

Critical Minerals

DEVELOPING PRICE TRANSPARENCY

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About State of Play

State of Play was initiated in 2012 to create a platform to support industry discussion of innovation and performance at a strategic level and provide macro-level insights into the industry ecosystem.

State of Play has undertaken 5 global surveys – 2015, 2017, 2019, 2021 and 2023. We have also undertaken drill-down research work into specific themes including electrification, the oil and gas transition, cybersecurity, critical minerals and the specific mining industries of South Africa and India.

State of Play is now a leading voice for industry leaders and decision-makers. Our research is the basis for strategic decision-making and investment analysis globally, across operators, suppliers, investors, and government. Our work directly impacts on-the-ground innovation efforts such as the Electric Mine Consortium and countless in-house innovation acceleration programs.

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About our major sponsors

Minerallink

Minerallink is an online minerals marketplace linking suppliers and buyers globally. They aim to provide a new route to market, simplifying processes to save time and money on contracting, compliance and logistics. Minerallink looks to digitally transform and strengthen the minerals supply chain, unlocking value for the industry.

www.minerallink.com

Slate Advisory

Slate provides strategic advice to the natural resources, energy and infrastructure industries to help solve the challenge of adapting to external forces. Slate advises established businesses on navigating these forces, through the design of business and functional strategy and tailored reviews. Slate also builds new businesses based on deep industry insight, through the design of business models and bringing together partners, capital and capability.

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Contents

INTRODUCTION	7
DEALING WITH COMPLEXITY	8
THE ROLE OF LONG-TERM CONTRACTS	10
GEOPOLITICAL COMPLEXITIES AFFECTING TRANSPARENCY	12
THE KNOWLEDGE GAPS	14
ENCOURAGING PRICE TRANSPARENCY	16
A CRITICAL MINERALS MARKETPLACE	17
THE BENEFITS OF A MARKETPLACE	18
CRITERIA FOR A SUCCESSFUL MARKETPLACE	19
CONCLUSION	20



The method:

In 2023, State of Play partnered with Minerallink and Slate Advisory to undertake research designed to better understand price transparency and market mechanisms within the critical minerals industry. This piece of work followed on from the 2022 report, Critical Minerals: An Industry Perspective, which identified transparency as a barrier to investment.

The research is a short form piece of work, designed to identify how accelerating the evolution of market mechanisms can help critical mineral markets mature faster.

The research consisted of:

- 60 individual surveys with a combination of miners, manufacturers, suppliers, government, investment, researchers and traders involved in critical mineral markets. The survey was open from July- August 2023.
- 8 interviews with critical mineral industry experts.
- Desktop research and analysis.

The State of Play team would like to thank all the people who were actively involved and contributed to this report.

The recommendations in this report do not necessarily reflect the views of all our sponsors and contributors, and are conclusions drawn by State of Play after analysis of the survey data, desktop research and interviews.

Introduction

The demand for critical minerals is vast and exceeding forecasts at every step. The current scarcity of minerals required for the energy transition is threatening progress towards meeting net-zero ambitions. It's predicted that many of the critical minerals fundamental to the energy transition will experience shortages as soon as 2030. For some materials, such as dysprosium, this shortage may be up to 70%¹.

The demand side pressures are well documented and will likely continue to escalate over the coming decade. In this report, we turn our attention to the supply side complexities, notably the relationship between price transparency and investment.

Critical minerals is the collective term mostly used to describe the minerals essential to our energy transition. Each are geologically and chemically different,

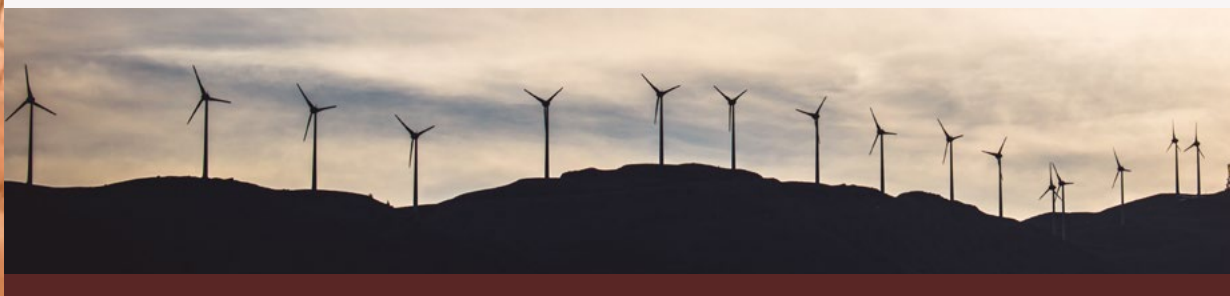
serving varying purposes and end users. The same goes for demand, supply, and the maturity of the markets. Critical minerals are not made equal.

