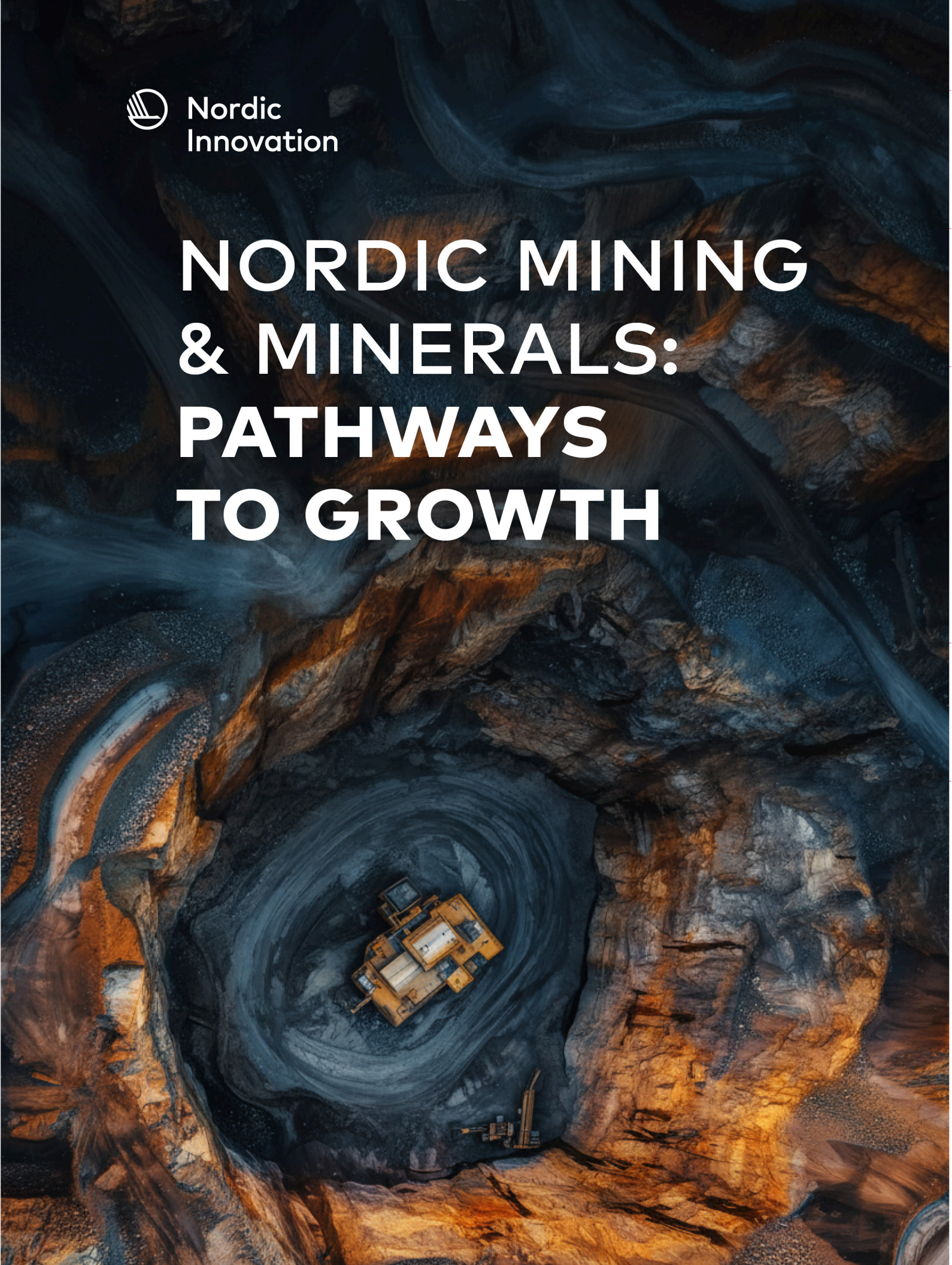
Nordic Innovation

NORDIC MINING & MINERALS: PATHWAYS TO GROWTH



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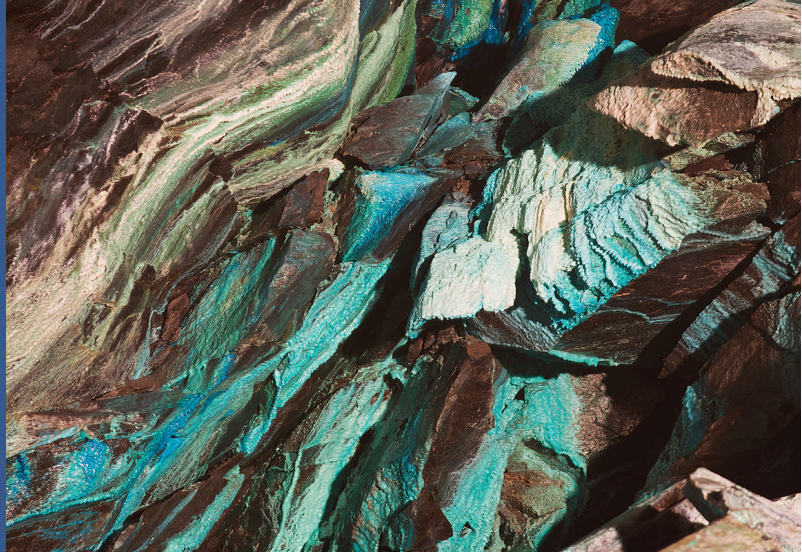


Oxidated copper on the walls of the underground copper mine in Roros, Norway.

Objective

The objective of this analysis is to deliver a comprehensive and holistic assessment of the Nordic mining and minerals sector, encompassing Denmark, Finland, Greenland, Iceland, Norway, and Sweden, within the broader global market context. By engaging with stakeholders across the entire value chain, the study aims to identify the sector's strengths, weaknesses, risks, and opportunities. The goal is to provide actionable recommendations that promote strategic Nordic collaboration and enhance sector performance, ensuring a sustainable and competitive future for the region's mining and minerals industry.

Project Scope

To achieve its objectives, the project encompasses mapping the current situation within the sector, highlighting key strengths, weaknesses, risks, and opportunities.

- **Value Chain Mapping:** The study gives an overview of the value chain and examines current and emerging trends influencing future demand for mining and minerals, identifies the global owners across the value chain and the Nordics. It also assesses how the Nordic countries complement each other – or where they do not.
- **Strengths and Weaknesses Analysis:** The analysis explores the major strengths of the Nordic region within the mining and minerals sector, as well as the principal challenges faced across the value chain at both the Nordic and broader European levels.

Project Methodology

This report is written based on both publicly available information that are referenced throughout the document and qualitative interviews with 35 stakeholders from the Nordic mining and mineral ecosystem. Interview candidates were selected based on multiple criteria to create a holistic understanding of the Nordic value chain. Participating parties include industry associations, geological surveys, exploration companies, mine operators, mineral processors, recycling companies, technology suppliers, and financial institutions as well as public institutions.

Executive Summary

Zinc ore showing metallic surfaces and irregular mineral structure. .

