispersion of ownership suggests that control of productive assets remains fragmented across a number of smaller actors, the ownership structures indicate a more complex story: though Indonesia accounts for the majority of global production and processing, domestic companies control less than 10% of production, compared with roughly 40% controlled by companies with Chinese majority ownership (IEA, 2024[11]).

Figure 4.1. Nickel supply chain



Note: HPAL = high-pressure acid leaching; FeNi = ferronickel; NPI = nickel pig iron; MHP = mixed hydroxide precipitate; MSP = mixed sulphide precipitate.
Source: (IEA-OECD, 2025[9]), CC by 4.0.

Secondary nickel including direct use of scrap currently supplies 26% of global demand (2023), leaving a shortfall as nickel consumption continues to surge, especially in developing economies where end-of-life stock is insufficient (IEA, 2024[12]). Most nickel is downcycled to stainless steel, and this is also the dominant source of recycled nickel. Stainless steel is highly recyclable and effectively recycled at exceptionally high rates (over 90% in the EU for example) (European Circular Economy Stakeholder Platform, 2020[13]; worldstainless, 2025[14]). Recycling input rates, i.e. the share of recycled nickel used as secondary material, vary widely across regions: some economies show very high rates (e.g., 85% in Europe, 83% in the United States, 72% in Japan), while others, mainly where stainless steel markets are more recent, exhibit lower rates as much of the material has not yet reached end-of-life (e.g., 31% in China, 56% in India) (worldstainless, 2025[14]). Some other countries, such as Indonesia and Thailand, despite their expanding steel stocks, remain major importers of steel scrap and therefore record high recycling input rates (Watari et al., 2025[15]). Globally, 50% of stainless steel supply is sourced through recycling steel, which reflects its high recyclability potential, but also its longevity and shortage of end-of-life steel stock in emerging economies (Lu et al., 2022[16]; British Stainless Steel Association, 2026[17]). However, the increasing nickel-rich EV batteries sales, accounting for 54% of global EV batteries sales in 2024 (IEA, 2025[18]), will substantially increase and diversify the pool of nickel available for recycling.

Indonesia's rise as the world's leading nickel producer, with production expanding by around 700% between 2012 and 2022, is tied to its strategic policy shift from exporting unprocessed ore to promoting domestic value addition (IEA, 2025[8]). Beginning with export restrictions on raw ore in the early 2010s and reinforced through subsequent investment regulations, Indonesia has incentivised the establishment of smelters and processing facilities that produce high-value products like ferronickel, nickel matte and battery precursors. By contrast, **the Philippines** has followed a more uneven trajectory. While it remains the second-largest nickel producer worldwide, nickel production in the Philippines has faced considerable environmental compliance challenges and moratoria on mining activity. Recent policy efforts have sought to rehabilitate the mining sector and attract investment while positioning the country as an alternative source of nickel for markets seeking to diversify away from Chinese-controlled supply chains. This has not come without challenges; in 2024, production in Australia and the Philippines declined by roughly 26% and 20%, largely due to company-level decisions to reduce or stop nickel production due to challenging market conditions and declining prices (USGS, 2025[7]).

4.3. Operational and governance risks

4.3.1. Environment risks from mining and processing

Nickel extraction and processing have been associated with considerable environmental, operational and governance risks. In Indonesia and the Philippines, mining competes for land with forestry, biodiversity and other human activities. Moreover, mining processes produce substantial amounts of waste, often containing toxic water and low-grade materials which contaminate soil and can leak to other parts of the ecosystem when mismanaged (Bravante and Holden, 2009[19]; Balbin et al., 2023[20]). Mining is associated with deforestation, water and soil pollution, high carbon emissions from coal-powered processing, and tailings-related damage to rivers and other ecosystems (IUCN, 2022[21]; CRI, 2025[22]; OCCRP, 2025[23]). In Indonesia, the smelting and refining of nickel is typically coal-powered and responsible for a large share of GHG emissions, as well as for the production of waste slags (about 150 million tonnes of slag per year) and leaching residues (Wei et al., 2020[24]; Bartzas, Tsakiridis and Komnitsas, 2021[25]). When nickel slags are improperly classified, improperly disposed of in surface dumps, dumped at sea, or accumulated in surface heaps, they present serious environmental hazards due to their content of toxic and heavy metal(loid)s with a high potential for leakage (Bartzas, Tsakiridis and Komnitsas, 2021[25]). More details on environmental hazards specific to Indonesia and the Philippines can be found in the dedicated sections below.

4.3.2. Social impacts and community engagement

Social harms affect local communities and Indigenous peoples through illegal land acquisitions, health risks, livelihood loss, inadequate compensation and attacks on environmental activists (CRI, 2025[4]; Amnesty International, 2025[26]). A shared concern across both Indonesia and the Philippines is the inadequate engagement of local affected communities. Concerns have also been raised concerning the failure to obtain Free, Prior and Informed Consent (FPIC) from affected Indigenous Peoples before projects proceed. Residents near the Weda Bay Industrial Park report that companies have violated FPIC requirements during land acquisition (CRI, 2025[4]). In the Philippines, Indigenous and rural communities have not received adequate information on the environmental risks of certain projects in the absence of legally-required consultations (Amnesty International, 2025[26]; CRI, 2025[22]). Projects have contributed to the destruction of livelihoods in both countries, among other documented consequences. For example, areas near Indonesian smelting complexes report a more than twentyfold increase in the incidence of respiratory infections between 2020 and 2023, while rivers polluted by smelting byproducts have become unsafe for drinking (CRI, 2025[4]). Similarly, communities in the Philippine Caraga region report that fishing and farming were strongly affected by pollution and siltation associated with mining and smelting activity (Amnesty International, 2025[26]). Occupational health and safety risks remain a major concern across the nickel value chain in both Indonesia and the Philippines, particularly in mining, smelting, and processing operations. Workers face exposure to hazardous conditions, including heavy machinery accidents, explosions, fires, landslides, dust, and chemical pollutants (CRI, 2025[22]; Pacific Asia Resource Center, n.d.[27]; Tempo, 2025[28]).

4.3.3. Governance challenges

Governance challenges persist along nickel supply chains. These include conflicts of interest, the involvement of politically exposed persons (PEPs) in commercial concerns, illegal mining and weak law enforcement, although some permits have been revoked to protect sensitive ecosystems (Syarif, 2025[29]; Vander Velde, 2025[30]). In both countries, close ties between political and commercial interests in the mining and processing sectors have complicated regulatory oversight. More broadly, the rapid pace of industrial expansion has, in some cases, appeared to outpace the capacity of regulatory frameworks to enforce existing operational requirements.

Nickel production and processing are also associated with significant fiscal governance challenges. The complexity of nickel value chains creates substantial BEPS risks. As with lithium, the mispricing of transactions between related parties, manipulation of treatment and refining charges and the use of intra-group financing arrangements can erode fiscal revenues in producing countries.

4.3.4. Manufacturing and recycling risks

Besides mining, the manufacturing of nickel applications – such as stainless steel and batteries – also causes environmental risks. Battery cell, module and pack manufacturing, for example, accounts for 22% of total cradle-to-gate CO_2 emissions, primarily from energy-intensive steps like electrode drying, formation cycling, and dry room operations (Kim, Lee and Wallington, 2023[31]; Knehr et al., 2024[32]). The energy intensity and related emissions of nickel-rich applications manufacturing is determined by the manufacturing technologies used, but also by the composition of the regional energy mix (Johnson et al., 2008[33]; International Stainless Steel Forum, 2021[34]). Utilising recycled materials in place of virgin materials substantially reduces both energy consumption and carbon dioxide emissions. For example, stainless steel produced only with recycled content emits less than a third of the CO_2 compared to production using solely virgin materials (Johnson et al., 2008[33]; Worldstainless, 2025[35]). However, while the recycling of stainless steel is well developed, it remains very limited for batteries. Moreover, similar to lithium-ion battery recycling, **nickel recycling from batteries may cause environmental and social hazards when improperly managed through informal networks** (World Health Organization, 2024[36]).

4.3.5. Nickel pricing

As observed in the preceding chapter on lithium, mispricing of mineral transactions remains a key challenge for producing countries, given the central role of mineral pricing in determining revenues from corporate income tax, royalties and withholding taxes. Where minerals are sold to related parties at below market value and subsequently on-sold at market prices, profits may be shifted out of the producing jurisdiction, eroding the domestic tax base. Safeguarding fiscal revenues therefore depends on the accurate determination of the price at which minerals are sold.

Applying the general pricing framework, nickel pricing varies depending on product form, grade and processing stage, as well as the level of market transparency. Nickel products range from ore and semi-processed materials such as matte and ferronickel to refined metal. In contrast to lithium, certain refined nickel products are more closely linked to exchange-based pricing, particularly through reference prices such as those published by the London Metal Exchange (LME). However, significant adjustments are required for semi-processed products. Product quality and composition are key determinants of price, with variations in grade and the presence of impurities resulting in penalties or discounts. Treatment and refining charges (TC/RCs) further reflect the costs associated with downstream processing. As a result, the valuation of nickel products depends both on the intrinsic characteristics of the material and the extent of further processing required.

Indonesia's Ministerial Decree No. 144.K/MB.01/MEM.B/2026 overhauled the country's mineral benchmark pricing methodology. **The reform replaced the previous nickel-grade-based pricing approach with a multi-component formula that values not only nickel content but also associated minerals** (e.g. iron, cobalt, and chromium) subject to specific thresholds, alongside moisture content. By recognising the economic value of by-products that were previously excluded from the benchmark price, the reform increased the benchmark value of many nickel ores, particularly limonite ores, which benefit from the inclusion of cobalt in the pricing formula (Indonesia Ministry of Mines and Energy Resources, 2026[37]).

Logistics costs, including freight and insurance, as well as contractual terms related to delivery and ownership transfer, also influence pricing outcomes. In vertically integrated multinational structures, these elements may be manipulated through related-party arrangements, particularly where semi-processed and intermediate products are traded between affiliated entities prior to final sale. BEPS risks in the nickel value chain therefore arise from the mispricing of semi-processed and intermediate products, inappropriate application of TC/RCs, and the structuring of transactions that shift profits across jurisdictions.

Beyond pricing, nickel value chains are also exposed to BEPS risks arising from financing arrangements and other related-party transactions. As outlined in Annex 3.A., the use of intra-group debt with unrealistic terms may result in excessive interest deductions, particularly in capital-intensive processing and refining stages. In addition, mispricing of logistics and intra-group service arrangements may further erode the tax base in producing countries.

Addressing these risks requires both accurate pricing and the effective application of domestic legal frameworks. This includes transfer pricing rules, interest limitation provisions and documentation requirements, to ensure that profits are taxed where economic activities take place.

In this context, traceability systems play a critical supporting role by providing verifiable data on product characteristics, physical flows and transaction conditions, thereby strengthening the application of the arm's length principle. The following sections examine how these risks manifest in Indonesia and the Philippines, the largest nickel-producing countries and the focus of this report's site visits and stakeholder consultations.

4.4. Indonesia

4.4.1. Indonesia: nickel production and processing

Indonesia has achieved a dominant role as the top global nickel producer, with output having increased by 16 times since 2015 (IEA, 2025[8])**.** Notably, Indonesia has leveraged export restrictions on unprocessed nickel in an effort to spur the development of domestic downstream industries (Andrenelli et al., 2025[10]). Beginning with export restrictions on raw ore in the early 2010s and reinforced through subsequent investment regulations, Indonesia has incentivised the establishment of smelters and processing facilities that produce nickel pig iron, ferronickel, nickel matte and battery precursors. The development of downstream economic activity, particularly related to the stainless steel industry, was driven to a large extent by Chinese state-supported investments. Differences in risk appetite, industrial strategy, and experience deploying these technologies at scale – in addition to capital intensity – may explain the prevalence of investment by non-OECD countries (Andrenelli et al., 2025[10]). Some estimates indicate Chinese companies accounted for 90% of the construction of Indonesia's domestic refining capacity, leading to varying degrees of the corresponding value addition to accrue domestically (across joint ventures, local equity participation, employment, procurement linkages and fiscal revenues), as well as mixed outcomes in terms of operational and governance performance (CSIS, 2024[38]).

Indonesia has adopted a centralised mineral production, processing and export model. The government owns mineral rights and grants mining business permits (IUP) or special mining business permits (IUPK). In 2026, 422 IUPs are active in nickel (Indonesian Nickel Mining Association, 2026[39]). Mining output is regulated by the state, which sets production quotas, and subjected to export restrictions on unprocessed nickel. Targets for 2026 are set to roughly 270 million tonnes. The current processing infrastructure encompasses 79 major facilities, dominated by 55 RKEF smelters producing nickel pig iron and ferronickel, 10 HPAL smelters, 8 nickel matte plants, and 6 integrated stainless steel plants, with precursor and cathode lines planned as part of the government's value addition strategy (Indonesian Nickel Mining Association, 2026[39]). In addition to domestic production, Indonesia imports roughly one-third of the Philippines' nickel ore output, primarily to optimise feedstock chemistry by blending the Philippines' higher-silicon ores with Indonesia's more magnesium-rich ores.

In 2026, Indonesia also introduced a centralised "single-gate" export system under the SOE Danantara for ferroalloys such as ferronickel and nickel pig iron. During a transition phase starting in 2026, nickel producers must initially report export activities to Danantara, before moving toward a system in which Danantara may act as the sole export intermediary by 2027 – purchasing products from domestic producers and selling them to global markets.

Foreign companies cannot bid directly for mining permits, but can enter into joint ventures with, or purchase stakes in, Indonesian companies that can submit bids for permits (Mining Transparency, 2025[40]). Foreign investors operating in Indonesia are further subject to mandatory share divestment and local ownership over time as well as incentives to invest in domestic processing capacity (Reuters, 2025[41]). The regulatory environment for the Indonesian extractives sector provides a key role to SOEs such as the state holding company PT Mineral Industri Indonesia (MIND ID), which controls significant upstream reserves through subsidiaries such as PT Antam while also participating in joint ventures with foreign partners. As highlighted in Table 4.1, this has led to a proliferation of joint ventures, often with fairly complex ownership structures.