What a number of these critical minerals have in common is the fact that they are relatively new markets. They have not been a core industry focus for decades and decades like iron ore and coal. They are not yet traded in large volumes, there is little liquidity and high volatility, all of which culminate into significant market complexities and price uncertainty.

With 84% of industry reporting transparency of price and supply as an issue in developing critical mineral markets, such structural market complexities will need to be addressed to accelerate industry progress, and importantly supply².

¹. [McKinsey](#)

². [State of Play](#)



Dealing with complexity

Mining is already an inherently risky industry, typified by its capital intensity, long payback periods, price volatility, geological uncertainty, and in select locations, heightened sovereign risk. While critical minerals are subject to the same features, there are several more layers of complexity that exacerbate the risk equation further.

Contributing to such complexity are the market mechanisms used to deliver critical minerals – they are immature, opaque, and poorly understood. As it stands there are no central spot prices, no derivative markets, and an overall lack of liquidity. It is imperative to investigate several of the major challenges facing critical minerals to further understand how industry can address these issues.

Small trading volumes

Critical minerals, despite their growing importance in the global supply chain, still have relatively small trading volumes compared to other major commodities. This is exacerbated by the fact that the majority of trade is currently executed within long-term offtake contracts, leaving only a small proportion of an already limited amount of product to be transacted through other means. Both buyers (59%) and sellers (56%) listed the lack of a central spot market as the greatest challenge with transacting outside long-term contracts. The development of a centralised spot market may incentivise greater volumes of trade outside of long-term contracts and reduce the industry's reliance on offtake agreements.

The extent to which a centralised spot market can provide liquidity and price transparency is, in turn, dependant on volumes reaching critical mass.

Lack of product standardisation

A lack of standardised products poses challenges for price discovery and market efficiency. While lithium stands out as a relatively promising example, other critical minerals like rare earths and various graphite products exhibit limited homogeneity. Conversations with industry experts and research into the graphite industry, for instance, reveal that the graphite specification is unique to each end user, with little to no standardisation across the market. Our data suggests the issue is almost doubly important for buyers than it is for sellers, with 26% of buyers citing product specification discovery as one of the major barriers facing trade. Commoditisation of certain product categories will require additional layers of dimensionality to be successful. Whilst a challenge, there are historical examples of success, most notably iron ore which has seen different indices emerge for the different blends.

**“It’s not gold, it’s not copper,
it’s not coal, you can’t just dig
it up and expect some customer
straightaway”**

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Price discovery

Without a central spot market, determining the price for a critical mineral at any point in time becomes a complex exercise- there are virtually no benchmarks or indices that can be used, due to the lack of liquidity and standardised products. As it stands, 40% of survey respondents stated they determine the price for critical minerals through direct negotiations. This places a greater emphasis on trade relationships and the ability to collect “on the ground information” to validate critical price assumptions. Published price reporting therefore relies on the awareness of deals and contracts that have been executed. For new entrants into the market, developing the relationships that provide channels for this information can be a time consuming and costly process.

Asymmetrical information

In the critical minerals industry, existing players may be reluctant to embrace price discovery initiatives due to concerns they are forgoing advantageous information or revealing sensitive pricing intelligence. The current situation (opacity) benefits the dominant players – those with established relationships and knowledge channels. It is the newer entrants (often junior companies) and the intermediary stakeholders or investors that suffer. As a result, established market participants may potentially resist efforts to enhance price transparency.