Key Takeaways for Decision Makers

The global demand for critical raw materials (CRMs) is increasing rapidly, primarily because these materials are essential for the development and deployment of energy transition technologies, such as batteries for electric vehicles (EVs) and magnets for wind turbines. Despite this rising need, Europe's supply chains remain fragile due to a lack of significant domestic production of CRMs. This vulnerability is exacerbated by the fact that CRM processing is predominantly concentrated in China, which presents severe supply risks for European manufacturing sectors.

The Nordic region possesses substantial mineral deposits, a robust innovation ecosystem, and access to affordable clean energy, all of which provide a solid foundation for securing the European supply of CRMs. However, efforts to scale up domestic production capacity face notable challenges, particularly related to permitting processes and economic viability. These obstacles discourage private investment in the sector. To overcome these challenges and unlock the full potential of the Nordic region, government intervention is necessary to accelerate deployment.

Strategic recommendations to accelerate Nordic CRM mining

The Nordic region needs a more coordinated and efficient approach to advance mining and processing of CRMs. The barriers to progress are complex and interconnected, yet each can be clearly addressed through targeted actions. Among these, permitting challenges are particularly acute: complex, uncertain, and lengthy approval processes impose significant risks and deter investments. Streamlining and harmonising permitting procedures across the Nordics as well as prioritising projects essential for the energy

transition and defence sector, would help to create a more predictable and attractive environment for investors.

Funding is another crucial element. Significant project risks arising from elevated uncertainty erode investor confidence and limit the availability of capital. The establishment of a public Nordic investment fund dedicated to mining and metals projects could de-risk investments and stimulate private sector engagement, supporting the scaling up of CRM supply throughout the region.

Market volatility and manipulation also pose significant challenges. Investor hesitation is heightened by artificial price swings, frequently orchestrated by dominant market players, as well as by geopolitical disruptions that can destabilise prices for critical minerals. Developing price stabilisation mechanisms – such as price guarantees or offtake agreements[1] – would help protect investments and producers from aggressive, politically driven price cuts, thereby fostering a more stable and secure market.

Furthermore, effective policy coordination and collaboration across the Nordic region is essential. Fragmented approaches limit the effectiveness of individual countries, diluting collective influence at the EU level and hampering the region's ability to address investment barriers. By aligning policy objectives and permitting standards, advocating together for strategic support and price stabilisation, and promoting cross-border cooperation, Nordic nations can create the foundation for long-term success in CRM mining.

1. Contract where a buyer agrees to purchase all or a substantial amount of a seller's future production, often negotiated before a project is built.

AREAS FOR NORDIC COLLABORATION

Area	Permitting Processes	Project Funding	Price Volatility
			
Challenge	Uncertain and lengthy permitting processes hinder development of projects and disincentivise investment.	Difficult to attract funding for mining developments due to project risks undermining investor confidence.	Volatile market prices with artificial price hikes and dumps by market leaders discourage investment.
Nordic value-add	Aligned Nordic permitting processes can reduce uncertainty for investors exploring cross-border projects.	Public Nordic investment fund for mining and metal projects can de-risk investments and attract more private capital.	Together, the Nordics have a stronger voice and could induce change on EU-level and promote price stabilization mechanisms such as e.g. floor prices or offtake agreements.
Industry voices	*"Policymakers need to streamline permitting and support strategic projects for green transition and defence."* **– Mine & Refinery Developer**	*"Capital and financing is a bottleneck for the mining industry in general in the Nordic countries."* **– Exploration Company**	*"Price guarantees can protect producers from aggressive, politically driven price cuts by foreign competitors."* **– Mine Operator**

Key takeaways

- The Nordic mining industry has a clear business potential, but the analysis has also shown that **existing barriers hinder** the Nordics from realising their full potential in CRM mining.
- **State intervention is necessary** to overcome these hinders and reduce reliance on foreign nations for critical raw material supply.
- To scale up Nordic supply, the **most critical elements are funding and permitting**, where permitting today has direct negative impact on funding.
- Government involvement may also be required to establish **price stabilisation mechanisms for selected minerals**, safeguarding European investments against geopolitical disruptions.
- **Nordic collaboration offers clear benefits in overcoming identified investment barriers** if policy makers can agree on a common vision and concrete actions to address the underlying issues.

Opportunities for Nordic cross-border collaboration in mining and minerals

The Nordic region presents substantial opportunities for cross-border collaboration within the mining and minerals sector. Industry experts highlight potential to advance extraction and refining processes, enhance the utilisation of waste streams, and co-develop mining solutions for the green and digital transitions.

The Nordic region can unlock significant value by leveraging complementary national strengths – such as Sweden's and Finland's advanced mining industries and Norway's processing capabilities – to build integrated, cross-border value chains. CRMs and emerging sectors like direct reduced iron, rare earth elements (REEs), and graphite represent key growth areas. For example, combining Norwegian natural gas with Swedish iron ore expertise could enable the production of direct reduced iron with up to 60-90% lower CO_2 emissions[2]. However, fragmented collaboration and national silos currently hinder progress. A unified regional strategy – rather than internal competition – could deliver greater results. Achieving this requires harmonised regulations and aligned political objectives across the Nordics to incentivise joint ventures and integrated projects among industry stakeholders and investors.

2. Industry expert interview and Peder Qvale, Planene om verdens mest miljøvennlige jernverk kan bli skrinlagt, *Teknisk Ukeblad.* (5 September 2013), https://www.tu.no/artikler/planene-om-verdens-mest-miljovennlige-jernverk-kan-bli-skrinlagt/234481

Processing and utilising side streams, such as slags and tailings, for metal recovery is an emerging but underdeveloped opportunity. By adopting innovative technologies and forming joint ventures, the Nordics could establish a circular material supply chain, integrating resources from urban mining and primary waste streams. The main barriers are not technological but structural: market and policy misalignment, indirect subsidies favouring primary extraction, and regulatory hurdles. Feedstock supply issues and pricing practices – where miners set tailings prices high – further constrain commercial recycling initiatives. Overcoming these challenges will require policy reform and financial models that make recycling economically viable.

Enhanced collaboration among Nordic OEMs in electrification and digitalisation – covering EVs, artificial intelligence, and digital solutions – could attract component suppliers and foster joint technology development. This would strengthen both individual companies and the region's global competitiveness. Yet, competitive dynamics across business segments often impede cooperation. Building trust and shared objectives will be essential to unlock synergies and position the Nordics as leaders in next-generation mobility and digital innovation.