Table 4.1. Select nickel mines in Indonesia

Project	Region	Output (Tonnes)	Operator	Ownership
PT Weda Bay Nickel Mine	North Maluku	317 750	Eramet S.A.	Tsingshan Holding Group Co., Ltd. (51.3%; CHN), Eramet S.A. (38.7%; FRA), Aneka Tambang Tbk PT (10%; IDN)
Harita Nickel Mines	North Maluku	213 972	PT Trimegah Bangun Persada Tbk. (Harita)	PT Trimegah Bangun Persada Tbk. (Harita) (100%; IDN)
Antam Mines	Southeast Sulawesi	174 995	Aneka Tambang Tbk PT	Aneka Tambang Tbk PT (100%; IDN)
Sulawesi Cahaya Mineral (SCM) mine	Southeast Sulawesi	168 600	PT Merdeka Battery Materials Tbk.	PT Merdeka Battery Materials Tbk. (51%; IDN), Tsingshan Holding Group Co., Ltd. (49%; CHN)
Hengjaya Mine	Central Sulawesi	141 431	Nickel Industries Ltd.	Nickel Industries Ltd. (80%; AUS), Other (20%)

Source: (Benchmark Mineral Intelligence, 2026[1])

Table 4.2. Select industrial parks in Indonesia

Project	Region	Output (Tonnes)	Operator	Ownership
Weda Bay Industrial Park (IWIP)	North Maluku	319 300	Tsingshan Holding Group Co., Ltd.	Tsingshan Holding Group Co., Ltd. (40%; CHN), Huayou Cobalt Co., Ltd. (30%; CHN), Zhenshi Holding Group Co., Ltd. (30%; CHN)
Morowali Industrial Park (IMIP)	Central Sulawesi	260 000	Tsingshan Holding Group Co., Ltd.	Tsingshan Holding Group Co., Ltd. (49.7%; CHN), PT Bintang Delapan Group (25.3%; IDN), PT Sulawesi Mining Investment (25%; IDN)

Source: (Benchmark Mineral Intelligence, 2026[1]),

4.4.2. Indonesia: Regulatory environment

Indonesia has taken notable policy measures to improve environmental and governance performance in its nickel industry. In order to ensure environmental protection, mining stakeholders are subject to several regulations, such as environmental approval mechanism (Analisis Mengenai Dampak Lingkungan/AMDAL), utilisation of forest area approval mechanism (Persetujuan Penggunaan Kawasan Hutan/PPKH) – restraining use to 10% of total local forest area, and mine reclamation funds submission (Jaminan Reklamasi) and a mandatory payment to collect collateral funds from companies (Nickel Institute, 2024[42]). Indonesia's rating system for environmental compliance (PROPER), which applies to companies meeting certain eligibility criteria established by the government, has prompted action to improve overall performance ratings (OECD, 2026[43]; Indonesian Ministry of Environment, n.d.[44]). Additionally, the National Mid-Term Development Plan (2020-2024) promoted a responsible approach to nickel processing and other downstream activities, while the National Energy Policy identifies approaches to reduce the carbon impact of nickel production and processing (IISD, 2025[45]). Indonesia's Corruption Eradication Commission is highly experienced in leading investigations related to the mineral sector. For example, it exposed corruption in legal and illegal nickel mining extraction in North Maluku and Sulawesi, including bribery, permit manipulation, and land grabbing (UNICRI, 2025[46]). In 2023, the Commission revealed that about 5.3 million tonnes of nickel ore from Indonesia were sent illegally to China from January 2020 to June 2022 (The Straits Time, 2023[47]).

In addition to establishing the SIMBARA traceability system (see Box 4.3**), Indonesia has implemented BEPS Actions 4 (Limitation on Interest Deductions), 8-10 (Aligning Transfer Pricing Outcomes With Value Creation) and 13 (Transfer Pricing Documentation) through a comprehensive transfer pricing reform to modernise their income tax law** (OECD, 2025[48]). Indonesia has implemented BEPS Action 13 (Transfer Pricing Documentation) requiring multi-national enterprises to prepare standardised transfer pricing documentation which should assist the tax administration to identify and address transfer pricing risks more effectively (See Annex 2.A.).

Tax incentives may be effective in encouraging investment in certain cases but come with risks and costs. Indonesia has utilised tax incentives, particularly, "tax holidays" as part of its broader industrial strategy aimed at strengthening strategically important sectors and promoting long-term economic development (UNCTAD, 2018[49]). Indonesia's policy objective of moving up the value chain, from raw mineral extraction to domestic refining and battery-grade production, has been promoted by a policy-mix including tax incentives and complementary measures, including restrictions on raw ore exports and incentives for domestic processing. Under the regime, eligible companies may receive substantial corporate income tax reductions, including "tax holidays" which consists of exemptions of up to 100 per cent for defined periods, depending on the scale of investment and sectoral classification. Policies restricting raw nickel ore exports and incentivising domestic processing coincided with an increase of foreign investment realisation of 47% in 2022 for sectors related to downstreaming (IMF, 2023[50]). China and Hong Kong accounted for nearly half of this change, marking a notable increase in Chinese capital participation in Indonesia's nickel processing sector (IMF, 2023[50]).

The use of tax incentives raises important policy considerations regarding the interplay between attracting investment and collecting tax revenues. Income-based incentives, such as tax holidays, are less likely to promote additional investment and risk providing windfall gains to businesses that would have invested anyways. Expenditure-based incentives (e.g. accelerated depreciation, enhanced deductions) are typically more effective in increasing additional investment and provide more value for forgone revenue. Tax incentive design should limit such unnecessary costs and distortions and their impact needs be evaluated thoroughly and lead, where necessary, to reform (IMF-OECD-WB-UN, 2025[51]; OECD, forthcoming 2026[52]).

Box 4.1. Indonesia's tax incentive regime – Promotion of nickel sector

Indonesia's income-based tax incentive was originally introduced in 2018 and amended in 2024 (Ministry of Finance, 2024[53]). The regime targets and provides corporate income tax reductions or exemptions for large-scale qualifying investments, including nickel mining and downstream processing sectors. The regime was extended until 31 December 2025.

Indonesia's tax incentive regime is primarily income-based and therefore more exposed to the implementation of the GMT rules as they may reduce effective tax rates below 15% for in-scope mining companies, potentially triggering top-up taxes. In contrast, incentives, more strongly linked to substantive investment, such as tangible assets and employment, are less likely to be affected.

In light of these developments, Indonesia should consider reassessing the design of its income-based tax incentives to ensure that it continues to support industrial policy objectives while safeguarding revenue in a post-GMT environment.

4.4.3. Indonesia: Operational and governance risks

Despite establishing policy measures to mitigate negative externalities associated with mining and processing, as well as strong state involvement in the mining sector more generally, considerable operational, environmental and governance challenges persist (Suprapto, 2023[54]; Kurniawan, Murayama and Nishikizawa, 2020[55]). Indonesian mining and smelting operations rely heavily on captive coal plants that supply energy to industrial facilities, exacerbating significant carbon emissions and pollution (CRI, 2025[4]; Barends, 2025[56]). In 2023, Indonesian nickel companies produced 29 to 70 tons of CO_2 per tonne of nickel, and around 60 tonnes of CO_2 per tonne of nickel on average (IISD, 2025[45]; IEA, 2025[8]). While the nickel production industry in Indonesia is subject to environmental regulation, the sector has become one of the leading drivers of deforestation, with forest loss more than doubling when processing plants become operational (Milko, Davey and Fassett, 2024[57]). Furthermore, tailings management presents acute risks. Recent dam failures, including one at Indonesia's Morowali processing park, released toxic waste into waterways (OCCRP, 2025[23]) (Moore, 2025[58]). Deep-sea tailings disposal adds further risk to fragile marine ecosystems, including coral reefs. Residents near mining and processing facilities in Indonesia report severe air and water pollution, health issues, destruction of fishing and farming livelihoods, a lack of accessible environmental information, and risk to intimidation or criminal charges (CRI, 2025[4]). Though Indonesia has ratified all eight Fundamental Conventions of the International Labour Organization (ILO), labour rights are enforced inconsistently, particularly in sectors dominated by SOEs (OECD, 2026[43]). A long-awaited Indigenous Peoples Law has been under discussion for over a decade, but has yet to be passed (Context, 2024[59]).

The sector is further exposed to conflicts of interest and governance challenges. Stakeholder consultations indicated that national and local Politically Exposed Persons (PEPs), members of the police and the military, hold beneficial ownership in mining and smelting operations or affiliated service providers. The legal presence of military actors in the sector, as well as PEPs, is viewed by many as undermining effective law enforcement (Syarif, 2025[29]) (Hermawan, 2023[60]) (Tempo, 2022[61]). Illegal operations often feature subcontractors to conduct mining activities, which limit accountability and visibility over ultimate beneficial ownership, and allegedly feed into smelters' supply chain to be legalised (Tempo, 2023[62]; Hermawan, 2023[60]). After conservation groups cited irregularities in permitting and raised alarm over threats to marine ecosystems, the Indonesian government announced it would revoke mining permits for four companies operating in the Raja Ampat archipelago – one of the world's richest marine-biodiversity regions (Velde, 2025[63]). Furthermore, the vast majority of Indonesia's current nickel refining capacity is owned by Chinese companies or shareholders, with identification of ultimate ownership complicated by widespread use of corporate entities registered in different countries (C4ADS, 2025[64]; IEA, 2025[8]).

Box 4.2. Site visits in Indonesia: challenges with enforcement of legislation at local level and impacts on local communities

Tensions may arise between industrial parks and local communities, especially as the extractive sector severely impacts local farming and fishing activities. Although these facilities may generate significant employment for Indonesians, local economic development opportunities are somewhat limited. Many local residents are excluded from employment due to education thresholds, and local procurement of food and services is not possible due to high capital requirements for prospective suppliers by smelters. Local economic activities such as food stands and housing have nonetheless emerged in and around the industrial parks. There were also complaints about cultural and social impacts linked to illegal economic activities (e.g. prostitution and drug use), which were allegedly absent before industrial parks. Companies report investing in local community services, such as waste collection and recycling.

Protests against mining operations have been met with crackdowns by security forces and strategic lawsuits targeting protest leaders. These actions are facilitated by harsher penalties introduced under the 2020 revision of the Mining and Coal Law. In at least one case, a representative from an NGO contributing to IRMA activities was arrested by the North Maluku regional police, and his house was raided.

A legal framework for freedom of association exists in the country. The law generally allows workers to form and join independent unions and engage in collective bargaining, and prohibits anti-union discrimination. However, it is not always adequately respected, with allegations of favouritism to certain trade unions over others. According to sources in trade unions, payments have been offered to avoid demonstrations on May 1 in at least one industrial park.

Worker safety is a serious concern. On December 24, 2023, a smelter explosion claimed 21 lives, highlighting ongoing risks. An estimated 104 workplace accidents took place at nickel smelters between 2019 and 2025, leading to 107 deaths (IISD, 2025[45]), with the real number being likely much higher due to alleged underreporting. Lack of investment in safety equipment and infrastructure, as well as low baseline salaries leading to demands of overtime and ensuing fatigue, are indicated as the main causes for these incidents. There have been questions over the fairness and transparency of hiring practices of Chinese workers, who face movement restrictions outside the industrial park perimeters and depend on the company for entering and leaving the country. Some companies report allowing the use of industrial parks' airports to facilitate repatriation of foreign workers for rest and recuperation periods.

The involvement of publicly listed Indonesian companies in smelter joint ventures makes it more likely such ventures will conduct better stakeholder engagement, according to some informants. Other NGOs report that the designation of certain mines as National Strategic Projects hampers transparency and accountability, as does the involvement of state-owned enterprises (SOEs).

Source: (TitaStory.id, 2026[65])

Complex ownership structures in the nickel sector may hinder responsible business conduct as well as supply chain traceability. The proliferation of joint ventures throughout the Indonesian nickel value chain reflects the central role of foreign investment in driving Indonesia's rapid development of domestic processing capacity. Chinese companies and investors have played a particularly prominent role in this process and are estimated to control around 75% of nickel smelting capacity in Central Sulawesi, Southeast Sulawesi and North Maluku (Transparency International, 2025[66]). While joint ventures and other partnerships have facilitated investment, technology transfer and other benefits, they have also created governance challenges in cases where partners may have differing tolerance to operational and governance risks, as well as disclosure and due diligence requirements. In such settings, effective oversight of environmental, labour and community impacts, as well as overall transparency, depends on the willingness of all partners, or at least the majority owner, to align with domestic regulations and international operational and governance standards. Should this alignment be absent, minority shareholders and downstream buyers may struggle to exercise leverage and meet due-diligence expectations.

Minority shareholders have highlighted that their lack of full decision-making power complicates environmental and regulatory compliance, noting that partner-managed processes do not ensure data transparency. This is exemplified by the PT Weda Bay Nickel mine and smelting facilities, which is Indonesia's largest nickel operation and produced over 516 000 tonnes of nickel in 2023, nearly more than Russia's entire nickel output (Discovery Alert, 2025[67]). Located within the Weda Bay Industrial Park, the project spans over 45 000 hectares and is a joint venture operated by PT Weda Bay Nickel and owned by Chinese, French and Indonesian companies (see Table 4). The project has been criticised for causing pollution, deforestation, as well as outsize impacts on local Indigenous peoples (including displacement without Free Prior Informed Consent) and neighbouring communities. In September 2025, the government of Indonesia seized over 148 hectares of land around the project that had been cleared without appropriate permitting, followed by an announcement in December 2025 that miners would face fines for every hectare cleared in breach of permit (Bloomberg, 2025[68]). Failure to adequately mitigate negative externalities has also impacted investment. Norway's sovereign wealth fund divested from Eramet in 2025 following a recommendation by its Council on Ethics due to Eramet's role in PT Weda Bay Nickel, citing the risk of "severe environmental damage and serious violation of the human rights of uncontacted Indigenous people" (Government Pension Fund Global, 2025[69]). Other initiatives have targeted multilateral financing for the project, including advocacy urging the World Bank to refuse to issue political risk insurance to the project (MIGA, 2010[70]).

4.5. The Philippines

4.5.1. The Philippines: nickel production and processing

While the Philippines remains the second-largest unprocessed nickel producer worldwide (roughly 45 million metric tonnes of nickel in 2024 (CRI, 2025[22])), nickel production in the Philippines has faced considerable environmental compliance challenges and moratoria on mining activity. Recent policy efforts have sought to rehabilitate the mining sector and attract investment while positioning the country as an alternative source of nickel for markets seeking to diversify away from Chinese-controlled supply chains (UNICRI, 2024[71]). This has not come without challenges; in 2024, production in Australia and the Philippines declined by roughly 26% and 20%, largely due to company-level decisions to reduce or stop nickel production due to challenging market conditions and declining prices, but production in the Philippines has shown some modest recovery in 2025/2026 (USGS, 2025[7]; Benchmark Mineral Intelligence, 2026[1]).

Under the Philippine constitution, the government of the Philippines owns all natural resources, including minerals. Mining in the Philippines operates within a hybrid governance model in which the central government holds primary regulatory and decision-making authority while regional and local entities play supportive but consequential roles. Key legislation includes the Philippine Mining Act of 1995, the Environmental Impact Statement (EIS) System, Indigenous Peoples' Rights Act (IPRA), and the Small-Scale Mining Act alongside sector-specific regulations (Asia Business Law Journal, 2025[72]). Under the 1995 Mining Act, the Department of Environment and Natural Resources (DENR) oversees permitting, licensing and regulation of large scale mining. Similarly, national agencies such as the Environmental Management Bureau (EMB) and National Commission on Indigenous Peoples (NCIP) enforce environmental and Indigenous consent requirements across the Philippines. While regional offices of the

DENR collect and process initial applications and conduct inspections, they do not exercise final decision-making power. However, local governments are authorised to issue business permits, environmental approvals and decisions related to “social acceptability” and have established ordinances restricting mining.

Ownership rules require most mining companies to be at least 60% locally-owned, though foreign companies can hold up to 40% of ownership. Foreign-owned companies are permitted full ownership of mining and smelting operations in cases where they enter into Financial or Technical Assistance Agreements (FTAA) with the government and invest a minimum of USD 50 million (Government of the Philippines, 2026[73]).

Mineral production in the Philippines is dominated by privately owned enterprises that have entered production-sharing agreements with the government. These include a number of publicly listed holding companies and family-controlled entities such as the Nickel Asia Corporation, Sumitomo Metal Mining, and Platinum Group Metals Corporation. There are two processing plants in the Philippines, which are both operated by Nickel Asia Corporation in partnership with Sumitomo Metal Mining. Overall, ownership is characterised by concentrated family ownership, partnerships with foreign investors (primarily from China) and complex intermediary ownership of processing and trading companies (Empower, 2025[74]). Research indicates that a small number of individuals hold significant ownership stakes in major nickel producing and processing companies across the Philippines (Empower, 2025[74]).

Though private companies remain dominant, SOEs play notable roles across specific segments of the value chain, particularly in cases with limited private investment or elevated risks of negative externalities. In the Philippines, SOEs such as the Philippine National Oil Company-Exploration Corporation (PNOC-EC) and the Philippine Mining Development Corporation (PMDC), participate in the market through direct operations and joint ventures (PH-EITI, 2025[75]).