Supplier and customer verification

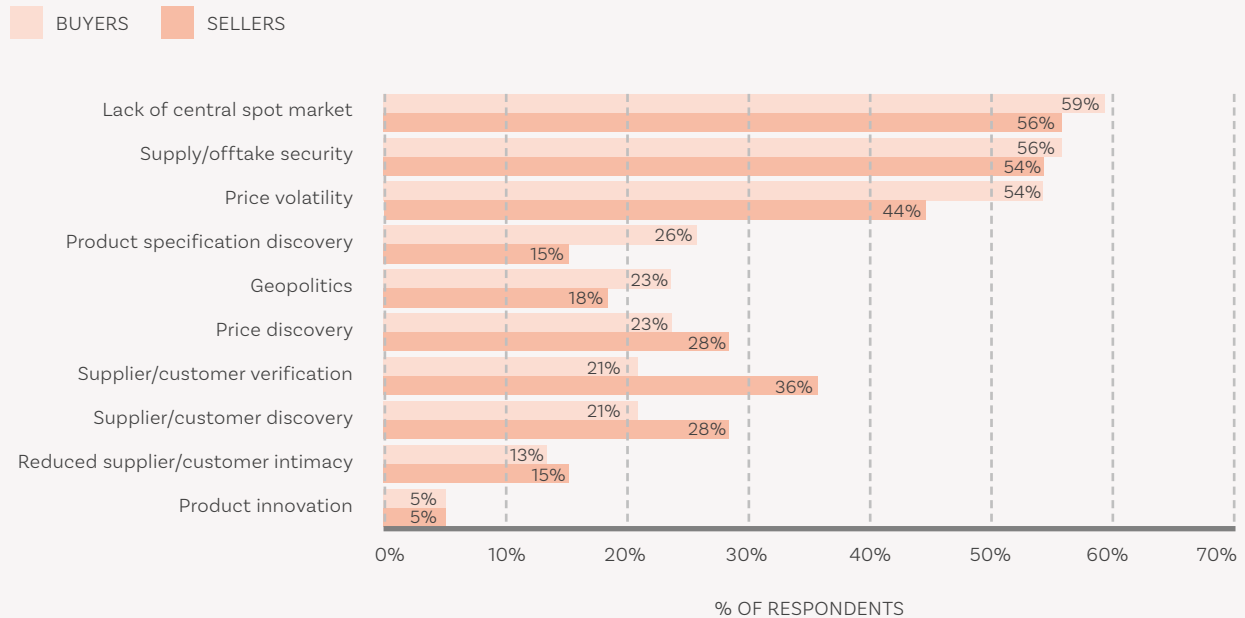
To execute a trade, considerable work is required in discovering the customer/seller, understanding and communicating the specification demanded, achieving product certification and proving creditworthiness before entering into sales agreements. Our survey suggests that 64% of sellers and 42% of buyers believe the customer verification and discovery process is a major challenge in executing trade agreements.

‘...in order to have contracts priced on an index, you’ve got to have some transparency and liquidity in that index. And at the moment, the view is [that] there really isn’t enough liquidity.’

EXECUTIVE, MINING COMPANY

We asked: What challenges do critical minerals buyers/sellers face when transacting outside of long-term contracts?

By % of respondents given three options



The role of long-term contracts

In the early stages of critical mineral project development, commercial offtake agreements are commonly executed to assist the project in moving through to construction. With 35% year on year growth in new EV purchases predicted by the end of 2023³, these offtake agreements are also an important vehicle for manufacturers to secure enough supply for their production. Recent examples include Lontown Resources' offtake agreements with Ford, Tesla and LG Energy Solutions for around 90% of their Kathleen Valley Project lithium reserves⁴, and Syrah Resources' offtake agreement with Tesla for majority of its natural graphite active anode material from its processing facility in Vidalia⁵.

The benefits of offtake agreements can be significant for both parties. For sellers, the agreements provide an assured sales channel, which is necessary to secure funding for project development. 54% of sellers stated offtake security as one of the biggest challenges to operating outside of long-term contracts. Many companies will often secure multiple offtake agreements before even reaching the production phase. For buyers, it allows them to lock in access to sufficient raw material supply at an agreed price and specification to support their product and growth plans. Security was high on the list of challenges experienced by those operating outside of long-term contracts- 56% of buyers stated supply security as a challenge.

3. [iea](#)

4. [iss insights](#)

5. [Financial Review](#)

For the broader market, offtake agreements become somewhat of a hurdle to price transparency and market evolution. These agreements are typically opaque, with few details available on the agreed price and sale conditions. As good practice, anything between 10 and 20% of a companies' supply is typically not locked into long-term contracts (usually to account for production fluctuations), leaving a small amount of product left to be traded through other means. For a market that is already coming off a small base, the ability to transact outside of offtake agreements with only 20% of the volume will make achieving a liquid market more difficult. Many of these contracts will not lapse for the next 3-10 years, further challenging the ability to create liquidity and price transparency in the short to medium term.