NORDIC OPPORTUNITIES WITHIN MINING AND MINERALS – HIGHLIGHTED BY INTERVIEWS

Area	Opportunities	Challenges	Industry voices
Cross-Border Extraction and Refining	Nordics can leverage complementary strengths – Sweden's and Finland's robust mining sectors and Norway's processing competence – to create cross-border value chains for extraction and refining. Greatest potential for cross-border value chains notably in CRMs and other developing value chains; interviews specifically highlight potential for direct reduced iron, REEs and graphite.	Fragmented collaboration due to national silos and limited cross-border cooperation hinder the realisation of integrated value chains and economies of scale. Harmonisation of regulations and political ambitions could incentivise the industry and investors to pursue Nordic joint ventures and integrated projects.	*"Green hydrogen is too expensive today; Norwegian natural gas and processing expertise with Swedish iron ore could produce direct reduced iron with 90% less CO_2 emissions."* ***– Mining Company*** *"If we all start thinking about the Nordic region as one region and stop competing amongst ourselves, we will achieve a lot."* ***– Industry Expert***
Waste Stream Utilisation	Nordic potential to develop circular material supply, building on technological competence across the value chain and pooling supplies from urban mining and primary waste streams.	Recycling challenge is not technology readiness, but market and policy alignment – indirect subsidies and taxes favouring primary extraction over recycling, feedstock supply and regulatory barriers disincentivises circular value chains. Financial disparity between miners and recyclers: requested prices from miners for e.g. tailings are often too high for recyclers to develop commercially viable products from.	*"Most companies only focus on 2–3 materials; we should learn from the Pulp & Paper industry and enable startups to access waste streams and create new products."* ***– Industry Expert*** *"Significant potential exists in processing and utilising side streams (slags, tailings, etc.) for metal recovery, but the area is underdeveloped and could benefit from new technologies and JVs."* ***– Mining & Refining Company***
OEM Electrification and Digitalisation Cooperation	Nordic collaboration on BEV, AI and digital solutions can benefit all stakeholders by attracting component suppliers and developing joint technologies and help increase global competitiveness.	Lack of collaboration due to competitive environment across several business areas.	*"Nordic equipment OEMs could collaborate further to develop battery solutions for mining equipment and counter Chinese competition."* ***– Equipment OEM***

Note: Quotes are paraphrased. **Source**: Business Sweden interviews and analysis

Global Industry Landscape

Close-up of raw hematite. Surface of iron ore.

The global mining and metals industry is undergoing a profound transformation driven by the energy transition, electrification, and digitalisation. Demand patterns are shifting rapidly as CRMs replace traditional bulk commodities at the centre of industrial growth. This evolution is creating new opportunities – but also exposing structural vulnerabilities in supply chains, intensifying geopolitical risks, and challenging established business models.

Global demand for CRMs is rising due to energy transition technologies, while supply chain concentration in few regions poses a major risk to European manufacturing.

OVERVIEW OF GLOBAL SUPPLY CHAIN DEPENDENCY

Global development	Rising CRM demand	Chinese dominance	Severe supply risk
Global metals & mining revenues grew with a CAGR of 7% between 2000–2024 to USD 3 trillion Five key materials represent 87% of total revenues	Mineral demand projections to 2035 are strong, especially for materials critical to energy transition technologies Lithium demand is projected to more than triple and demand for REEs is set to nearly double	Global mineral supply chains are geographically concentrated Processing is significantly more concentrated, with China accounting for most of the capacity	China's dominance is a severe supply risk for EU manufacturing USA–China trade war is directly affecting EU companies because of the role of American intermediaries

Key takeaways

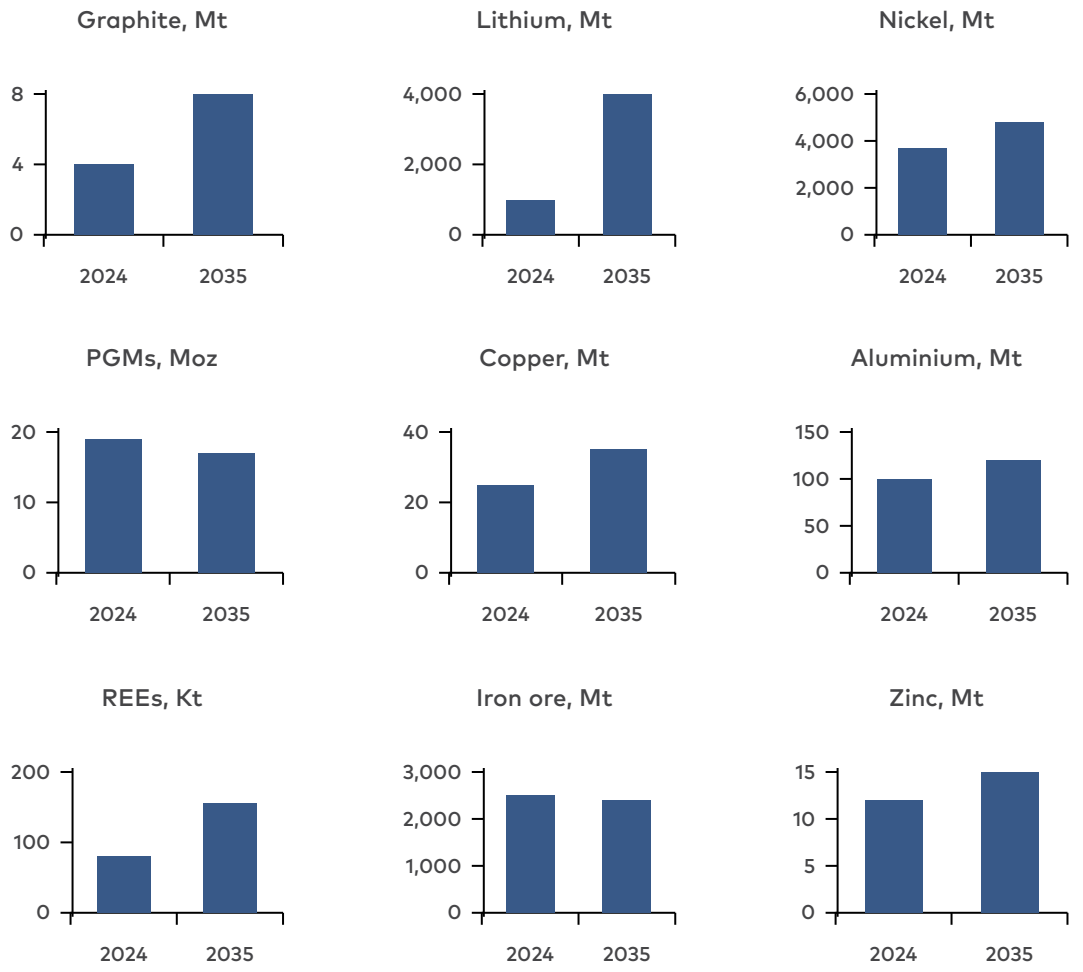
- The **world is moving away from traditional industrial materials** towards critical minerals as the energy transition accelerates.
- **Investment opportunities are emerging** in the domains of critical mineral extraction, processing infrastructure, and advanced material manufacturing, e.g. batteries and permanent magnets.
- Global **supply chains are fragile**, especially for Europe, which lack significant domestic production of several CRMs such as REEs, lithium and cobalt.
- Chinese dominance translates directly into political leverage, as any **export restrictions**, even those targeting non-EU countries, **can ripple through global supply chains** and threaten European production.
- A further challenge lies in **China's significant pricing influence**, which has the potential to erode the competitiveness of domestic production initiatives and discourage investment in local supply chains.
- The **EU is responding with strategic policy** but faces significant challenges in scaling domestic capacity and reducing dependency.