4.5.2. The Philippines: Regulatory environment

Following the 2017 closure of non-compliant mines, the Philippines has enforced stronger mechanisms for revenue-sharing and environmental protection. For example, the Mine Rehabilitation Fund was initiated in 2018 to audit mine rehabilitation, while the Enhanced Compliance Rating System ranks operators, with only top performing mines eligible for further expansion. Despite these measures, some regional governments have sought to prohibit new mining activity due to negative environmental and social impacts. For example, Palawan imposed a fifty-year provincial moratorium on mining in 2025.

Starting with the 1995 Mining Act, the Philippines has developed a relatively comprehensive regulatory framework for environmental management in mining, though implementation and enforcement remain inconsistent in practice (IEA, 2022[76])**.** To guarantee that environmental safeguards are incorporated, an Environmental Impact Assessment must be carried out and receive an Environmental Compliance Certificate from the government prior to the development of any mining project (Environmental Management Bureau, 2026[77]). In 2022, the Department of Environment and Natural Resources issued an order requiring companies to assess their current and future biodiversity impacts, conduct baseline studies, and prepare rehabilitation plans. Because some impacts may emerge after operations have ended, companies must also continue monitoring them for up to ten years following mine closure (Pascual, Domingo and Manejar, 2022[78]). However, environmental regulations are not correctly enforced by the Philippine government, leading to negative social and environmental impacts and large pollution levels (UNICRI, 2024[71]).

The Philippines have introduced a Strategic Investment Priority Plan (SIPP), which provides income-based tax incentives, as part of a broader strategy to strengthen strategically important sectors. For the mining sector, these incentives are directed at value-adding activities along the mining value chain such as mineral processing, refining and smelting. Given the scale of mining projects, particularly mineral processing, an alternative approach could be to consider an accelerated depreciation regime, which materially improves early cash flow and reduces taxable income in initial years, during the investment payback period. Accelerated depreciation or immediate expensing limits revenue foregone compared to other tax incentives and increases the likelihood of generating additional investment. It can be particularly beneficial for longer-lived assets, projects with high-upfront costs and liquidity-constrained firms.

Similar to the issues identified for Indonesia, concerns regarding the limited effectiveness, risk of windfall gains, economic distortions, limited value for money of income-based tax incentives are equally relevant for the Philippines, particularly, in light of the implementation of the GMT. On the other hand, expenditure-based incentives (e.g. accelerated depreciation, enhanced deductions) are typically more effective in increasing additional investment, provide more value for forgone revenue and are treated more favourably under the GMT.

In September 2025, the Philippines enacted the Enhanced Fiscal Regime for Large-Scale Metallic Mining Act, to modernise and unify the tax and fiscal framework applying to large-scale metallic mining operations nationwide. This legislation amends the National Internal Revenue Code and consolidates fiscal obligations for mining companies, both within and outside mineral reservations, with the goal of balancing investment attraction, revenue collection and transparency (IEA, 2024[79]). It also introduced additional measures to protect the mining tax base such as the introduction of a ring-fencing regime, which requires each mining project to be treated as a separate taxable unit for revenue and tax purposes, thereby preventing companies from artificially shifting income/expenses between projects and offsetting losses from one project against profits from another (OECD; IISD, 2025[80]). Nevertheless, translating the revised mining fiscal framework into local growth has proven difficult, as confirmed by interviews with local stakeholders. Despite being the second largest nickel producer, the nation's mining industry contributes less than 1% to GDP, with large-scale mining provinces hosting the highest poverty incidences (Bantay Kita, 2024[81]).

The regime further enhances the audit and monitoring powers of the Bureau of Internal Revenue (BIR) and strengthens transparency and reporting requirements, including mandatory disclosures, closer co-ordination with environmental and geoscience authorities and through the establishment of the Transparency Office for Extractives (TOE) (IEA, 2024[79]). These measures will enhance BIR's and other government agencies' ability in accurately determining the value and movement of the nickel across the value chain. The Philippines has implemented key OECD BEPS measures that are particularly relevant to mitigating mining-related BEPS risks, such as thin capitalisation rules, Actions 8-10 (Aligning Transfer Pricing Outcomes with Value Creation) and Action 13 (Transfer Pricing Documentation).

4.5.3. The Philippines: Operational and governance risks

The environmental and social impacts of mining sites in the Philippines are well documented. The development of mining sites can result in reduced land availability for local biodiversity and forestry resources (Pascual, Domingo and Manejar, 2022[78]). Moreover, once material extraction is complete, large areas of land become unproductive and covered with mine waste. Indeed, nickel mining discards subsequent amounts of low-grade material waste onsite, often containing toxic water (Bravante and Holden, 2009[19]). If nickel laterite mine waste is not properly managed, it can quickly erode during rainfall and pollute nearby ecosystems (Balbin et al., 2023[20]). These environmental hazards resulting from mining activities can also generate significant social hazards, including population displacement, major disruptions to livelihoods and land-use conflicts (Pascual, Domingo and Manejar, 2022[78]).

Limited compliance to existing environmental regulations has challenged the Philippine administration. Widespread environmental violations led to the closure of 22 of 41 open pit mines as well as a moratorium on new mining projects in 2017 (USGS, 2021[82]). Although nickel laterites are not extracted through open-pit mining, some nickel operations, such as the Eramen Minerals Inc. (EMI) mine, were affected by the ban due to reported violations of mining and environmental regulations (Pascual, Domingo and Manejar, 2022[78]). The moratorium was reversed in 2021, encouraging new investments in the sector. Recent efforts have sought to distinguish the Philippines as a “greener” trading partner through more environmentally sound production practices.

In the Philippines, the increase in mining activities has been associated with impacts on water quality, agricultural land, and local food systems (CRI, 2025[22]; PH-EITI, 2025[75]). Indigenous groups and rural communities have faced human rights abuses, including attacks on environmental defenders, loss of access to clean water, flooding linked to mining-driven deforestation, and insufficient consultation (CRI, 2025[22]; Amnesty International, 2025[26]). Despite the significant wealth generated, compensation has often been inadequate, and the country is considered the most dangerous in Asia for land and environmental defenders (CRI, 2025[22]) (Amnesty International, 2025[26]). Nickel projects have been repeatedly linked to weak or contested FPIC practices, and communities have reported loss of livelihood due to disruption to fishing and agricultural activities caused by mining and processing, as well as health concerns (PH-EITI, 2025[75]). Concentrated ownership, including by PEPs, further contributes to conflict of interest and other governance risks in the Philippines (Empower, 2025[74]).

Operational and governance challenges may also impact foreign investment. Exploration activities by Woggle Corporation in Dupax del Norte, in the northern province of Nueva Vizcaya, were halted by local protests beginning in August 2025. Demonstrators cited lack of meaningful consultation, failure to obtain official authorisation and concerns over environmental impact. Despite initial crackdown by the local police, protests were supported by local lawmakers, environmental groups, and the local Catholic church diocese. In 2026, the government suspended the exploration permit and Woggle Corporation announced the withdrawal of all its equipment from Dupax del Norte following a Senate hearing (ABS CBN, 2026[83]).

4.6. Uptake of multi-stakeholder and industry initiatives on responsible business conduct

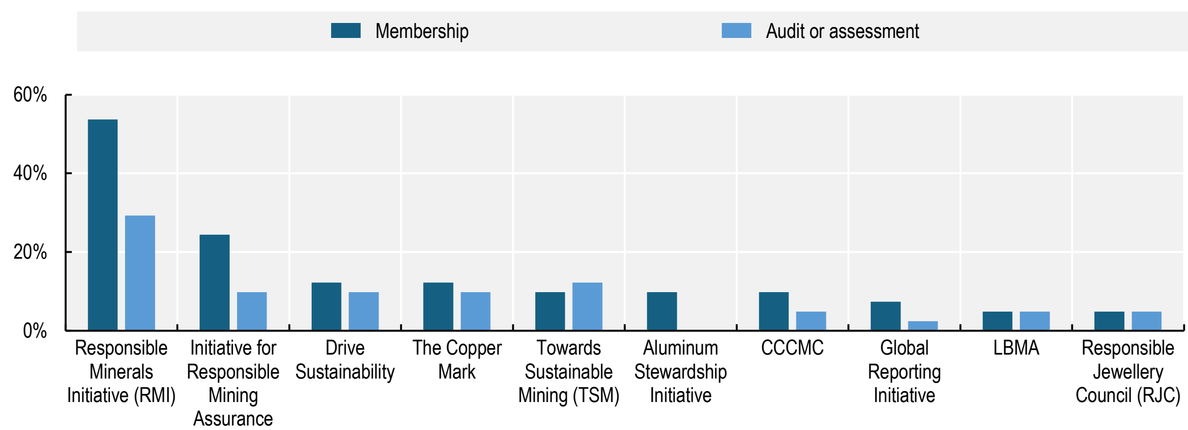
Indonesia and the Philippines are both EITI implementing countries (EITI, 2026[84]). However, Indonesia was awarded a fairly low score in implementing the 2019 EITI Standard, in particular in the field of transparency. Although EITI acknowledges government’s efforts in disclosing extractive industry data, it highlights the scope to improve the comprehensiveness, disaggregation, accessibility, and reliability of the data (EITI, 2024[85]). In the Philippines, the EITI has worked to address hidden control and PEP risks through improved disclosure of social and environmental expenditures, subnational transfers and beneficial ownership of mining companies (PH-EITI, 2025[75]). In 2024, The EITI acknowledged efforts made to improve civil society engagement, highlighting that civil society participation at the subnational level remains weak and needs to be improved (EITI, 2024[86]).

Various nickel operations in Indonesia have taken steps to align with international standards and certification systems. To date, there are three mines participating in IRMA to varying degrees. Harita Nickel, an integrated mining and processing company, was the first mine in Indonesia to commit to an IRMA audit in 2024 (IRMA, 2024[87]). Since then, it has undergone a Stage 2 Independent Audit, currently in a corrective action period. Also in 2024, the PT Vale Sorowako Mine agreed to undertake an IRMA Stage 2 Independent Audit, with site visits planned for late 2025 (Vale, 2024[88]). Weda Bay Nickel conducted initial self-assessments in 2023, though no IRMA-led independent audit has been conducted to date (Weda Bay Nickel, 2026[89]). There are ten nickel facilities in Indonesia that conform to the RMI’s requirements for its Global Responsible Sourcing Due Diligence Standard, four of which have undergone RMI’s facility standard assessment (RMI, 2026[90]). PT CNGR Ding Xing New Energy and PT Indonesia Tsingshan Stainless Steel in the Indonesia Morowali Industrial Park and PT Eternal Nickel Industry in Weda Bay underwent independent third-party assessment of their supply chain management systems by the China Chamber of Commerce of Metals, Minerals and Chemicals Importers and Exporters in 2025.

In recent years, mining and processing companies in the Philippines have taken notable steps to improve alignment with international assessments. As of 2025, all member companies of the Chamber of Mines of the Philippines committed to implementing Towards Sustainable Mining self-assessment reports spanning eight protocols (PH-EITI, 2025[75]). Despite this broad uptake of the TSM, engagement with other standards and certification schemes remains limited. No company has undergone RMI's facility standard assessment (RMI, 2026[90]). There is currently one nickel mine in the Philippines that is taking initial steps to align with IRMA. Owned by the Nickel Asia Corporation, the Rio Tuba Nickel Mine, a joint venture between Nickel Asia Corporation (60%), PAMCO (36%) and Sojitz (4%), is currently undergoing a self-assessment within the IRMA framework (BHRC, 2025[91]).

Figure 4.2. Participation and membership in key multi-stakeholder and industry initiatives in the nickel supply chain

Nearly nine in ten respondents active in the nickel supply chain indicated membership in at least one multi-stakeholder and industry initiative. The Responsible Minerals Initiative is most commonly cited in terms of membership as well as audits and assessments.



Note: This figure presents responses to survey Question 32 ("Have you been audited or assessed by one or more of the following sustainability initiatives?") and Question 33 ("Are you a member of one or more of the following sustainability initiatives?"), for key company types and respondents active in the nickel supply chain. Multiple responses were permitted. "Other" write-in responses were reviewed and mapped to standardised initiative categories; one response could be mapped to more than one category where relevant. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

4.7. Uptake of traceability

Tracing nickel products as they move along value chains presents distinct challenges with notable implications for both responsible sourcing and fiscal governance. As described above, this complexity stems from several reinforcing factors, namely the routine mixing of ores from different mines during transportation and processing, often opaque ownership structures, and limited coverage of existing responsible sourcing standards. In the context of these challenges, this section identifies gaps in the uptake of public and private traceability systems in Indonesia and the Philippines. These results are then contextualised using the survey data in the following chapter.

Traceability in nickel supply chains in Indonesia and the Philippines is in early stages. Developing traceability systems for nickel supply chains is complex due to the diverse sources of ore, varied processing pathways, but also the large diversity of economic sectors utilising nickel products. Although traceability for certain nickel produced in contexts of vertical integration may be more straightforward, both Indonesia and the Philippines present certain challenges (IEA-OECD, 2025[9]). In both countries, unprocessed nickel from multiple mines is often mixed either for transportation or smelting. This means that it is often impossible to differentiate between nickel that was produced according to specific standards or other requirements. Smelters' need for varied ore sources to reach the required grade and industrial parks' ownership structures also create significant challenges to full traceability of nickel supply chains (IEA-OECD, 2025[9]). The different levels of purity create distinct processing requirements to produce battery-grade nickel from these types of nickel, which increases the overall complexity of nickel supply chains.

Responsible sourcing requirements vary in their coverage of nickel types. The London Metal Exchange (LME) requirements are for the **Class I nickel** traded on the exchange, but this form of nickel may represent as little as **15% of global flows** (Ferreira, 2025[92]). The EU Batteries Regulation will be complementary to the LME requirements since the EUBR addresses separate battery-grade nickel types, though stainless steel hovers around 70% of nickel use and consists primarily of Class II non-battery-grade nickel. Stainless steel's lack of coverage by responsible sourcing requirements is an obstacle to traceability and responsible production in the overall nickel supply chain. Some exchanges are exploring trading in nickel sulphate, building on existing futures contracts in cobalt hydroxide (CME) and lithium hydroxide (LME and CME), but lack of liquidity in such markets is a challenge, potentially limiting traceability options (CME, 2025[93]).

Complex ownership structures further complicate the picture. In Indonesia, smelting is dominated by foreign-owned companies, whose ownership is complex and often opaque, stretching across multiple layers of corporate entities registered in multiple countries (C4ADS, 2025[64]). Recent efforts to trace ownership structures of refining operations in Indonesia found that an estimated 30% of company ownership structures were untraceable (Schreier et al., 2025[94]). Furthermore, there is evidence that contracts among companies along the nickel supply chain contain non-disclosure agreements that make tracing the flow of material along nickel supply chains more challenging (Sangadji, Rahayu and Paramarini, 2025[95]). The opacity of the ownership structures creates difficulties when applying international tax legislation such as transfer pricing which often relies on the definition of a related party to be applied. Appropriate traceability systems, tracking each mineral to the various beneficial owners could assist in alleviating this concern.

Indonesian authorities developed the government-led SIMBARA system to strengthen the traceability of coal and other mineral commodities. The system can support risk-based audits by several government agencies by identifying inconsistencies between production data, transport records and export sales, helping detect volume underreporting, grade misclassification, and related-party pricing that diverges from international benchmarks**.** However, limitations in reconciling production and smelting data, create potential opportunities for underreporting and diversion of flows. (see Box 4.3).

Box 4.3. SIMBARA: Indonesia's mineral traceability system

Indonesia's Sistem Informasi Mineral dan Batubara (SIMBARA) is a blockchain-based integrated digital platform connecting data from licensing, production, transportation, export and taxation across six government ministries and institutions. Led by the Ministry of Finance, it mandates data sharing across ministries overseeing mining operations, ports, exports, and processing, using the national taxpayer identification number (NPWP) as the common identifier linking entities across the supply chain. First implemented for coal in 2022, coverage was expanded in 2025 to include nickel and tin tracking from mines to domestic processing facilities, with cobalt planned for addition in 2025 (Government of Indonesia, 2025[96]).