Accelerating Global Demand for CRMs

The ongoing energy transition is fuelling a global shift away from traditional industrial materials and toward CRMs. The rapid adoption of energy transition technologies – such as EVs and renewable energy technologies – is driving exponential growth in demand for specific minerals. Notably, lithium demand is projected to more than triple by 2035, while demand for REEs is set to nearly double. Graphite demand is also expected to double, primarily due to its essential role in lithium-ion battery anodes. Copper demand will rise significantly (+40%), driven by electrification and power grid expansion. In contrast, demand for platinum group metals (PGMs) and iron ore is expected to decline as technologies evolve and markets mature.[3]

3. McKinsey & Company, Global Materials Perspective 2025

GLOBAL DEMAND PROJECTIONS FOR MINERALS. 2024 VS. 2035, VARIOUS UNITS



Notes: Data shown covers key materials only and does not include all critical minerals.
REE = Rare earth elements; includes dysprosium, neodymium, praseodymium, and terbium.
Source: McKinsey & Company – Global Materials Perspective 2025. IEA's Global EV Outlook 2024.

Shifting Global Metals & Mining Revenues

Between 2000 and 2024, global metals and mining revenues grew at a compound annual growth rate (CAGR) of 7% reaching USD 3 trillion in 2024 from USD 0.6 trillion in 2000 – peaking at USD 4 trillion in 2021. Five key materials represent 87% of total revenues – dominated by steel, accounting for 38% of revenues in 2024. However, the share of steel is gradually decreasing, especially in China, while battery-related materials such as lithium, nickel, cobalt, and copper are showing the strongest growth outlook. This signals a structural shift away from traditional bulk commodities towards minerals critical for electrification and decarbonisation. Despite long-term stable growth, global revenues decreased by nearly 25% 2021-2024, reflecting market volatility and weaker demand.[4]

Fragile and Concentrated Global Supply Chains

Global supply chains for CRMs are structurally imbalanced. While mining activities are regionally diversified – with Latin America, Oceania, and Sub-Saharan Africa playing key roles in supplying lithium (Australia), cobalt (Democratic Republic of the Congo), nickel (Indonesia), and manganese (South Africa) – processing capacity is highly concentrated. China is the dominant processor for 14 out of 15 key materials, creating severe vulnerabilities for downstream manufacturing[5]. EU processing capacity is below 5% of global supply for most critical minerals, except cobalt (8%)[6]. This concentration creates systemic risks, as any export restrictions or geopolitical disruptions in China can ripple through global supply chains, threatening European and global production.

China's Strategic Dominance and Supply Risks for Europe

Chinese dominance in CRM processing translates directly into geopolitical leverage. Strategic industrial policy, sustained investment, and infrastructure support have positioned China at the centre of global CRM supply chains. Europe's reliance on Chinese REE exports for example, exposes its manufacturing sectors – especially automotive – to significant supply risks. Recent Chinese export restrictions on REEs and magnets have already led to production line and plant closures in Europe.

Even when European or American companies source finished goods from non-Chinese suppliers, these often depend on raw materials ultimately originating from China. For example, the United States obtains about 80% of its REEs from China. Any disruption in Chinese exports would have cascading effects, impacting both American and European manufacturing due to the interconnectedness of global supply chains.[7]

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4. Ibid.
5. Ibid.
6. European Commission. *RMIS – Raw Materials Information System.*
7. European Central Bank, Economic Bulletin, Issue 6, 2025

The concentration of CRM supply chains in China is reinforced by several factors. Aggressive domestic state subsidies and export incentives as well as stricter environmental and social standards outside China make relocating processing expensive and slow. Additionally, developing countries rich in critical minerals like cobalt, copper, gold, and lithium are working to increase control over their own natural resources and thereby reducing diversification options.[8]

Policy Response: The EU's Critical Raw Materials Act (CRMA)

To address these vulnerabilities, the EU has enacted the Critical Raw Materials Act (CRMA), which identified 34 CRMs – 17 of which are considered strategic. By 2030, the CRMA sets targets for at least 10% of EU CRM demand to be met by domestic extraction and 25% from recycling, and that EU processing capacities should meet 40% of demand. The Act also seeks to limit reliance on any single non-EU country to 65%. These measures are designed to secure supply, boost circularity, and drive resource efficiency, ultimately reducing Europe's exposure to external risks and supporting the transition to a low-carbon economy.

On 25 March 2025, the European Commission approved 47 strategic projects under the CRMA to boost domestic supply and reduce dependence on single-country imports by 2030. The Nordic region plays a pivotal role, hosting 11 of these projects – accounting for roughly one-fifth of all CRMA flagships.[9]

8. Verisk Maplecroft, *Political Risk Outlook 2025*
9. Commission Decision (EU) 2025/840 of 25 March 2025

Nordic Minerals and Mining Value Chain

Gold ore in black stone layers

Mining has been a cornerstone of the Nordic region for decades, encompassing both base metals and CRMs. Although the Nordics contribute modestly to global mining output, the region plays a pivotal role in CRM extraction and refining within Europe. This makes the region essential for supporting Europe's ambitions to reduce resource dependencies and strengthen supply security.

Traditionally, Nordic mining value chains have been domestic and vertically integrated, covering a range of minerals. However, there are notable exceptions: Norway and Iceland's refining industries are largely disconnected from Nordic supply, relying on imported raw materials (alumina). Boliden stands out as the only major company operating across several Nordic countries. While metal recycling is well-established for traditional metals, there are significant untapped opportunities to expand recycling for CRMs, which would advance the circular economy and decrease supply dependency.

As a result, cross-border collaboration within the Nordic mining sector has historically been limited. Nonetheless, new types of Nordic collaboration are emerging, particularly in the development of cross-border value chains for REEs and graphite.

NORDIC MINERALS AND MINING VALUE CHAIN

Exploration	Mining	Refining	Recycling	Key takeaways
				Mining in the Nordics has a long-standing tradition, encompassing both **base metals as well as critical raw materials** (CRMs). Despite being a **modest contributor on the global stage**, the Nordics have a **dominant role in CRM extraction and refining** in Europe, making them essential for securing Europe's ambition to reduce resource dependencies. Mining value chains have traditionally been **domestic and vertically integrated across various minerals**, except for Norway and Iceland, whose refining industries are largely disconnected from Nordic supply. While recycling is well-established for traditional metals, significant **opportunities remain untapped** for advancing the circular economy and reducing supply dependency. With Boliden as the only major player operating across multiple countries**, cross-border collaboration within the Nordic mining sector remains limited.** There are however different types of Nordic collaboration present and **cross-border value chains are starting to emerge** for new CRM mining projects.
Nordic exploration spending tripled since 2015, driven by critical minerals and gold projects, holding 100% of EU31 projects in nickel, REEs, and PGMs.	The Nordics account for over 90% of European extraction of CRMs but less than 4% globally. Mining activity is concentrated in Finland, Norway, and Sweden, with each country typically specialising in specific minerals.	The Nordics have developed considerable refining capacities building on its affordable green energy resources. Refining has traditionally been domestic and vertically integrated across various minerals.	Nordic recycling largely targets base metals with established value chains; CRM recovery is still low yet advancing in areas like battery materials.	

Exploration Trends

Exploration activity in the Nordics has surged, with spending tripling since 2015. This growth has been driven primarily by projects focused on critical minerals and gold. The region holds all EU31[10] projects in nickel, REEs, and PGMs. Thanks to its rich geological resources and attractiveness for investment, the Nordics have several promising projects in the pipeline, particularly in nickel, REEs, and PGMs.

The Fraser Institute's Annual Survey of Mining Companies 2024 ranked the Nordics among the top 10 most attractive jurisdictions for mining investment, citing high security, comprehensive geological databases, and political stability.[11] Gold projects are especially prevalent, both globally and within the Nordics, as rising gold prices amid global economic uncertainty have spurred investment. CRMs are also a focus of exploration due to their critical role in the green transition and the EU's desire to reduce supply chain risks. According to the Geological survey of Sweden (SGU), gold was the second most common material for permit applications in 2024, with approximately 500 applications, only 50 fewer than copper.[12]

Overall, exploration investments in the Nordics have grown approximately 3.3 times from EUR 100 million in 2015 to EUR 330 million in recent years. Specifically, Swedish investments increased 3.3 times to about EUR 200 million[13], Finnish investments grew 3.1 times to roughly EUR 94 million[14], [15], and Norwegian investment expanded 7.7 times to about EUR 30 million between 2015 and 2022[16]. Both Nordic and foreign actors are active in exploration, with foreign investors – mainly from Canada, Australia, the UK, and the US – being particularly prevalent in Norway, Finland, and Greenland.

Mining Production

The Nordics are significant contributors to European CRM extraction, accounting for over 90% of the region's production of cobalt, nickel, titanium, PGMs, graphite, and phosphorus. The region also dominates European iron ore extraction (95%). However, on a global scale, the Nordics contribute less than 4% to overall mineral extraction, underscoring Europe's continued reliance on non-European sources for industry supply.

10. EU31 = EU27 + Iceland, Norway, Switzerland and United Kingdom
11. Fraser Institute, Annual Survey of Mining Companies, 2024
12. Geological Survey of Sweden. (2025). Statistics of the Swedish Mining Industry 2024
13. Geological Survey of Sweden, Mineral statistics.
14. Finnish Safety and Chemicals Agency (Tukes). Mineral exploration decreased, mining investments increased. (28 March 2025)
15. John Zadeh, Nordic Mining Overview 2025, Discovery Alert. (7 April 2025)
16. Norwegian Directorate of Mining. Bergrettigheter og undersøkelseskostnader. (19 February 2025

Mining activity is concentrated in Finland, Norway, and Sweden, with each country typically specialising in specific minerals. While Sweden is mostly extracting iron ore, copper and zinc, Finland focuses on nickel and cobalt. Norway has two operational mines for titanium and one for iron ore. In cases where extraction overlaps, one country usually accounts for more than 75% of the total output for that mineral, except for silicon and gold. Greenland's mining sector is limited, with only two active mines, while Denmark and Iceland have minimal operations, extracting mainly clays and volcanic rocks, respectively.[17]

Refining Capabilities

The Nordics have developed robust refining capacities, leveraging abundant and affordable green energy resources. This is particularly notable in cobalt, titanium, nickel, and aluminium refining where the region accounts for 60–100% of the EU31's total capacity.[18]

Norway and Iceland are prominent for their significant aluminium smelting capacities, despite not extracting raw materials domestically. Mineral processing and refining typically take place within the same country – and often within the same company – that extracts the minerals. There is clear specialisation: Norway leads in titanium (100%) and aluminium (63%), Finland in cobalt (75%), and Sweden focuses on iron ore (49%) and copper (57%).

Despite these strengths, the region currently lacks large-scale refining capacity for lithium, REEs, and graphite. However, several projects, such as Keliber (lithium) in Finland, REEtec (REEs) and Vianode (graphite) in Norway as well as Talga (graphite) in Sweden, are underway to establish domestic processing capabilities for these materials.

Recycling Initiatives and Challenges

Recycling activities in the Nordic region primarily target base metals, while the recovery of CRMs remains limited but is gradually improving, particularly in battery recycling. Enhanced metal recycling has the potential to significantly strengthen Europe's clean energy supply by 2050 and reduce dependence on primary raw materials. At present, many CRM recycling rates remain below 1%, underscoring the need for accelerated progress. In response, the EU Critical Raw Materials Act has set an ambitious target to meet 25% of CRM demand through recycling by 2030.

Utilising secondary (recycled) metals instead of primary sources can greatly reduce emissions – for example, recycled aluminium has a 96% lower CO_2 footprint compared to

17. World Mining Data 2025. Austrian Federal Ministry of Finance, 2025
18. United States Geological Survey. Mineral Commodity Summaries. (Various years)

primary aluminium. Ongoing Nordic projects, developed by companies such as Hydrovolt, Fortum, and Stena, are focused on battery recycling. Despite progress, several challenges remain:

- Weak business cases and technical limitations due to small waste streams or low metal content, making recycling uneconomical.
- Poor collection and sorting processes, resulting in end-of-life metals failing to reach recyclers.
- Complex product designs, including miniaturisation and mixed metals, which complicate recycling – especially for EV batteries where chemical compositions are proprietary.
- Outdated regulations that restrict the use of recycled materials in certain applications.
- Lack of European customers for recycled battery materials, as gigafactory development has encountered scale-up challenges.[19]

Cross-border collaborations

Cross-border collaborations in the Nordics are growing, with new value chains beginning to take shape, particularly within critical raw material mining projects. Several types of partnerships have emerged, highlighting the interconnectedness of companies and resources across national boundaries.

For example, Swedish company Grangex owns the Norwegian mine Sydvaranger and is planning to reopen it for iron ore extraction. Grangex also operates other sites in Sweden, including Dannemora, Sala Bly, and Grängesberg. Similarly, Bluelake Mineral, another Swedish firm, owns Norway's Joma Gruver mine, with plans to restart copper and zinc extraction. Beyond Norway, Bluelake Mineral is actively exploring for copper-zinc, nickel, and gold in Sweden and Finland, illustrating how companies are leveraging assets across the region.

Some collaborations involve a single company operating in multiple countries. Swedish Boliden is a prime example, supplying its Norwegian smelter in Odda with raw materials sourced from its mining operations in both Sweden and Finland where the company also houses other smelters. This ongoing arrangement demonstrates efficient resource integration within the Nordic region.

There are also partnerships between different companies and countries. Canadian Neo Advanced Materials is exploring REE mining in Greenland, aiming to supply their separation plant and magnet factory in Estonia. Greenroc, meanwhile, is developing a

19. KU Leuven and Eurometaux. (2022). *Metals for clean energy: Pathways to solving Europe's raw materials challenge*

graphite mining project in Greenland and an anode materials processing plant in Norway, further tying Greenlandic resources to Nordic processing capabilities.

Cross-border supply chains extend into the steel industry as well, with Swedish company LKAB providing iron ore to steelmaker SSAB's plant in Finland. Another notable collaboration is Finnish Outokumpu's 10-year offtake agreement with Greenland Resources, a Canadian-owned firm, for the future supply of molybdenum – an arrangement covering about half of Outokumpu's annual requirement and valued at approximately USD 160 million per year.

Additionally, Norwegian REEtec's separation and processing plant for REEs will be supplied with raw materials from LKAB in Sweden – who is also the largest shareholder of REEtec.