What SIMBARA does in practice

SIMBARA automates a sequence of compliance checks across the licence to export lifecycle. It is linked to the government's digital mining quota records (RKAB), enabling real-time tracking of remaining production quotas and alerting authorities to discrepancies between output and sales data. Mining business permits (IUP/IUPK) are validated against payment of non-tax state revenues (PNBP), including royalties, dead rent, exploration fees, and approved work plans; port loading is checked against export allocations; and customs clearance is conditional on reconciliation between declared volumes and upstream records. Smelters are required to register their ore sourcing and originating mines, and are unable to unload shipments from operators with outstanding royalty payment obligations. An automated alert flags anomalies including export volumes inconsistent with declared production and mismatches between port, customs, and tax records, supporting risk-based audits across the Ministry of Finance, Customs, tax authorities, and the Ministry of Energy and Mineral Resources. Since its launch, SIMBARA has prevented state revenue losses of over IDR 8 trillion (approximately USD 500 million), comprising IDR 3.47 trillion from prevention of illegal mining, IDR 2.53 trillion from risk profiling of operators, and IDR 1.1 trillion from recovery of outstanding receivables.

Remaining limitations and takeaways

In the context of traceability across the entire supply chain, SIMBARA illustrates both the potential and the limits of Government-led traceability systems: it is a highly effective revenue monitoring tool, but its architecture was designed primarily for that purpose rather than for end-to-end mineral chain of custody traceability. The most significant gap is the absence of smelter-level mass balance reconciliation as the system cannot currently verify that declared smelter intake volumes are consistent with mine-level output. Without this, it cannot serve as a due diligence instrument for downstream buyers or supply chain compliance frameworks such as the OECD Due Diligence Guidance or the EU Battery Regulation. This gap has direct supply chain integrity implications. The processing sector faces overcapacity, and there are reports of illegally mined nickel, being introduced into formal supply chains (Hermawan, 2023[97]). Without smelter-level intake verification, illegally sourced material risks being laundered into compliant export streams.

Institutional fragmentation adds a further layer of complexity: under Law No. 3 of 2020, vertically integrated mines and smelters fall under the Ministry of Energy and Mineral Resources, while standalone smelters are regulated by the Ministry of Industry, a division that risks creating oversight gaps precisely at the mine-to-smelter interface that the system does not yet cover.

For countries developing comparable systems, SIMBARA offers three clear lessons:

1. Inter-agency data integration must be designed from the outset rather than retrofitted
2. Linking traceability to existing quota and licensing frameworks (as SIMBARA does via RKAB) multiplies compliance leverage at relatively low additional cost
3. Where possible, systems should integrate both fiscal revenue assurance and material chain of custody, as they are both necessary for a system to serve due diligence purposes and domestic revenue mobilisation simultaneously.

Complex and fragmented export routes make it challenging to trace nickel shipments out of the Philippines. Many mining companies reportedly use private shipping facilities and barges rather than centralised ports, which makes it challenging to identify which mining site produced the material contained in a given shipment (Empower, 2025[74]). Furthermore, the widespread use of intermediary companies to export nickel products makes it difficult to verify which actors are directly involved in nickel shipments as well as tracing ore to original production sites (Empower, 2025[74]).

Regarding traceability of recycled nickel, the recycling system for stainless steel, the main end-use of mined nickel, is highly effective, and steel is the most recycled metal worldwide, suggesting that sufficient information reaches secondary-market stakeholders to enable efficient processing (Watari et al., 2025[15]). By comparison, recycling of nickel from batteries, namely EV batteries, the second-largest and fast-growing application of nickel, remains underdeveloped as discussed in the lithium chapter. Recyclers have reported that traceability issues such as missing or incorrect labelling of batteries are among the key barriers to efficient battery recycling.

Ultimately, the nickel supply chain presents a more demanding environment for traceability. Blending of ores, diverse processing pathways, opaque ownership and other challenges leave significant portions of global flows outside of effective oversight. Indonesia's SIMBARA platform and growing participation in international audit programmes provide a foundation, but the gap between traceability potential and implementation is wider than for lithium, with much higher consequences at stake through inaction. These findings inform the targeted recommendations for nickel in chapter 6.

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5 Enablers and obstacles for responsible business conduct and traceability

Recent years have seen a proliferation of initiatives designed to improve operational and governance performance, yet implementation varies widely. This reflects the complex interplay of regulatory requirements, market incentives, ownership structures and corporate governance. Understanding what drives companies to adopt, ignore or resist responsible business conduct, transparency and traceability systems is increasingly important. This section explores how the regulatory and non-regulatory measures available to policymakers are influenced by market conditions, company-level ownership models and governance structures.

5.1. Context

Understanding what drives companies to adopt traceability and RBC initiatives is as important as understanding their uptake, as it illustrates where policy can be most effective. The survey findings suggest that market forces, particularly customer demand and brand reputation, are the primary motivation for traceability uptake, with regulatory requirements a close second. This has important implications for policymakers: regulations that align with or anticipate market expectations appear more likely to drive meaningful adoption, while measures that operate in isolation from commercial incentives may have limited reach. At the same time, the fact that the majority of respondents report it is too early to say or were unable to identify tangible benefits from traceability underscores the importance of reducing implementation costs and demonstrating the business case, particularly for smaller actors who may lack the resources to absorb upfront investment.

The uptake of RBC, transparency and traceability initiatives is increasingly driven by a mix of regulatory requirements, voluntary standards, and market measures. Governments apply diverse policy tools: some impose mandatory transparency or traceability obligations, while others rely on incentives to encourage adoption. Many regulatory frameworks build on the OECD's risk-based due diligence approach, tailoring traceability expectations to the level of risk within a company's supply chain. Certain policies are particularly far-reaching, for example, the EU Batteries Regulation and the EU Ecodesign for Sustainable Products Regulation, which introduce digital product passports, as well as China's Battery ID system and its Rare Earth Management Regulation.

In addition to direct regulations, indirect mechanisms have also become significant drivers of traceability. In the United States, measures such as tax credits under the Inflation Reduction Act and import restrictions imposed by the Uyghur Forced Labor Prevention Act illustrate how incentives and enforcement actions can prompt industry-wide alignment on traceability practices, even in the absence of explicit traceability mandates. The survey conducted as part of this study explored the key drivers of RBC adoption and traceability from the perspective of companies in mineral supply chains.

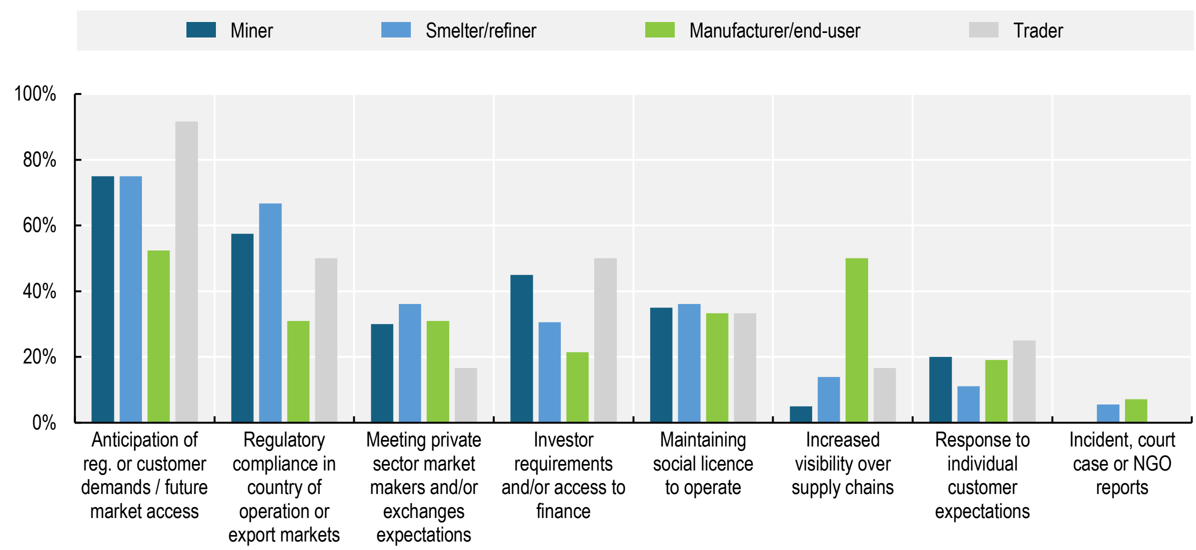
5.2. Key drivers of RBC and traceability initiatives

5.2.1. Market and regulatory pressure as drivers of RBC uptake

Anticipation of regulatory changes and market access considerations appear to be the primary forces driving company engagement with RBC along the supply chain. As shown in Figure 5.1, anticipation of regulatory or customer demands, and market access considerations are the most frequently cited drivers of company implementation of RBC due diligence and for participation in multi-stakeholder and industry initiatives on RBC, with motivations varying across supply chain segments. Miners' and smelters' high number of responses for anticipation of regulatory demands and regulatory compliance in country of operation or exports may be explained by the developing regulatory infrastructure on supply chain due diligence that has targeted these supply chain stages over the last ten years. Many of these regulations are based on the OECD Due Diligence Guidance for Responsible Mineral Supply Chains, which identifies smelters and refiners as the "control point" in the supply chain – the stage in which a high volume of minerals passes through a low number of actors, which have good visibility upstream – hence the point where audits of due diligence systems take place.

Motivations for participation in multi-stakeholder and industry initiatives on due diligence vary across sectors. While traders have been traditionally not in scope of supply chain due diligence regulations, anticipation of regulatory demand and customers' demands features in 92% of traders' survey responses (11 out of 12). This may be due to the supply chain scope of regulatory expectations being cascaded up to traders, pointing to this supply chain stage as a sector with the same characteristics of a control point, in an even more concentrated form. Another explanation is that many of the traders in the survey are vertically integrated (spanning mining, smelting, recycling and transporting activities) and are thus preparing for future or existing market requirements. Access to finance seems to be a more important factor for miners and traders (close to 50%) compared to other sectors. Manufacturers' reported motivation of increased visibility over supply chains stands out compared to other supply chain segments. As explained in the section below, increased visibility over the supply chain may entail different kinds of tangible benefits for downstream actors.

Figure 5.1. Primary drivers of company participation in multi-stakeholder and industry initiatives on RBC



Note: This figure presents responses to survey Question 34 ("What are the primary factors influencing your company's participation in one or more of the above sustainability initiatives?"). Percentages refer to the share of respondents selecting each factor (answers restricted to top three factors). Based on a subsample of 40 miners, 36 smelters/refiners, 42 manufacturers/end-users and 12 traders, irrespective of whether they reported implementing a traceability system. Recyclers and transporters are excluded; manufacturers and end-users are grouped into a single category. "Other" response options are not shown in the figure. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

Although regulatory frameworks on waste and products affect company behaviour, their impact on the selection and implementation of multi-stakeholder and industry initiatives on RBC remains variable. Extended producer responsibility schemes and recycling targets place the responsibility for collecting and recycling products on manufacturers. Eco-design requirements may also introduce recycled-content mandates, including the verification of recycled-content claims, an obligation that is difficult to fulfil under current traceability frameworks, in particular due to the varying waste and by-product classifications of materials and products. However, less than half of survey respondents (42%) indicate that waste legislation and product standards impact their selection and implementation of multi-stakeholder and industry initiatives to a moderate or large extent. Approximately two-thirds (68%) of these respondents engage in downstream activities such as manufacturing, recycling and/or are end-users, and over a third (37%) are involved in smelting/refining activities. Nearly half of respondents engaged in mining activities report that such considerations do not apply to them.

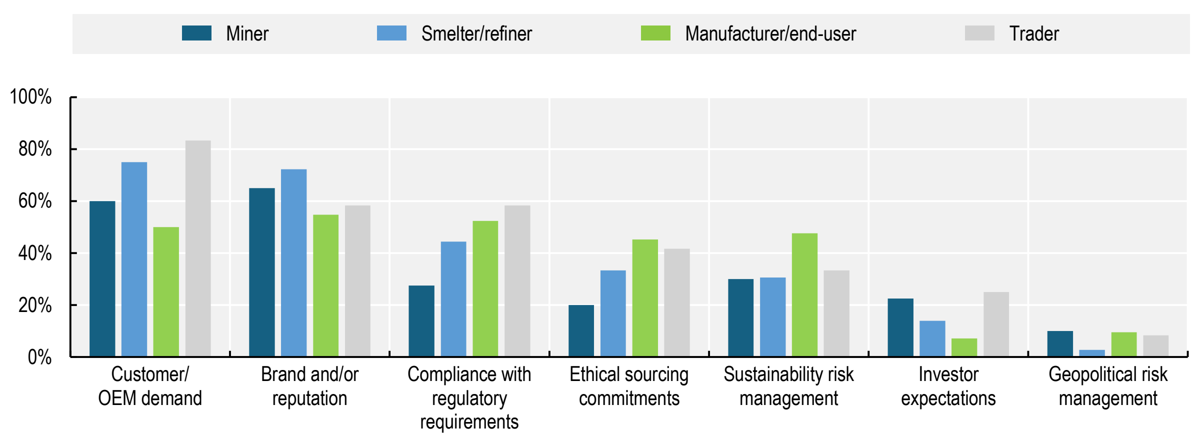
Recent scholarly work mapping the development timeline of voluntary sustainability standards in the minerals space suggests that their accelerated adoption since 2018 has been primarily driven by growing environmental and social pressures, including from investors and original equipment manufacturers, as well as regulatory alignment (Zhang et al., 2026[1]).

5.2.2. Market incentives as drivers of traceability uptake

When it comes to the uptake of traceability systems, market incentives such as brand reputation and customer demand appear to be the strongest driving factor (Figure 5.2). Regulatory requirements, which have sometimes anticipated those same market requirements, follow closely behind. More than 60% of survey respondents identify brand reputation or customer demand as the primary reasons for setting up traceability. Compliance with regulatory requirements and adherence to ethical sourcing commitments are reported to be the primary reasons in 40% of the responses. Investor expectations and geopolitical risk management are each referenced in about one in ten answers. Obtaining fiscal incentives such as tax credits is referenced in only one answer.

Figure 5.2. Primary drivers for pursuing traceability in mineral supply chains

Customer demand, brand and reputation considerations and regulatory compliance are the most frequently cited drivers for traceability.