Together, these collaborations reflect a trend towards integrated, cross-border value chains in the Nordics, aimed at strengthening the region's position in the extraction, processing, and supply of critical raw materials essential for Europe's industrial needs.

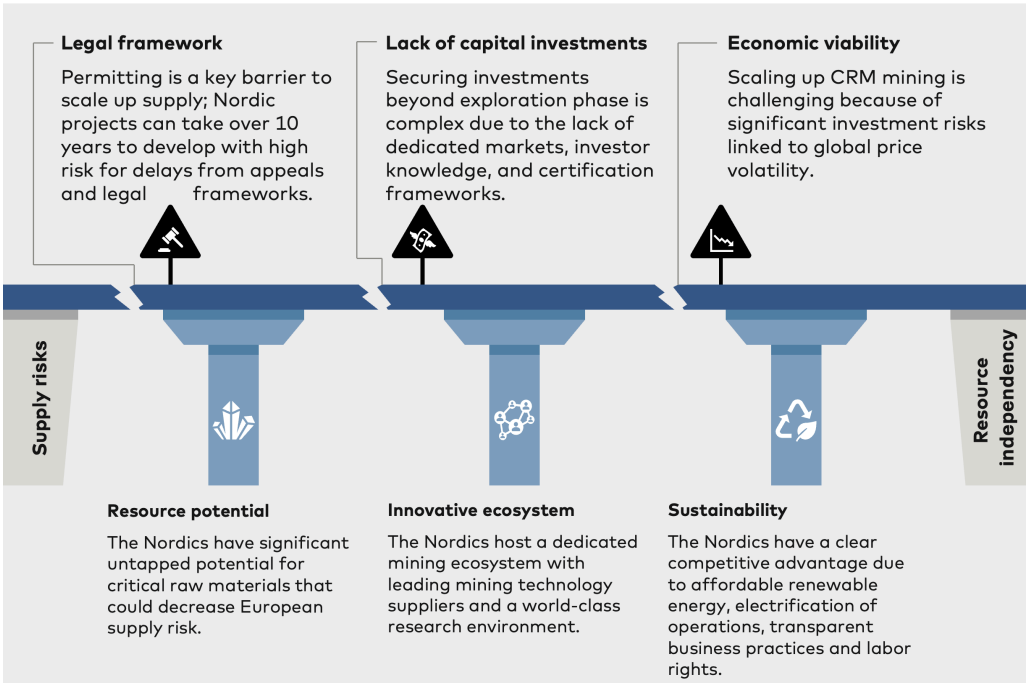
Nordic Strengths and Challenges in Critical Raw Materials Mining

A bird's-eye view of a lithium mining exploration site

The Nordic's geological wealth, robust innovation ecosystem, and access to clean, affordable energy create a solid foundation for the Nordics to become a reliable source of responsibly sourced minerals essential for the European market.

Despite these advantages, several major obstacles currently impede further development and investment in mining within the Nordics, especially concerning CRMs. These challenges create uncertainty around the returns on investment, classifying mining projects as high-risk and diminishing investor confidence.

MAIN STRENGTHS & CHALLENGES FOR SCALING UP CRM MINING IN THE NORDICS



Strengths

Resource Potential

The Nordics hold considerable untapped potential for CRMs, which could significantly reduce Europe's supply risk. The region's rich geology shares similarities with other resource-rich nations like Australia and Canada. A 2021 study by the Nordic geological surveys found that the region contains deposits of all 25 CRMs then listed by the EU. An updated study is underway based on the latest EU CRM list. Of these, 11 materials were identified as holding significant importance and potential from a Nordic perspective, due to both resource availability and their relevance to Europe. There is notable overlap across the countries: Sweden has deposits of all 25 materials, Finland and Greenland have 24, and Norway has 23, while Iceland and Denmark have limited potential due to their geology.[20] The availability and quality of geological data vary across the region, with Finland's Geological Survey recognised as a leader. Collaborative efforts among the Nordic geological surveys, such as the CRM study, are cited as strong drivers for continued exploration investment.

20. https://www.nordicinnovation.org/critical-metals-and-minerals

CRM AVAILABILITY IN THE NORDICS, 2021

Most important from a Nordic persective

Cobalt 100% of European mine production	**Graphite** 90% of European mine production	**Hafnium** 100% of European resources	**Lithium** Battery-grade production under development	**Niobium** 8% of global and 99% of European resources	**PGMs** 100% mine production and 99% of resources in Europe
REEs 9% of global resources	**Silicon metal** 6% of global and 50% of European production	**Tantalum** 99% of European resources	**Titanium** 100% mine production and 90% of resources in Europe	**Vanadium** 10% of global resources	

Known resources

Antimony	**Baryte**	**Beryllium**	**Bismuth**	**Copper**	**Fluorspar**
Gallium	**Manganese**	**Nickel**	**Phosphorus**	**Scandium**	**Tungsten**

No known resources but assumed potential

Germanium	**Indium**

Innovative Ecosystem

The Nordics boast a dedicated mining ecosystem, supported by leading mining technology suppliers and world-class research institutions. The region is home to a dense network of technology suppliers who lead in automation, electrification, and digitalisation of mining operations and export advanced technologies globally. Top universities and research institutes contribute to advancements in mineral processing, mining automation, and environmental technologies, often working closely with industry partners. Geological surveys provide crucial geoscientific data to help de-risk investments and guide sustainable development. Industry associations promote responsible mining, foster collaboration, and drive innovation through shared research initiatives. The mining ecosystem is especially concentrated in Finland and Sweden, reflecting their longer mining traditions. In contrast, Norway, Iceland, Denmark, and Greenland have less developed ecosystems owing to different industrial focuses or limited mining potential.

Sustainability

Nordic mining and metal production demonstrates significantly lower CO_2 intensity compared to the global average, primarily due to access to low-carbon power grids and electrification of operations. The region benefits from affordable renewable energy sources such as hydropower and wind in Norway and Sweden, complemented by substantial nuclear capacity in Sweden and Finland, creating a low-emission energy supply. Given that metal processing is extremely energy-intensive, grid emission factors play a critical role in determining production footprints. Abundant natural resources and strong grid connectivity provide Nordic producers with a strategic advantage in delivering low-carbon metals to the manufacturing industry, positioning the region as a preferred supplier under increasingly stringent ESG requirements. However, this competitive edge may diminish if energy capacity expansion slows down or if market integration drives up electricity prices.

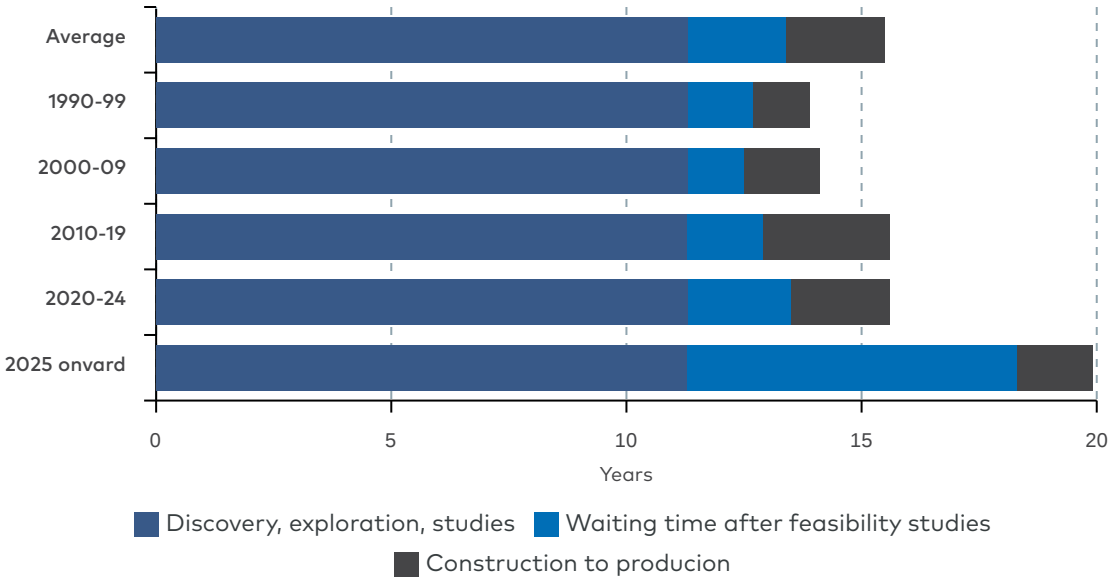
Challenges

Legal Framework

Permitting remains a complex aspect of scaling up supply in the Nordics. Mining projects often require long lead times, with approvals for new mines typically taking several years due to environmental considerations and multi-level regulatory requirements. Differences in national legislation and administrative procedures can complicate cross-border projects, while overlapping EU, national, and local rules add layers of complexity – particularly for SMEs. Streamlining and harmonising permitting processes across the region would help reduce administrative burdens and create a more predictable environment for investors.

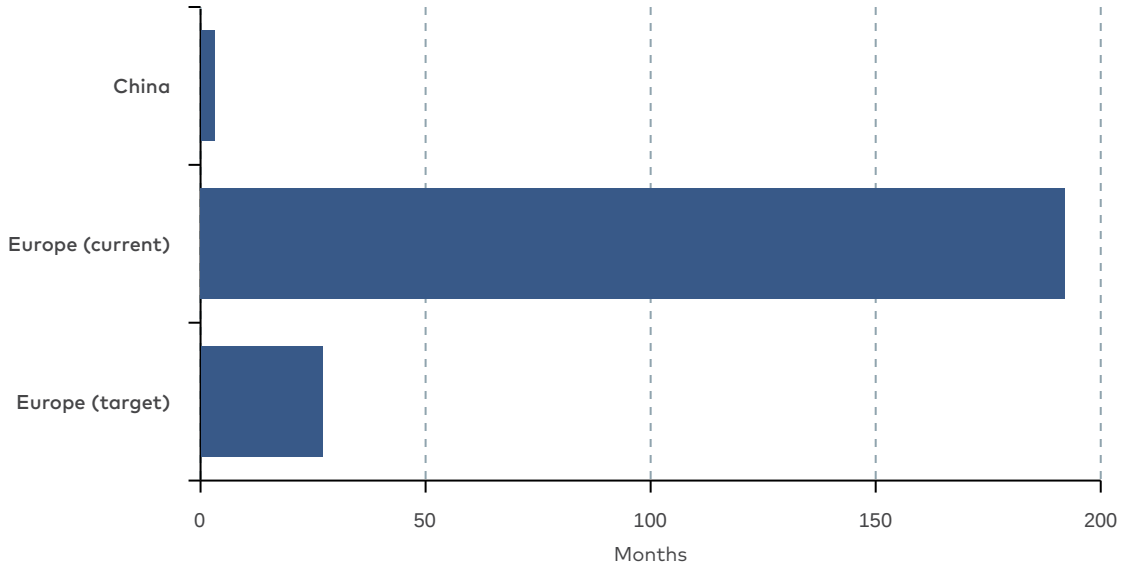
GLOBAL MINE OPENING LEAD TIMES, FROM DISCOVERY TO PRODUCTION,
Years per step and mine opening, excluding Europe[21]

Mine lead times have grown nearly 5x as exploration, permitting and study phases become lengthier and more scrutinous.



21. Data only available for countries with 5 or more mines opened during the researched period, of which no European country had opened 5 or more

MINE PERMIT TIMES – CHINA VS. EU



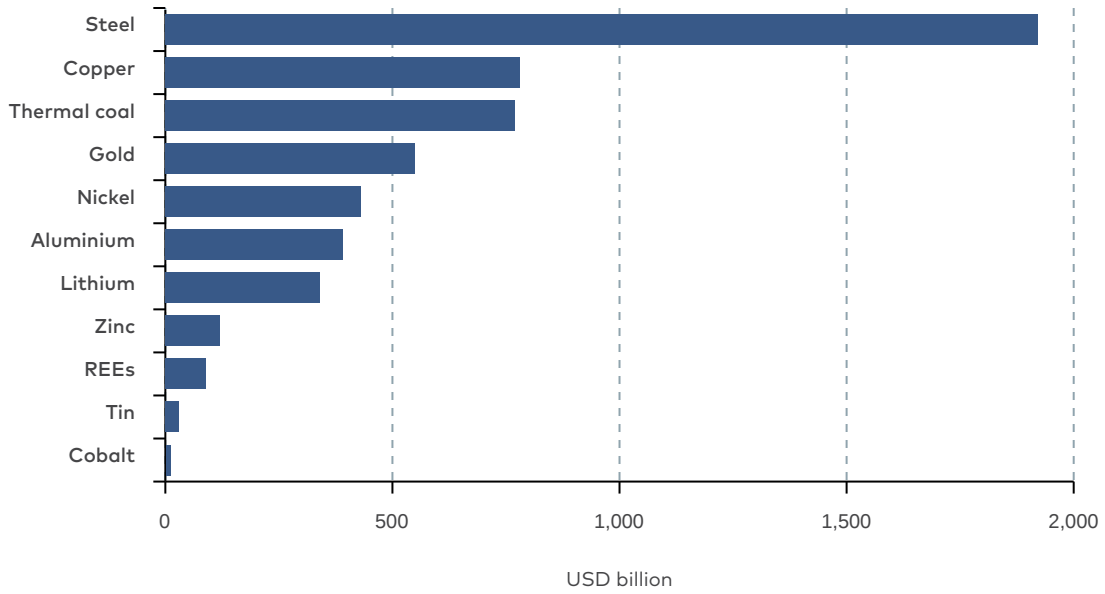
Voices from the industry				
"Permitting can take decades, even for known deposits; starting from scratch can take 20 years" **– Mine Developer**	"Lengthy permitting processes and EU regulations are still the greatest challenges." **– Industry Association**	"If the permitting could be solved, everything else would be peanuts in comparison." **– Mine Developer**	"Even after permits are secured, NGOs can initiate court cases that threaten project viability for years" **– Industry Expert**	"Mining projects in the Nordics face significant social and environmental opposition, leading to long and unpredictable permitting processes." **– Industry Expert**

Lack of Capital Investments

Investment flows into Nordic mining are still developing. Globally, the sector will require significant capital – estimated at USD 5.4 trillion by 2035 – to meet growing demand for raw materials. While Nordic projects benefit from strong ESG credentials and political support, challenges such as limited investor familiarity with mining projects, absence of specialised capital markets, and long project timelines can limit investment. Clearer certification frameworks and greater regulatory predictability could help attract both domestic and international capital.