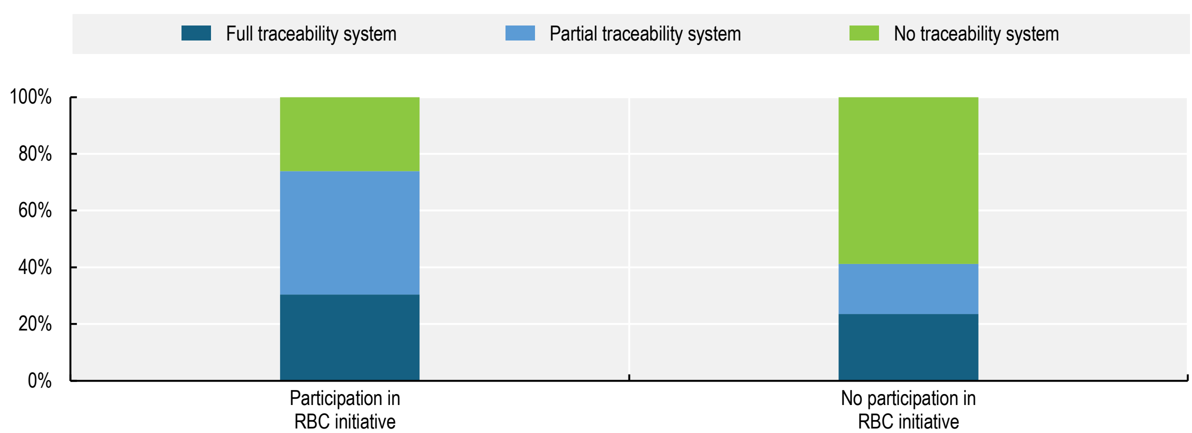
Note: This figure presents responses to survey Question 27 ("What are the primary drivers for pursuing traceability in your organisation?"). Percentages refer to the share of respondents selecting each factor (answers restricted to top three drivers). Based on a subsample of 40 miners, 36 smelters/refiners, 42 manufacturers/end-users and 12 traders, irrespective of whether they reported implementing a traceability system. Recyclers and transporters are excluded; manufacturers and end-users are grouped into a single category. "Other" response options are not shown in the figure. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

Research also shows that investors' screening of portfolios cascades pressure upstream on mining companies to align with selected industry standards (Agapova, Filatovab and Yuk, 2025[2]). This is underscored by the Global Investor Commission – Mining 2030, an ambitious initiative by some of the world's leading pension funds to establish consensus expectations for a responsible mining sector (Mining 2030, 2025[3]). This also aligns with the decision of Norway's sovereign wealth fund to divest from Eramet over the environmental and social performance of the PT Weda Bay Nickel project, which illustrated investor pressure acting as a driver for stronger alignment with RBC standards.

5.2.3. Link between traceability and participation in multi-stakeholder and industry initiatives

There is also evidence of a link between participation in multi-stakeholder and industry initiatives on RBC and progress in traceability. As shown in Figure 5.3, companies participating in initiatives on RBC more frequently report full or partial traceability systems. Given the correlation between the two it is not possible to draw firm conclusions on the relationship between participation in initiatives and uptake of traceability. As mentioned above, some multi-stakeholder and industry initiatives provide protocols for traceability information to be passed on through supply chains.

Figure 5.3. Participation in multi-stakeholder and industry initiatives on RBC and status of supply chain traceability systems



Note: This figure presents 86 responses to survey Question 7 (“Does your company currently use, or participate in, any traceability system?”) and Question 33 (“Are you a member of one or more of the following sustainability initiatives?”), including 69 respondents reporting participation in one or more sustainability initiatives and 17 respondents reporting no such participation. “No traceability system” combines the response options “No, but we are planning to” and “No current plans”. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

5.2.4. Early evidence on the benefits of traceability

While the benefits of traceability are not yet fully tangible, early evidence points to a range of operational and reputational gains for companies that have invested in systems. Close to half of the respondents who set up traceability systems stated that it was too early to indicate any benefit, and 14% found no tangible positive impact in running a traceability system. Among the 31% who did report tangible benefits, respondents identified reputation management, customers’ trust and improved market access, in line with responses related to incentives guiding them to set up a system in the first place.

Other respondents indicated that better visibility over the supply chain allowed them to optimise performance in logistics between supply chain actors, develop better supplier engagement strategies, and make changes within their supply chains to adapt to market and regulatory developments. As a concrete example, one respondent cites that when international sanctions were introduced in certain importing markets due to the Russian Federation (“Russia”)'s war of aggression against Ukraine, the company had all the relevant information at hand to comply.

5.3. Main gaps and shortcomings of existing multi-stakeholder and industry initiatives on RBC and traceability systems

Traceability systems face real barriers to effective implementation. Cost and lack of interoperability are the most commonly cited obstacles, alongside data reliability concerns and limited leverage over suppliers. For policymakers, the survey points to a clear set of priorities: financial incentives, shared data infrastructure, and more consistent regulations across jurisdictions are the measures companies most want to see. The overall outlook is encouraging, with nearly three quarters of respondents planning to increase investment in traceability over the next three years, but policy action will be key to turning that intent into practice.

5.3.1. Uneven capacity across supply chain actors

Industry, transparency and traceability initiatives are not always designed to accommodate the significant diversity in scale, resources, and awareness across supply chain actors. Literature shows that smaller companies, especially artisanal and small-scale miners (ASM), face numerous barriers to meeting operational and governance benchmarks, due to lack of access to formal infrastructure for digital technology, finance and insurance (Levin Sources, 2025[4]) (World Bank, 2023[5]). In contrast, large companies or multinationals generally fare better due to internal policies and processes focused on meeting regulatory requirements and investor scrutiny. Nevertheless, this often has to do with the way RBC initiatives are designed. An OECD study comparing over 2 000 RBC metrics from eight major rating products found that 68% of all metrics measure company policies and activities rather than their impacts. This emphasis is particularly pronounced for topics such as labour rights (81%), human rights (89%), and biodiversity (82%) (OECD, 2025[6]).

5.3.2. Data scarcity and fragmentation

Data scarcity, fragmentation and reliability remain major obstacles. Several critical minerals have large data limitations, in particular with regard to trade and production data across the entire supply chain, which makes tracing these minerals challenging (NRGI-EITI-OECD, 2025[7]). This is also evident in lithium and nickel supply chains, as mentioned in chapters 3 and 4, as data at certain segments of the supply chain can be obscure or publicly not available. Moreover, data for some end-of-life products containing critical minerals, such as e-waste, are difficult to obtain due to waste collection challenges and leakage. Existing trade codes also do not differentiate between minerals and their compounds sourced from primary sources as opposed to recycling. The reliability of traceability systems depends heavily on the accuracy of the data entered; if false information is entered, the entire system can be compromised. This risk is especially high in jurisdictions with weak governance.

5.3.3. Fiscal governance

For government-led systems, similar challenges persist, which creates multiple entry points for fiscal revenue erosion, for example through reductions in corporate income tax and royalties that are volume or valued based. In the development and production phases, technical, management, and engineering services charged within mining groups can be overstated or duplicated, eroding the tax base. These services are often difficult to verify and may include exaggerated mark-ups not aligned with value creation. At the extraction stage, production volumes may be underreported through limited or outdated equipment, insufficient technical expertise to operate advanced systems, and a lack of independent verification of the data entered. Following extraction, mineral grade and quality can be understated through selective sampling, testing in affiliated laboratories, or weak state assay capacity. Pricing and its adjustments depend heavily on grade, purity, moisture content, and impurities contained in the mineral with even small differences in the grade or quality potentially having a significant fiscal impact.

Logistics costs, including freight and insurance, are another area of vulnerability. Inflated freight rates, captive insurance arrangements, and bundled logistics contracts routed through investment hubs can significantly reduce taxable profits. Finally, financing arrangements remain one of the most persistent BEPS risks especially in the extractive sector given the significant capital requirements associated with a mining project**.** The mining sector is generally characterised by thinly capitalised capital structures through intra-group funding arrangements with detrimental terms and conditions, particularly, excessive interest rates and quantum of debt. These allow for excessive interest deductions throughout the project lifecycle, reducing the profit base in mining countries and subsequently reducing the taxes paid to the host state.

5.3.4. Credibility of multi-stakeholder and industry initiatives

The quality of implementation of multi-stakeholder and industry initiatives depends on their credibility. Where industry initiatives and audit programmes evaluate sites, company risk management practices or products, they vary considerably in the quality of their assessment methodologies and teams, robustness of their monitoring and oversight systems, levels of independence, accountability and transparency of decisions (Manuel C. Kathan, 2025[8]; Ellen Pei-yi Yu, 2020[9]; OECD, 2024[10]). The inclusiveness of initiatives' governance models (especially with regards to non-industry stakeholders, such as Indigenous Peoples), levels of independence, accountability, transparency of decisions and impact on local communities have emerged as key indicators for the credibility of these initiatives (OECD, Forthcoming[11]).

5.3.5. Cross-border regulatory inconsistencies

Cross-border regulatory inconsistencies may further complicate traceability requirements especially for secondary supply chains. For example, the varying classification of battery waste and black mass as hazardous or non-hazardous materials, or even as waste or products, across jurisdictions creates significant verification challenges. In countries such as Argentina and Chile, classifications and guidance for how battery waste should be handled, disposed or recycled is not yet clearly defined, despite an increasing recognition of the risks that incorrect handling can result in (Boletín Oficial de la República Argentina, 2025[12]). Large portions of black mass trade fall outside open-access reporting frameworks and are declared under multiple Harmonised System codes, limiting transparency and creating regulatory arbitrage risks (Institut Français de Relations Internationales, 2024[13]; GAIA, 2025[14]). Without explicit classification under existing frameworks, companies face uncertainty in documenting and verifying the origin of recycled content when materials cross borders (IEA-OECD, 2025[15]). Given the documented exposure of other waste and secondary material flows to trafficking, informality, and corruption at the recycling and trading stages, traceability risks associated with black mass warrant closer examination (Isarin, 2023[16]).

5.4. Barriers to scaling up traceability – insights from the survey

Despite growing momentum, significant barriers to effective implementation remain: **Cost and lack of interoperability are the most commonly cited obstacles**, while confidentiality concerns, limited supplier leverage and data reliability issues constrain ongoing operations. The proliferation of overlapping standards adds further complexity, particularly for smaller producers. Nevertheless, most respondents plan to increase investment in traceability over the coming years, pointing to an important window for policy intervention.

5.4.1. Gaps between audits and customer expectations

Participation in RBC initiatives that verify performance, such as audits or assessments, may not exhaust customers' expectations regarding suppliers' performance on RBC, **pointing to a need for more credible and comprehensive verification processes.** Over 60% of survey respondents reported undergoing at least one RBC-related audit in the past year. At the same time, 70% also reported that they had received at least one RBC-related enquiry from individual customers. While 45% of respondents reported receiving between one and ten enquiries annually, eight respondents reported receiving more than one hundred individual requests over the same period. There are also inconsistencies in exposure to responsible sourcing requirements and requests. One quarter of respondents reported neither receiving individual enquiries nor undergoing any audit. This variation is only partially explained by their supply chain position, as upstream companies are typically more exposed to audit requirements by downstream companies. The complexity of multiple, sometimes overlapping, standards can become a barrier, especially for smaller producers with little insight on standard implementation and recognition by stakeholders.

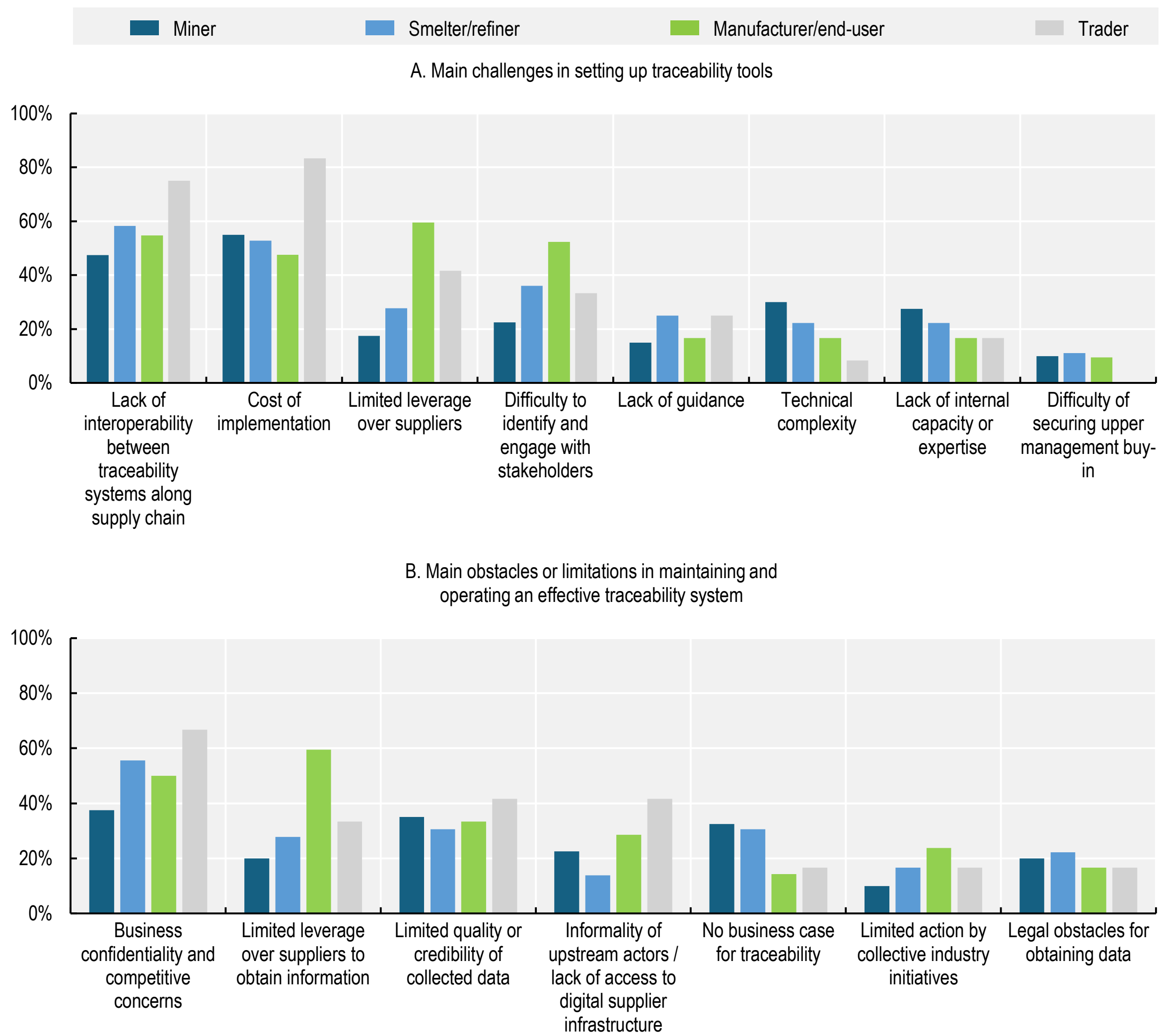
5.4.2. Implementation and operational barriers

Companies face a distinct but overlapping set of barriers at both the implementation and operational stages of traceability adoption. As shown in Figure 5.4, more than half of the respondents to the survey identified the cost of implementation and lack of interoperability as the main obstacles to setting up traceability systems. The vast majority of respondents had not, however, undertaken a cost estimate at the time of the survey. The cost of implementation of a traceability system varies based on the technology used, the complexity of the supply chains as well as the availability of existing infrastructure and systems (IEA-OECD, 2025[15]). Adherence to traceability systems is not costless, even if systems are in place both at the company and institutional level which makes data easier to collect and report. However, these costs will be more substantial where there are no pre-existing reporting systems. Traders, miners and smelters appear to be most impacted by the cost of implementation, reflecting the need for data collection more upstream. Interoperability between different systems is necessary for an efficient data exchange across the supply chain.

When asked about operational limitations companies faced when maintaining and operating effective traceability systems, business confidentiality, limited leverage, and limited credibility of collected data were identified as the main obstacles. **This appears to be a general concern as beyond issues of having the ability to collect traceability data,** companies **may also be reluctant to participate in traceability systems** on the basis that product design and composition is considered proprietary information which they do not wish to disclose (Mewangi, 2025[17]).

Figure 5.4. Main challenges in setting up and operating traceability systems

Implementation challenges centre on cost and interoperability, while ongoing operation is constrained by confidentiality concerns, supplier leverage and data quality issues.



Note: This figure presents responses to survey Question 21 ("What are the main challenges, if any, that your company has faced in setting up traceability tools?") and Question 22 ("What are the main obstacles or limitations, if any, that your company has faced in maintaining and operating an effective traceability system?"). Respondents could select up to three options. Based on a subsample of 40 miners, 36 smelters/refiners, 42 manufacturers/end-users and 12 traders, irrespective of whether they reported implementing a traceability system. Recyclers and transporters are excluded; manufacturers and end-users are grouped into a single category. "Other" and "None" response options are not shown in the figure. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.

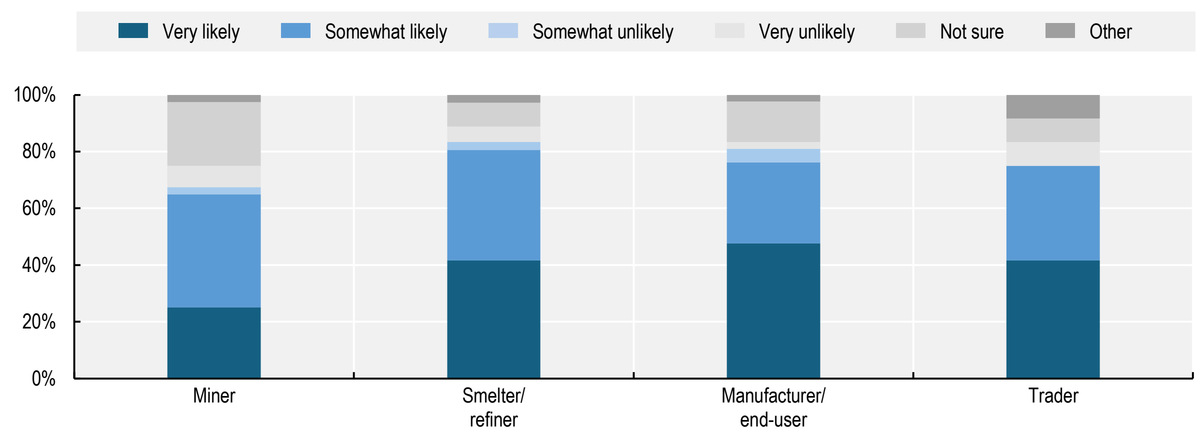
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

5.4.3. Industry appetite for investment into traceability

Notwithstanding the challenges outlined above, industry's appetite for traceability investment appears strong. Despite shortcomings of existing traceability systems and challenges with their implementation, **nearly three quarters of respondents to the survey across all supply chain segments indicate they are likely to increase investment in traceability** over the next three years (Figure 5.5).

Figure 5.5. Likelihood of increased investment in traceability over the next three years

Nearly three quarters of surveyed companies indicate they are likely to increase investment in traceability over the next three years.



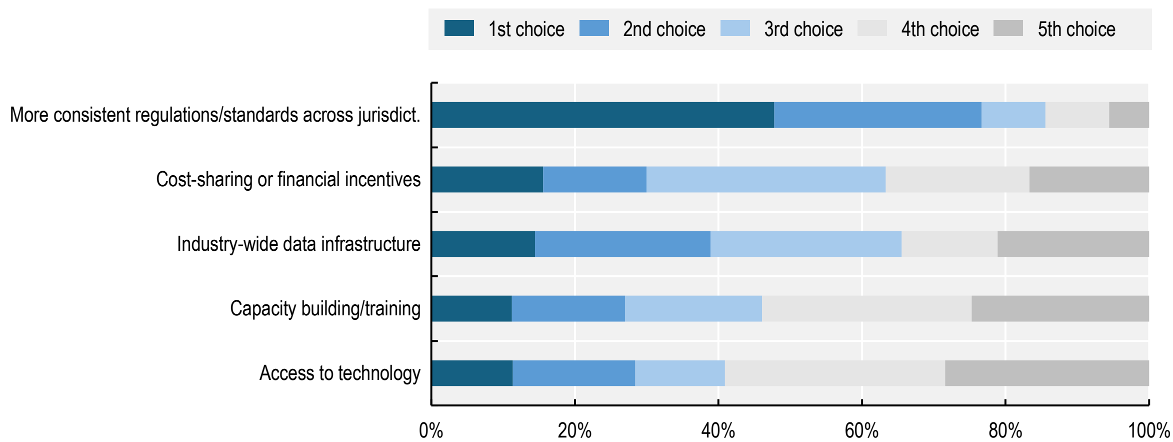
Note: This figure presents responses to survey Question 30 ("Over the next 3 years, how likely is your company to increase its investment in traceability?"). Based on a subsample of 40 miners, 36 smelters/refiners, 42 manufacturers/end-users and 12 traders, irrespective of whether they reported implementing a traceability system. "Other" includes two open-ended responses indicating continued or targeted investment approaches. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

5.5. Factors for scaling implementation

Survey respondents broadly agree on what would most support the scaling of traceability efforts: greater regulatory consistency across jurisdictions, financial incentives, and interoperable data infrastructure are the most frequently cited priorities (Figure 5.6). These insights align with previous OECD-IEA research on the role of traceability in critical mineral supply chains (IEA-OECD, 2025[15]). They also align with information collected during site visits, which highlighted the potential for greater financial incentives in particular to drive uptake of traceability.

Figure 5.6. Ranked preferences for support measures to scale traceability efforts

Regulatory consistency is most frequently ranked as the top priority, while financial incentives and shared data infrastructure follow as secondary enablers.



Note: Based on survey Question 31 ("What kind of support would most help your organisation scale traceability efforts? (Rank in order of importance)"). Percentages are calculated using the total number of respondents (n = 90) as the denominator. Respondents were asked to rank five support options from 1st (most important) to 5th (least important); each percentage reflects the share of respondents assigning a given rank to each option. Survey data was collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

5.5.1. Market incentives and price premia

Market incentives alone are unlikely to be sufficient in the near term. Although provenance can enhance reputational value, evidence that RBC-linked certification consistently delivers a price advantage is limited, though emerging evidence suggests it can be a factor in some circumstances. Prior to introducing responsible sourcing requirements, for example, LME cobalt traded at a discount compared to spot transactions (Bernards, 2021[18]). Some traders have noted that clients are increasingly insisting on certified material, especially when sourcing from locations with high-risk profiles. While this has not led to discernible price premia for certified minerals, it conceivably could in a tight market. Due to these developments, traceability has increasingly become an important tool to distinguish responsibly produced material in a market that increasingly accords importance to operational and governance factors in the supply chain, even if it does not always provide sufficient competitive differentiation to command a price premium. Additionally, under OECD Transfer Pricing Guidelines, pricing of minerals between related parties must reflect market conditions and the terms and conditions that independent parties in comparable circumstance would agree to. As every commodity is different with its own unique supply and demand dynamics, it is important for any transfer pricing analysis to thoroughly evaluate the particular critical mineral (OECD & IGF, 2023[19]).

Greenhouse gas (GHG) emissions are generally more quantifiable and verifiable than other dimensions, which has enabled the piloting of so-called "green" premia defined as the price differential between commodities produced with a low versus high carbon footprint. According to an industry survey, the share of traded volumes qualifying as "green" remains relatively limited, ranging from 9% to 12% of respondents' sourcing for battery-grade lithium and nickel, but is expected to grow as companies strengthen commitments to reducing Scope 3 emissions and as downstream demand for lower-carbon inputs increases (McKinsey, 2024[20]). In October 2025, the London Metal Exchange (LME) announced a roadmap to develop RBC metal premium pricing for LME-approved brands, including a proposed maximum carbon-footprint threshold of 20 tonnes of CO_2 per tonne for nickel, with relevant RBC data disclosed through the LME passport (London Metal Exchange, 2025[21]). It is important to note that LME-approved brands are required to comply with the LME's Responsible Sourcing requirements, which are aligned with the OECD Due Diligence Guidance for Responsible Supply Chains of Minerals, thereby establishing a baseline level of compliance. Lithium RBC premia exist in selective commercial arrangements and premium product niches, but they are not yet widely reflected in fungible benchmark prices or exchange-level pricing mechanisms, and overall uptake remains limited.

The nascent premium landscape is confirmed by survey responses, with over 70% of respondents indicating that they did not observe any price differentiation for material produced by a mine certified by an audit programme. Those that did report around the same rate (10%) of discount for non-certified material, a price differential only depending on origin, and a premium based on social audit certificates and a premium based on low greenhouse gas emissions.

5.6. Implications for policymakers

Taken together, these findings point to a clear set of priorities for policy action. Market forces and regulatory expectations are driving uptake, but cost, interoperability and fragmented regulatory environments remain significant barriers. Most companies have yet to see tangible returns on investment in traceability, indicating that its business case is still maturing. At the same time, nearly three-quarters of respondents plan to increase that investment, suggesting that policy intervention at this stage could have an outsized impact in shaping how traceability systems develop. The recommendations that follow respond directly to these findings, setting out a targeted and phased approach that works with existing market momentum.

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6 Conclusion and policy recommendations

Building on the findings of the preceding analysis, this chapter provides recommendations for strengthening traceability in lithium and nickel supply chains. Building on the experiences of Argentina, Chile, Indonesia and the Philippines, it identifies measures to identify where traceability is necessary and outlines risk-sensitive policy actions to improve traceability for critical mineral supply chains.

The findings of this report indicate significant differences in uptake of traceability, with many producing countries still in the early stages of adoption. This is apparent in lithium and nickel supply chains, where regulatory frameworks, data collection capacities and technological readiness vary. Furthermore, scaling traceability faces a range of obstacles but also a need for stronger political commitment and support by policymakers. Where traceability has been adopted and implemented, its success has generally emerged from a combination of regulatory and institutional foundations, market incentives and data collection and technological capacity. While policymakers increasingly view traceability as a cornerstone of more resilient and diverse mineral supply chains, it is a means to achieve specific policy objectives rather than an end in itself. Above all, end-to-end traceability is neither feasible nor desirable in many circumstances. Less intensive forms of supply chain transparency may be sufficient or more implementable.

The following recommendations set out approaches for policymakers for targeted, cost-effective traceability that contributes to achieving policy objectives while being compatible with market realities in mineral supply chains. Operationalising this approach may involve using different types of supply chain transparency at different supply chain segments. A hybrid approach can only work if different systems are interoperable. Where traceability is costly, operationally difficult to implement or politically charged, it makes sense to target traceability to a certain minimum share of materials with sensitive downstream uses rather than aiming for comprehensive implementation.

These recommendations are supplemented by a phased pilot approach applying them to lithium and nickel supply chains. These minerals provide a strong basis for assessing the utility and application of traceability due to their contrasting supply chain structures and levels of complexity and distinct operational and governance risks, among other qualities. The action plan, outlined in the executive summary, sequences these recommendations by feasibility, distinguishing near term measures from medium and longer-term actions that require new infrastructure or international co-ordination. The recommendations below provide the analytical basis and supporting evidence for each.

6.1. Applying traceability to specific policy goals

6.1.1. Diversification and geoeconomic goals

Economic security has become a central lens through which governments approach critical minerals. Recent initiatives such as FORGE, RESourceEU and the G7 Minerals Action Plan and Roadmap combine trade with trusted partners, public and blended finance, stockpiling, price floors, and exploration support, among other policy measures. Traceability underpins each of these instruments in distinct ways: it helps locate dependencies and vulnerabilities in the value chain; it verifies that finance, procurement and price support reach producers meeting agreed standards; and it facilitates procurement from trusted partner supply chains. Key data points include countries of origin or processing and entities in the supply chain that may raise national security concerns, with the depth of traceability calibrated to the sensitivity of the end-use.

To track the overall impact of resilience policies on supply chain diversification, trade data analysis may be largely sufficient. Several regulations in OECD members aiming to diversify critical mineral sourcing have supply chain transparency requirements but do not necessarily mandate full traceability. The EU Critical Raw Materials Act requires a supply chain risk assessment using supplier mapping for large companies in strategic sectors (European Union, 2024[1]). The US One Big Beautiful Bill Act (OBBBA) has provisions requiring companies to avoid sourcing or receiving material assistance from certain foreign entities, even many tiers away, to redeem tax credits for energy and advanced manufacturing (Internal Revenue Service, 2026[2]). OBBBA requires cascading certification or representations by supply chain actors to comply while United States defence procurement rules prohibit sourcing rare earth elements, tantalum or tungsten from China, Iran, the Democratic People's Republic of Korea (DPRK) or Russia do not specify compliance modalities aside from requiring material tracking if contractors are otherwise unable to determine provenance (US GAO, 2024[3]).

The exact role of traceability in complying with these regulations may be in flux due to the latitude current rules provide. The number of supply chain tiers and the blending of minerals at different stages also call into question feasibility.

Policymakers aiming to strengthen supply chain transparency for diversification might consider the following measures to address geopolitical risks or upstream ownership that could affect security of supply (in order from lowest to highest effort commensurate with level of priority under each heading):

Understanding and addressing bilateral dependencies

- Allow for mass balance and more flexible supply chain transparency approaches when they are sufficient for enabling more detailed information needed on dependencies than trade data alone, using resulting data to support **probabilistic but credible findings on provenance;**
- Expand trade data analysis to go beyond binary mining and processing dependencies to account for multi-tiered mineral beneficiation and related **intermediate products;**
- **Strengthen disclosure of mineral country of origin by smelters and refiners in mineral supply chains through existing due diligence audit programmes**, in addition to more detailed disclosure to regulators in cases in which dependencies are of highest concern or in which the comparison of trade analysis with due diligence disclosures reveals inconsistencies;
- Use a **recognised smelter approach**, akin to the Smelter White List envisioned as part of the EU Conflict Minerals Regulation, to facilitate public procurement from smelters with more diversified sourcing; this approach could be accompanied by **joint off-taking** with private sector downstream companies to build leverage for more diversified sourcing.

Understanding and addressing the presence of specific entities of concern

- **Promote deeper supply chain mapping and risk assessments by companies in strategic sectors;**
- Work towards **common expectations for ownership transparency and disclosure** globally, with a focus on partner countries, to prevent complex ownership structures and shareholding arrangements obscuring the presence of entities of concern in critical mineral supply chains;
- Establish **full traceability**, including identity preservation, for necessary volumes of the most national **security-sensitive materials** in supply chains resembling closed pipe sourcing models when other models fail to sufficiently address supply chain dependencies and vulnerabilities.

Other recommendations

- **Monitor how companies are complying with existing regulations aiming to enhance diversification**, in addition to other regulations with higher expectations for traceability like the Uyghur Forced Labor Prevention Act and EU Batteries Regulation and apply successful use cases to policy measures aiming to enhance traceability in support of diversification;
- Explore opportunities with **commodity traders** to establish secure, more resilient supply chains, leveraging their significantly higher use of identity preservation based on the survey;
    - **Integrate traceability into price floor and stockpiling instruments among other trade-related measures**. Price floor mechanisms, as well as national stockpiling programmes, should use traceability data to differentiate eligible material produced by trusted partners and responsible operations from material that would not advance the economic security objectives

of the instrument. In most cases, mass balance supported by credible audit and origin disclosure will be sufficient; identity preservation should be applied to the most sensitive volumes. This ensures that price support flows to the supply chains it is designed to strengthen rather than generating windfalls for non-compliant production.

6.1.2. Responsible mineral supply chains

OECD standards on responsible business conduct call for risk-based due diligence. This means that the measures that an enterprise takes to conduct due diligence should be commensurate to the severity and likelihood of the adverse impact. When the likelihood and severity of an adverse impact is high, then due diligence should be more extensive. This includes measures to establish supply chain transparency. More detailed information on provenance, geographic path, and chain of custody puts companies in the supply chain in a better position to assess and respond to specific risks to which they may be linked.

The OECD Minerals Guidance translates this approach to the minerals sector through an expectation for downstream companies to map their supply chains to smelters and refiners, where the supply chain tapers, and for smelters and refiners to **institute traceability or chain of custody systems if they have identified** higher risks in their supply chains. RBC standards therefore provide a **clear framework for targeting traceability**.