PROJECTED CAPEX[1] NEED PER MATERIAL TO MATCH DEMAND IN 2035

USD billion, total need between 2024–2035



Note 1: Accounting for sustaining, project and exploration-phases.
Source: McKinsey Global Materials Perspective 2024 & 2025.

Voices from the industry				
"Capital and financing is a bottleneck for the mining industry in general in the Nordic countries" **– Mine Developer**	"If you want to make something happen, the states need to get more involved and take the risk off" **– International Financial Institution**	"We are not so attractive for risk capital, and that is a bit of a shame" **– Industry Association**	"We have the minerals, the money, and the institutions to make this happen – if we act together" **– International Financial Institution**	"The main barrier for junior mining companies is access to capital (...) Financing is a critical bottleneck for project advancement" **– Mine & Refinery Developer**

Economic Viability

Market volatility remains a key consideration for investors. Prices for some critical minerals have fluctuated sharply in recent years, influencing project economics and investment decisions. Geopolitical factors and concentrated supply chains add further uncertainty. Despite these dynamics, strong downstream demand and supportive policy frameworks provide a foundation for long-term growth, particularly for projects that can demonstrate resilience and cost competitiveness.

Gold is often considered a more secure investment, underpinned by recent price developments and its demonstrated resilience amid volatility in broader mineral markets. This dynamic is further evidenced by recent foreign direct investment trends, which indicate a marked preference for precious metals over other mineral categories.[22]

Other challenges

Other challenges highlighted by stakeholders include social acceptance, energy access, talent shortages and technology adoption.

Public acceptance of mining varies across the Nordic countries. While mining is widely recognised as essential for the green transition, engagement with local communities and respect for indigenous rights remain critical. Transparent dialogue and benefit-sharing can help strengthen trust and ensure projects contribute positively to regional development.

Mining and processing are energy-intensive, and access to reliable, affordable, and preferably renewable energy is vital. Nordic power prices are competitive within Europe,

22. fDi Markets, A Financial Times data source (2025)

but continued investment in capacity will be important to maintain this advantage as demand grows.

Securing skilled talent is an ongoing challenge and priority. Interest in mining careers has declined among younger generations, and competition from other sectors, such as oil and gas, adds pressure. Building attractive career pathways and fostering international recruitment will be key to meeting future workforce needs.

Innovative technologies, including AI and electrified machinery, offer opportunities to improve efficiency and sustainability. While adoption has been gradual, growing interest in digital solutions and automation signals a positive trend toward modernisation across the sector.

OTHER CHALLENGES

SOCIAL LICENCE	ENERGY ACCESS	TALENT SHORTAGES	TECHNOLOGY ADOPTION
			
While mining is seen as vital for the green transition in Sweden and Norway, public support in Finland is rather mixed. Local communities often support projects for jobs and regional development. Indigenous rights (e.g., Sámi land use) remain a major source of conflict especially in Norway and Sweden.	The industry is energy-intensive and heavily reliant on access to abundant affordable (green) energy. Nordic power prices are highly competitive on a European level but integration into the EU's power market, global competition and lack of capacity additions threaten competitiveness. Mining and metals could account for 3% of renewables demand 2035.	Attracting and retaining skilled workers is difficult, with declining interest among youth in mining careers and challenges for international talent integration – threatening future workforce pipelines. – Especially challenging in Norway as oil and gas sector attracts many geologists. Globally, metals and mining industry will need 340,000 new jobs by 2035 to scale supply.	New technologies such as AI, electrified machinery and other innovations present opportunities to combat operational inefficiencies and declining ore grade but suffer from slow adoption rates. •Many operators remain risk averse and are not willing to jeopardise billion-dollar assets with unproven technologies.
"Public acceptance remains a challenge, with 'not in my backyard' attitudes and outdated perceptions of mining practices." **– Mining & Refining Company**	"Energy costs can be up to 50% of smelter expenses – policy changes have a major impact" **– Refining Company**	"Persistent difficulty attracting young professionals to mining programmes and industry roles across the Nordics." **– Industry Expert**	"Mining operators are often hesitant to use new technology because the risks to large, long-term assets are too high." **– Industry Expert**

Note: Quotes are paraphrased
Source: Business Sweden interviews and analysis

About this publication

Nordic Mining & Minerals: Pathways to Growth

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This report offers a comprehensive strategic analysis of the Nordic mining and minerals sector. It focuses on the unique strengths of the region, the current challenges it faces, and the opportunities that can be leveraged for future growth. By drawing on global market trends and conducting a holistic assessment of the value chain, the study demonstrates how enhanced Nordic collaboration and focused interventions can help ensure a sustainable supply of critical minerals for Europe.

The findings and recommendations provided in this report are intended to inform a wide range of stakeholders – decision-makers, industry participants, and trade promotion organisations – on practical measures that can foster investment, drive innovation, and enhance the international competitiveness of the Nordic mining industry.

Disclaimer

The analysis and recommendations contained in this report are founded on a combination of publicly available data, proprietary research, and 35 stakeholder interviews conducted between September and November 2025. While every effort has been taken to ensure the accuracy and objectivity of the information presented, the conclusions reflect the perspectives of the authors and interviewees as of the time of writing. This document does not constitute specific investment advice and should not be relied upon as the sole basis for making business decisions.

About the Collaboration

This study was jointly commissioned by Business Finland, Business Sweden, Innovation Norway, and Nordic Innovation. The aim was to deliver a thorough, cross-border perspective on how the Nordic region can bolster its position within the global mining and minerals value chain. As national trade promotion organisations (TPOs), these entities are dedicated to enhancing international competitiveness, promoting cross-border collaboration, and supporting the growth of key Nordic industries.

The participating organisations have a well-established history of collaborative action to confront strategic challenges and seize emerging opportunities. Successful joint initiatives in the battery and chip sectors have already demonstrated the benefits of coordinated efforts, accelerating innovation, investment, and market positioning for Nordic businesses. Recognising the pressing need for a secure, sustainable supply of critical minerals, the TPOs have once again joined forces to provide a holistic, cross-border analysis. By combining their expertise and networks, this report is intended to support policy development, encourage investment, and foster stronger collaboration between public and private stakeholders throughout the Nordic region.

Acknowledgement

We extend our sincere gratitude to all the individuals and organisations who generously contributed their time, expertise, and perspectives during the interview process. Their insights have been crucial in shaping the analysis and recommendations contained in this report. We especially thank the representatives from mining companies, technology suppliers, investors, public authorities, and industry associations across the Nordic region for their openness and collaborative spirit. Without their valuable contributions, the completion of this report would not have been possible.

Nordic Innovation

Nordic Innovation is an organization under the Nordic Council of Ministers that promotes innovation, entrepreneurship, and competitiveness in Nordic businesses. Nordic Innovation acts as a catalyst and enabler in the Nordic Prime Ministers' 2030 Vision by bringing together forces across sectors, borders, and disciplines to drive solutions that create lasting change and value.

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