Regulations on responsible business conduct in the minerals sector, like those for diversification, often require a level of supply chain transparency that involves traceability in some segments or circumstances, but do not involve end-to-end traceability. Only the EU Batteries Regulation (EUBR) and the US Uyghur Forced Labor Prevention Act (UFLPA) conceivably require companies to engage in near end-to-end traceability. While EUBR compliance modalities are in development, metals shipments detained under UFLPA have progressively fallen from a high of USD 18 million to negligible amounts. It is **unclear how much this trend represents traceability implementation, sourcing that avoids exposure to forced labour risks altogether or changes in enforcement** (US CBP, 2026[4]).

Site visits reinforced where leverage on RBC implementation is most effective. In Indonesia, stakeholders across government, industry and civil society consistently pointed to smelter joint ventures involving publicly listed partners as conducting stronger stakeholder engagement than purely private, closely-held operations, suggesting that exposure to market and investor scrutiny is an important transmission mechanism for RBC expectations. In Argentina and Chile, lithium operators noted that demand for traceability has come primarily from customers based in jurisdictions accounting for a relatively small share of global lithium demand, and that scaling uptake will depend either on broader regulatory alignment across importing markets or on clearer market signals.

In a context of inconsistent coverage, policymakers aiming to strengthen RBC in mineral supply chains, including to de-risk investment, may consider the following policy measures:

Support increased interoperability and harmonisation across RBC and traceability initiatives

- Interoperability was cited most frequently as the greatest obstacle to traceability. Nearly 50% of survey respondents made regulatory coherence their first preference for support measures to scale traceability while another 50% made industry-wide data infrastructure their first or second preference;
- While mandates that are incompatible with complex supply chains and mineral blending may be counterproductive, there is scope for a smart mix of policies and the use of common approaches on interoperability and recognition between audit schemes, provided that they meet credibility and fitness expectations (OECD, Forthcoming[5]);

- Develop a roadmap with practitioners for data interoperability to consolidate emerging industry efforts at developing channels for secure communication of sensitive data (RBA, 2025[6])
    - When data interoperability efforts reach an impasse, consider prioritising the most sensitive materials and supply chains with like-minded countries, potentially through a trusted platform.

Deepen engagement with the midstream: traders, commodity exchanges, smelters, and refiners

- **Traders report the highest use of identity preservation**, collecting the most RBC risk information through traceability, the most interest in using multi-stakeholder and industry initiatives with supply chain transparency elements to **access markets (>90%) and finance (>50%)** but, perhaps counter-intuitively, also report more obstacles to traceability due to cost and business confidentiality concerns. This suggests that traders have experience in scaling traceability under the right conditions. Governments can tap into traders' expertise and influence by **teaming on sourcing for defence or other public procurement needs**;
    - Commodity exchanges help operationalise shared expectations for traceability and due diligence. This is limited though since only one major exchange sets out rules and the trading of nickel sulphate or lithium hydroxide mostly happens off-exchange via contracts. Governments can give **priority to exchanges implementing rules on supply chain transparency to support initiatives on resilience like stockpiling and price floors**, among other related measures, and can support research on extending transparency rules to futures contracts better suited to trading in intermediate forms of metals and minerals.
    - The survey highlighted smelters and refiners' role as due diligence control points, with levels of traceability uptake somewhat lagging traders but still high. Governments can strengthen due diligence and traceability implementation by harmonising high expectations for disclosure by smelters and refiners and the multi-stakeholder and industry initiatives auditing them within the framework of existing regulations.

Leverage bilateral agreements on critical minerals for transparency and de-risking investment

- While full traceability may not always be feasible or cost-effective, governments can integrate RBC standards into bilateral critical mineral agreements to drive supply chain transparency and where relevant traceability (i.e. where the risks warrant it), and help de-risk investment accordingly.

6.1.3. Circularity and resource efficiency

Enhanced traceability enables policymakers and companies to track material flows and their associated environmental impacts throughout the product lifecycle. It helps identify opportunities for reducing those impacts and optimise resource efficiency, and support verification of recycled content claims, thereby facilitating reuse and recycling. The importance of such capabilities is growing rapidly. In addition to regulatory requirements for ethical sourcing and transparency, consumers, and investors increasingly expect strong due diligence practices and detailed information on material origins as well as its associated environmental impacts. Traceability is a central element of these efforts.

The site visits highlighted that, although circularity and resource efficiency in mineral supply chains are on the policy agenda, implementation remains at an early stage. The limited uptake reflects broader structural challenges in waste management and recycling that extend well beyond mineral supply chains, as well as the lack of lithium-ion battery recycling infrastructure. As recycling markets in these countries mature and downstream mineral buyers face increasingly stringent circularity requirements, such as recycled content requirements or information obligations linked to digital product passports for products placed on the EU market, the inclusion of mineral producers in traceability frameworks will become progressively more important.

This report proposes three policy levers to strengthen mineral supply chain traceability for circularity and improved resource efficiency:

Deepen the inclusion of smelters, refiners and recyclers in multi-stakeholder and industry initiatives and transparency frameworks

- Midstream actors in mineral supply chains, such as smelters, refineries, and metal chemical processing plants, occupy a critical position and are often identified as the chokepoint of mineral supply chains where traceability and due diligence efforts can be most effective. Compared with upstream mining, midstream operations are far more geographically concentrated and involve a smaller number of companies. Smelters and refiners often act as the junction between primary and secondary mineral supply chains as they aggregate materials sourced from multiple origins and transform these. These characteristics make midstream actors essential for strengthening traceability for circularity and reduced environmental footprint across mineral supply chains;
- Recyclers can also be more effectively integrated into transparency frameworks as mineral suppliers, given the growing importance of secondary minerals markets for overall mineral supply. This is particularly important for critical minerals with emerging recycling markets, such as lithium and battery grade nickel, as large volumes of EVs' lithium-ion batteries are expected to reach their end-of-life in the coming decade and battery recyclers become key suppliers of battery minerals. Future traceability efforts can build on existing collaboration across the supply chain between recyclers and more upstream actors that aims to optimise the collection and use of recycling feedstock.

Strengthen traceability of secondary mineral flows through recycled content requirements

- As policies promoting the recycling of critical minerals continue to expand globally, it will be increasingly important to complement them with measures that strengthen demand for secondary minerals, ensuring that recycled minerals re-enter the economy. Broader adoption of recycled content requirements could not only incentivise traceability, but also help build confidence in secondary minerals and support their market uptake, further encouraging investment in recycling;
- While recycled content requirements create new challenges for implementing traceability, especially regarding the verification of recycled content claims, companies are beginning to apply practical and simple methods. These include collecting, recording and sharing information with direct customers and suppliers, and analysing paper trail evidence to verify claims. Such methods could be further promoted where traceability is unfeasible and costs are prohibitive;
    - The EU is leading efforts to introduce recycled content requirements for certain critical minerals. Under the EU Battery Regulation, manufacturers will need to document the share of recycled content for key battery metals, namely lead, lithium, nickel, and cobalt (expected from August 2028). Similarly, the EU Critical Raw Materials Act requires disclosure of recycled content in permanent magnets, reinforcing downstream transparency obligations. Already one third of respondents to the survey, particularly those already tracing materials and those active in downstream stages, report tracing the recycled content of materials in their products and feedstock.

Support for a wider application of digital product passports where appropriate

- For products with both high environmental impacts and high circularity potential, digital product passports (DPP) can play a key role in supporting more responsible, transparent and circular production chains, ensuring that relevant information is transmitted to the end of the value chain;
- DPP are also warranted in cases where a given product is exposed to opaque supply chain conditions that contribute to operational and governance risks, requires inputs from multiple minerals that complicates traceability efforts, and high demand growth risks embedding unaddressed operational and governance risks into the supply chain;
- Introduced so far in the EU, other governments may consider adopting DPP requirements, particularly for batteries, a key product which contains critical minerals and faces rapidly growing global demand. Expanding DPP schemes beyond the EU could help harmonise global data practices, reduce information gaps, and support more responsible and resilient battery supply chains;
- In particular, the battery industry is encouraged to participate actively in government- and/ or industry-led battery passport initiatives, not only to stay ahead of regulatory requirements but also to demonstrate strong commitment to good operational, governance and traceability practices. This could be done through battery passport pilots or other existing initiatives. For example, emerging initiatives, such as the joint UNECE–ISO work on digital product passports, may also help address key challenges related to data standardisation and interoperability that are currently hindering effective traceability;
- Where feasibility and resource constraints limit the adoption of DPP, governments and companies may adopt alternative supply chain transparency measures, strengthen product- and company-level data collection and report as well as promote eco-labelling and environmental certification schemes that all facilitate information sharing across the supply chain.

6.1.4. Local development in mining regions

Governments play a critical role in ensuring that mining activities generate lasting benefits for host regions and communities while minimising social and environmental impacts. Achieving this requires governance approaches that are sensitive to local contexts, inclusive of affected stakeholders, and supported by transparent and reliable information. To do this, governments can strengthen localised mining strategies and improve stakeholder participation in impact assessment processes as well as enhance the quality and accessibility of data on extractive activities.

Embedding traceability and transparency systems across the mining value chain can further support these efforts by ensuring that data on production, environmental impacts, and benefit-sharing is consistently tracked to specific projects and locations, and passed on to downstream actors in the supply chain. This can improve understanding of mining projects' contribution to local economies to calibrate public services accordingly, align mining projects with broader regional development objectives, and increase community acceptance of mining projects.

Tailor mining standards to cultural and local contexts for improved local and host country benefits.

- Subnational governments can tailor expectations on the economic, social, and environmental impacts and benefits from mining to suit their local contexts. This can assist mining companies, especially those new to specific regions in navigating social acceptance as well as mitigate negative externalities and ensure local benefits are captured where possible.

- Integrating expectations from these locally tailored frameworks into traceability systems can help ensure that commitments made at the regional level such as local procurement, employment, or environmental safeguards are monitored and verifiable in practice. Some regions have implemented mining strategies to guide the operational and governance performance of projects and to improve interactions with communities and impacts on the environment.
- For instance, the development of the **Regional Mining Strategy of Antofagasta Chile** was to better link mining with long-term development as many challenges from mining persist across the region. The region's economy heavily relies on mining, contributing to 72% of its GDP in 2023 (Chapter 3). Mining strategies of subnational governments can also help co-ordinate community programmes led by mining companies (such as public infrastructure investments or health/education initiatives) to ensure alignment with local values and to avoid duplication of efforts among companies.
- In la Puna, Argentina the provincial government mining development strategy helps to leverage mining companies 'activities for local development focusing on supporting local skills and linking local suppliers to mining projects (Chapter 3). Traceability and transparency tools can support this co-ordination by tracking contributions, investments, and outcomes across actors, helping ensure that benefits are equitably distributed and aligned with local priorities. This can include multi-actor government structures to identify common needs and define action plans, such as the governance structure for the regional mining strategy of Antofagasta, Chile, public-private co-ordination platforms or municipal mining plans with a dedicated contact point (e.g. Sodankylä in Finland).

Increase stakeholder engagement in the impact assessment processes to include local communities and regional governments.

- **Effective impact assessments require broad and meaningful stakeholder participation, extending beyond immediate actors in the mining and processing sectors.** In many countries, legal frameworks may formally mandate consultation, yet the depth and quality of engagement often remain limited. Affected communities, particularly those living in or near extraction areas, typically possess intimate knowledge of local environmental conditions, socioeconomic vulnerabilities, and cultural dimensions that external experts or operators may overlook. Without their voices meaningfully integrated and being provided adequate resources to participate, assessments risk failing to capture the true scale and distribution of project impacts.
- In la Puna, Argentina, rapid growth in mining has increased pressures on regional government capacity to handle planning and monitoring, often without sufficient resources or training of public sector staff. Strengthening engagement requires investing in participatory mechanisms that both provide a platform for communities to voice their perspectives and exercise meaningful influence over the assessment process and resulting decisions. Traceability systems can reinforce these processes by providing communities with access to verifiable, site-specific information on environmental performance, resource flows, and compliance with agreed standards.
- **Governments and industry actors also stand to benefit from improved engagement.** Early and continuous communication can reduce conflict, enhance trust, and surface concerns before they become sources of opposition or litigation. It can also lead to better-designed mitigation strategies, more culturally appropriate compensation arrangements, and improved long-term project acceptance. Achieving this in practice requires overcoming persistent obstacles including limited local capacity to engage with technical data, imbalances in negotiating power, lack of independent facilitation, and, in some contexts, weak enforcement of procedural requirements. Addressing these challenges calls for stronger institutional oversight, clearer minimum engagement standards, and support mechanisms, such as community advisory groups and capacity building to create a level playing field between communities, industry, and government.

- **Ultimately, improved stakeholder engagement helps align extractive projects with broader development and environmental-protection objectives**. It enables a more democratic and transparent process, where affected groups can meaningfully shape project outcomes rather than merely being consulted as a formality. This not only enhances procedural fairness but also contributes to more resilient and socially legitimate decisions.

Improve the comprehensiveness, disaggregation, accessibility, and reliability of the disclosed data on extractive activities

- **Robust transparency is a cornerstone of responsible resource governance, yet many countries struggle to provide sufficient data**. Incomplete reporting, whether about licensing, production volumes, revenue flows, environmental impacts, or community benefits, limits the ability to assess whether resource extraction delivers public value. In la Puna, Argentina it is observed that local community engagement and related reporting from mining companies is not always visible or adequately integrated into local policy making, creating missed opportunities in improving monitoring the impact of mining (Chapter 3). Similarly, insufficiently disaggregated data (for example, aggregated by region instead of project, or by company instead of contract) makes it difficult to identify site-specific risks or distributional inequities. Improving reporting frameworks therefore means ensuring that information covers the full local value chain and is made available at the appropriate level of detail. Traceability systems can be a key enabler of such improvements, especially when they link data across different supply chain stages, ensuring consistency and comparability over time and across actors.
- **Accessibility is another critical dimension.** Even where governments publish data, it may remain difficult to interpret due to technical formatting, or complex data structures. User-friendly open-data portals, standardised templates, and proactive dissemination practices can greatly enhance the usability of information. Reliability, consistency, regular updates, and independent verification are equally important.
- **Enhanced transparency supports not only public accountability but also better policy design.** High-quality data enables governments to identify revenue leakages, understand environmental impacts, compare contractual performance, and anticipate socio-economic risks associated with extraction. Building comprehensive and credible disclosure systems strengthens institutional credibility, helps prevent corruption, improves local community perceptions surrounding projects and provides the informational foundation needed for evidence-based decision-making.

6.1.5. Robust fiscal policy

Across all stages of the mining value chain, countries can mobilise domestic revenues by incentivising the adoption of traceability systems by mining companies while simultaneously establishing governance infrastructure capable of accessing, verifying, and integrating operational data. International standards developed under the OECD/G20 BEPS Project provide an important legal foundation which, when applied alongside data generated through traceability systems, can help curb BEPS risks in the mining sector. In particular, BEPS Actions 4 (Limitation on Interest Deductions), 8-10 (Aligning Transfer Pricing Outcomes with Value Creation) and 13 (Transfer Pricing Documentation), together with ring-fencing provisions and evidence-based tax incentive frameworks, can reinforce this governance architecture. Traceability systems complement these legal tools by linking operational data, with the financial and tax information reported by MNEs, strengthening transparency and enabling tax administrations to translate this information into effective compliance and enforcement. Where reliable private systems are not available, governments may also consider developing interoperable state-led traceability platforms. Legal and institutional frameworks should aim to address key fiscal risks and enhance traceability systems across the mining value chain through the following measures:

- **Addressing undervaluation of production volumes through independent production verification mechanisms:** Governments should establish independent production verification mechanisms, including mandatory third-party calibration and periodic audits of measurement systems. Joint verification protocols between mining regulators and tax authorities, supported by technology-enabled monitoring tools such as smart meters, satellite imagery, and drone-based surveys, reduce reliance on company self-reporting and enable systematic cross-checking across agencies. Where full traceability systems are not implemented, supply chain mapping can help identify key control points in the production and processing chain where independent verification of minerals can be prioritised, such as concentrators, smelters, and export terminals with relevant examples being Indonesia's SIMBARA and Zambia's MOSES.
- **Addressing undervaluation of mineral quality and grade through mandatory independent assay and sampling regimes:** Independent assay and sampling rules should require accredited laboratories and split-sampling procedures involving company, state, and referee samples. Reference pricing frameworks should incorporate transparent quality adjustments and penalty matrices to ensure the mineral sold reflects market prices. In the absence of a full traceability system, chain of custody mechanisms can help record the sequence of actors handling the mineral and identify where sampling, blending, or processing occurred along the supply chain.
- **Addressing inflated freight, insurance, and intra-group service charges through strengthened transparency:** Governments should introduce benchmarking and review mechanisms to ensure costs remain within appropriate ranges based on comparable routes, vessel type and services. Separate disclosure requirements for freight and insurance arrangements, together with benefit tests for feasibility, technical, and management services, help prevent duplicative or non-value-adding charges. In the absence of a full traceability system, chain of custody documentation and shipment records can still provide visibility over the actual routes, operators, and service providers involved in mineral transport, allowing authorities to benchmark freight and insurance costs against comparable market conditions.
- **Closing the mine to smelter traceability gap**: Systems that track mineral flows for revenue assurance purposes, but do not reconcile mine-level production data with smelter sourcing, cannot detect the mixing of illegally mined material into formal supply chains, nor serve as credible due diligence instruments for downstream buyers or exporting plus importing-country regulators. Extending SIMBARA-type systems to mandate smelter intake records, linked to upstream mine production data, would represent a significant step toward closing this gap. Governments without full traceability systems should consider requiring standalone smelters to maintain and disclose sourcing registers.
- **Addressing excessive interest deductions and thin capitalisation through enhanced transparency over intra group financing**: Governments should enhance transparency over corporate governance, ownership and financing structures. Oversight of intra-group financing arrangements, supported by profit-based interest limitation rules and disclosure obligations, reduces opportunities for base erosion through excessive interest deductions. Where a full traceability system does not exist, mapping the entities involved in the supply chain can help tax administrations identify related-party lenders, infrastructure entities, and service providers that may be used to shift profits through intra-group financing arrangements.
- **Review tax incentive regimes as a potential tool to promote traceability systems.** Tax incentives should only be used when their expected benefits outweigh their costs, they are justified (e.g. when there is a market failure and no alternative policy approach) and are aligned with national priorities. Preference should be given to incentives tied to expenditures (e.g. investment, employment) with clear and careful targeting. Their implementation should support transparency,

certainty and simplicity and their costs and benefits carefully evaluated. Traceability systems can support this process by providing reliable operational data that enables governments to assess whether tax incentives are generating the intended economic activity and value addition within their jurisdiction.

- **Ringfencing mining operations**: traceability systems or the chain of custody, where the former are not available, can support the effective enforcement of ring-fencing regimes by enabling governments to monitor production volumes, mineral quality and sales from individual mining projects. By linking operational data to project-level financial reporting, authorities can ensure that revenues, costs and taxable profits are correctly attributed to each mine or project. Many resource rich countries have implemented ringfencing regimes such as Argentina, Papua New Guinea, South Africa and Zambia. Applying ring-fencing, including on a mine-by-mine basis, therefore creates a strong incentive for companies to maintain accurate and robust records.

6.2. Applying a targeted approach to implementing traceability for lithium and nickel

Lithium and nickel can serve as test cases for a targeted approach to traceability. Supply chain structure and complexity, the significance of RBC risks in the supply chain, potential benefits for producing countries, and trade dependencies will help determine the need and usefulness for traceability or other transparency measures.

The recommendations below translate the general policy measures set out in section 6.1 into specific actions for lithium and nickel, drawing on the supply chain analysis in Chapters 3 and 4.

6.2.1. Lithium sourcing from Argentina and Chile

- **Trade dependencies and entities of concern:** Existing trade data and supplier mapping highlight significant dependencies for processing in China**.** Continued monitoring can help assess the effects of diversification efforts, like public support for processing in other jurisdictions. **Enhanced ownership transparency**, through registries or other forms of disclosure, however, could help address the need for information of foreign entities of concern in the upstream supply chain. For defence sector-linked energy storage procurement, a **mass balance** approach could be piloted to ensure specific suppliers track overall diversification of their own sourcing. If ineffective in achieving sufficient diversification, **identity preservation could be mandated for the most sensitive procurement needs** to ensure sourcing bypasses entities of concern. Where countries introduce price floors or preferential procurement for lithium, traceability data (at minimum on country of origin, smelter/refiner identity and beneficial ownership) should determine eligibility, so that fiscal support flows to diversified and responsible supply.
- **RBC risks and host country benefits**: Lithium mining in Argentina and Chile is highly formal, but is linked to risks spanning environment and stakeholder engagement. Most companies can **use due diligence and supply chain mapping to identify and mitigate such risks**, including through using leverage on suppliers and, as relevant, co-operate in the provision of remedy. **Stronger transparency on the physical evolution** of mineral products, potentially through a mix of disclosures and regulatory spot checks involving material testing, could help **address BEPS risks, particularly under-valuing the mineral**. Besides supporting tax authorities by addressing information asymmetry in enforcement, this would enable stronger due diligence by customers regarding due payment of taxes by suppliers. As policymakers expand related efforts beyond these focus regions, more exhaustive traceability including all four constituent data points, may be more relevant but also more challenging to roll out in informal settings like emerging artisanal and small-

scale sources in Africa. This can, however, build on existing public chain of custody systems and due diligence reporting requirements in Central and Southern Africa. Site visits in Argentina and Chile indicated that operators view traceability demand as coming primarily from jurisdictions that represent a relatively small share of global lithium demand. Uptake is likely to remain limited unless accompanied by regulatory alignment across larger importing markets or clearer market signals, reinforcing the case for co-ordinated, multi-jurisdiction approaches rather than unilateral requirements.

6.2.2. Nickel sourcing from Indonesia and the Philippines

The nickel supply chain in Indonesia and the Philippines is somewhat more complex, including small-scale sources feeding into in-country smelting; this context warrants efforts to enhance supply chain transparency. The combination of existing market and regulatory requirements for due diligence, audit and certification initiatives, and an in-country traceability system (in Indonesia) that cover nickel, provide a strong basis to address outstanding gaps.

Policymakers could strengthen and complement existing systems with some of the following measures with relevance to meeting both resilience and RBC policy objectives. Site visits in Morowali, Indonesia, highlighted that complex ownership structures and limited minority-shareholder leverage within smelter joint ventures are practical constraints on due diligence that formal RBC standards alone cannot fully address. Beneficial ownership transparency should therefore be understood not only as a governance recommendation, but as a precondition for the effective implementation of the other nickel recommendations set out below.

- **Stronger beneficial ownership transparency:** Like the lithium supply chain, this would help downstream companies that source nickel better understand potential entities of concern in the supply chain, but also help mitigate integrity risks linked to the involvement of politically exposed persons.
- **Leverage existing due diligence and traceability requirements:** Existing requirements and audit programmes for nickel relevant to traceability and due diligence span regulations in net importers, the London Metal Exchange, site certification and supply chain audits, and a national traceability system. Prevailing enforcement challenges and a lack of interoperability between these systems compromise their usefulness and leave transparency gaps that affect important parts of the sector, including for **battery-grade nickel**. Harmonised expectations that leverage the complementarity of existing requirements given how they are situated at different parts of the supply chain can help address such gaps while avoiding duplication. As for lithium, increased transparency on physical evolution of materials, potentially as part of national traceability systems, could help address BEPS risks.
- Focussing prospective more intensive traceability investments, including for identity preservation in cases of acute security of supply concerns, may be most relevant to nickel used in superalloys for the defence sector.

A targeted approach to traceability, starting with lithium and nickel, can help reach policy objectives on resilience, responsible business conduct and development in countries along the value chain while being in sync with expectations for regulatory simplification and burden reduction on companies. Co-operation among the G7, OECD, IEA and trade partners is poised to serve as a platform, including through multi-stakeholder engagement, to operationalise these recommendations.

Annex 6.A. Methodology

This report was prepared based on qualitative research that included a literature review, desk-based research, remote semi-structured interviews, and primary data collected through a dedicated survey and site visits.

Survey

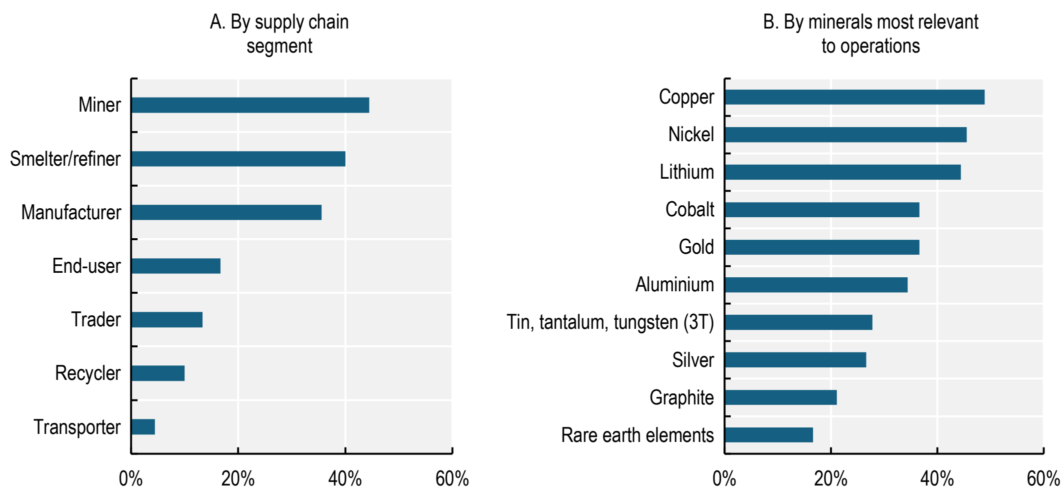
The survey was designed and run jointly by the OECD and the IEA in late 2025 through early 2026, with respective analyses reflecting the mandates of each organisation. Designed specifically to inform this report, the objective was to gather information from industry actors on the scope and design of traceability systems, as well as associated costs, barriers, drivers and perceived benefits. The target population comprised companies operating at different stages of mineral supply chains, including mining, smelting and refining, transport, trading, manufacturing, and recycling.

The survey was distributed to approximately 500 companies and industry networks across minerals value chains and a total of 90 valid responses were received. The questionnaire included 39 questions and was made available in four languages: English, Spanish, Bahasa Indonesian and Chinese. Most questions were single or multiple-choice questions, while selected questions included ranking exercises and open text fields. The OECD and IEA shared the questionnaire directly with companies and industry associations and encouraged recipients to forward it to relevant suppliers and business partners, including upstream actors. Participation was voluntary and respondents could choose to remain anonymous. Only completed survey submissions were included in the final sample, which was screened for internal consistency and to identify potential duplicate submissions.

Percentages are calculated based on the number of valid responses to each question. Some questions received fewer than 90 responses, as indicated in relevant figure notes. Survey results may differ slightly between the IEA and OECD publications, as the OECD report incorporates additional survey submissions received after January 2026. Given the voluntary nature of participation and reliance on self-reported data, results should not be interpreted as statistically representative of the global minerals sector and may be subject to reporting bias, reflecting companies that were willing and able to respond within the timeframe. Self-reported data are difficult to independently verify, particularly in areas such as compliance, environmental, operational or governance performance. **Respondents span the full range of supply chain segments and mineral exposures and report geographically diversified operations, sourcing and sales activities.** Miners, smelters/refiners and manufacturers account for the largest share of respondents (Annex Figure 6.A.1 Panel A). Around 36% of respondents operate across multiple supply chain segments. Companies also reported activity across multiple minerals, most frequently copper, nickel and lithium (Annex Figure 6.A.1 Panel B). Geographically, respondents reported operations, sourcing and sales across all major regions. Asia, Europe and North America were most frequently cited across these dimensions.

Annex Figure 6.A.1. Profile of survey respondents by supply chain segment and relevant minerals

Miners, smelters/refiners, and manufacturers account for the largest share of respondents, with copper, nickel and lithium most frequently cited as most relevant to operations.



Note: This figure presents summary statistics based on survey Question 2 ("How would you describe your company?") and Question 3 ("Which minerals are most relevant to your operations? (Select all that apply)"). Percentages indicate the share of respondents selecting each option. As categories are not mutually exclusive, shares may sum to more than 100%, and results should be interpreted as reflecting overlapping supply chain functions and multi-mineral operations within the sample. Overall, 36% of respondents report operating across multiple supply chain segments. Integration is particularly pronounced among recyclers (n = 9) and transporters (n = 4), all of which reported additional supply chain functions, as well as midstream actors such as traders (n = 12) and smelters/refiners (n = 36), where 75% operate across more than one segment. In addition, 64% of mineral respondents indicate activities across two or more minerals. Multi-mineral exposure is highest for aluminium, silver, graphite and rare earth elements (100% of respondents active in these minerals also report other minerals), and lowest for lithium (73%). Based on 90 valid responses, collected between late 2025 and early 2026. Please refer to the methodology section for further detail.
Source: OECD-IEA Survey on Traceability in Critical Mineral Supply Chains

Site visits

In June 2025, the OECD conducted site visits to Indonesia to examine responsible business conduct practices linked to nickel production and smelting, and related impacts. The visits included semi-structured interviews and direct observation in Jakarta and the Regency of Morowali in Sulawesi. Stakeholders interviewed included representatives from business operators at mining, smelting and manufacturers, consultants, multi-stakeholder and industry initiatives on RBC, several ministries and government departments, international co-operation agencies, civil society organisations working on environment, human rights, and Indigenous Peoples, local community leaders, trade unions and former industrial park workers. In September 2025, a further OECD mission to Jakarta provided an opportunity for high-level engagement on critical minerals with senior Indonesian government officials, the private sector and other stakeholders. Discussions reinforced the importance of RBC standards, traceability, responsible investment and transparent fiscal frameworks to Indonesia's critical minerals strategy. The mission highlighted the importance of alignment with international standards such as the OECD Due Diligence Guidance as a precondition for sustained market access and high-quality investment.

In October 2025, the OECD conducted site visits to Argentina and Chile to examine lithium supply chain governance and traceability practices in two of the world's most significant producing countries. In Argentina, the visit included the largest lithium production site in the country, as well as meetings with an OECD-based company in the early stages of initiating lithium production and processing operations in Argentina. Engagement with subnational and community stakeholders formed a central part of the programme, including meetings with the Salta Secretary of Mines and with representatives of Indigenous Peoples living in the Puna region. In Chile, the visit encompassed the largest lithium production facility in the country alongside a broad programme of stakeholder engagement. Meetings were held with local government officials, including the Governor of Antofagasta, the Mayors of Antofagasta and San Pedro de Atacama, and other local representatives, as well as with representatives of Indigenous Peoples' communities. At the national level, the visit included meetings with the Minister of Mines, senior representatives of the top lithium and copper producing companies operating in Chile, and representatives of a number of state-owned enterprises (SOEs).

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Enhancing Resilience Through Traceability

Insights from Lithium and Nickel Supply Chains in Latin America and Southeast Asia

A level-playing field for responsible business conduct, circularity and tax policy in critical minerals can contribute to resilient supply chains that deliver economic security and better development outcomes. Based on a dedicated industry survey, this report analyses the incentives, constraints, and operational realities shaping traceability and responsible sourcing uptake across the supply chain, with a focus on nickel in Indonesia and the Philippines, and on lithium in Argentina and Chile. The report also sets out policy recommendations that governments and industry may consider for scaling up traceability in targeted, cost-effective ways.

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