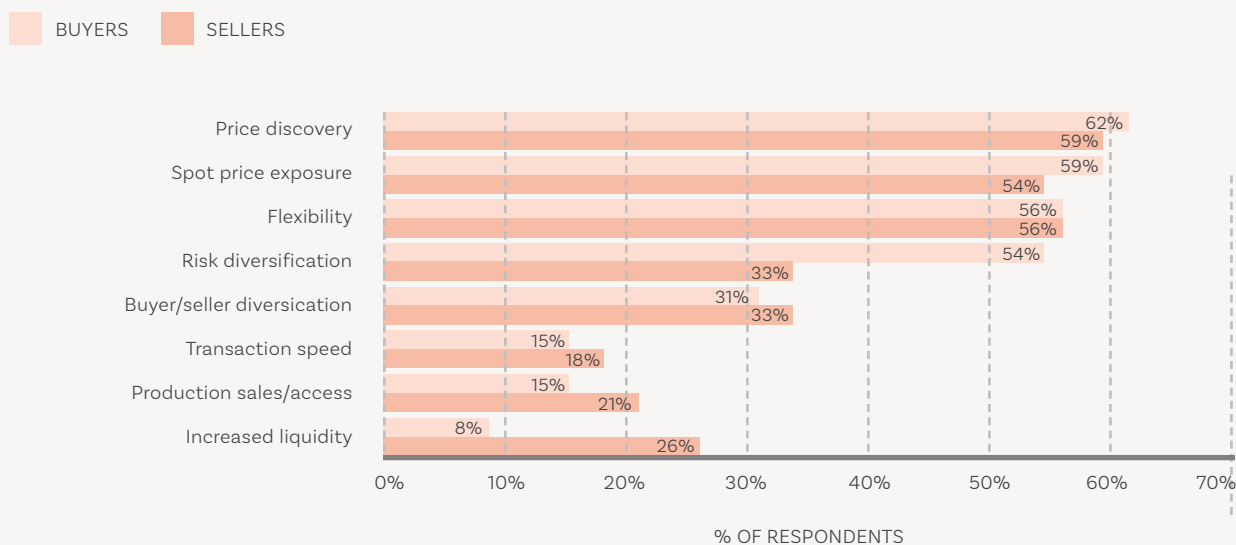
Whilst challenging, unlocking the capacity to transact greater volumes outside of long-term contracts will bring about a number of benefits to the broader industry. According to our data, both buyers and sellers agree that price discovery, spot price exposure and greater flexibility will come as a result, each contributing to mitigate risk and encourage further investment from outside the industry's traditional means.

'...most of them are concerned about getting offtake agreements early on, otherwise they don't get financing. So, by the time they're actually in production, they've got five offtake agreements, at least for a decade....'

DIRECTOR, RESEARCH CENTRE

We asked: What benefits do critical minerals buyers/sellers receive from transacting outside of long-term contracts?

By % of respondents given three options



Geopolitical complexities affecting transparency

Geopolitical phenomena continue to challenge global critical minerals markets. As an industry that currently relies on substantial foreign investment and trade, critical minerals are not immune to the turbulent geo-strategic backdrop. It is expected, at least in the medium term, that the geopolitical volatility will continue, particularly as tensions threaten to escalate between the East and West.

The industry recognises critical minerals present a once in a generation opportunity to re-strategise global supply chains, with several nations taking steps toward onshoring many aspects of the value chain. The 2023 State of Play Mining Industry Survey has indicated that the industry believes geopolitical alliances will have the biggest impact on global supply chains in the mining industry.

Many countries are now taking targeted policy action in an attempt to minimise their exposure to supply chain disruptions. Through the Inflation Reduction Act (IRA), the US has aimed to increase the attractiveness of onshore processing of battery minerals, or diversifying supply through countries such as Australia and

Japan which have free trade agreements in place (Japan has a limited FTA in place)⁶. Other countries such as Germany, Japan, South Korea, Australia and the UK have followed suit, aiming to diversify and secure supply by implementing critical minerals strategies.

Despite these attempts to diversify supply chains, the dominance of countries such as China, has resulted in increasing complexities with supply and price transparency. As one resource company CEO succinctly summarised it, “there’s not a battery on the planet at a commercial scale that’s manufactured outside of China exclusively”.

Early investment in securing critical minerals by China has been well documented, especially in rare earths, beginning in 1986 with the implementation of the National Five-Year Plan for Rare Earth Industry.⁷ More recently, China has also established dominance in downstream lithium refinement (representing 60% of refinery and 80% of lithium hydroxide supply) and cobalt (70% of refinement).⁸ This is despite China containing only 8% and 3% of global lithium and cobalt reserves respectively.⁹

Trade tensions have further exacerbated supply and pricing issues, with critical minerals trade, particularly in minerals which are fundamental to defence, AI, and advanced computing technologies, becoming politicised. Sudden restrictions on exports of gallium and germanium in response to American and European trade restrictions, of which China accounts for 94% and 60% of global production respectively, has resulted in a 40% increase in gallium prices and 9% increase in germanium ingot prices.^{10 11}

Geopolitical dominance of midstream and downstream processing also undermines efforts to address transparency issues. Without participation from the dominant markets such as China, any effort by others to address these concerns would only affect a small proportion of the overall supply. Under a structural supply deficit, the ability for stakeholders to preference transparent trade avenues is limited, as the ability to secure supply remains more important.

6. [Australian Financial Review](#)

7. [CSIS](#)

8. [International Energy Agency](#)

9. [Australian Strategic Policy Institute](#)

10. [Reuters](#)

11. [Australian Financial Review](#)

The knowledge gaps

Capital markets go to places where they can make money at a reasonable risk. To date, critical minerals projects are as risky as you can get - little liquidity, no derivative market, and no track record.

A project is seen as bankable when its risk-return profile meets investors' criteria, and they can secure funding to implement a project. To reduce risk and complete adequate due diligence, investors need to be able to accurately assess the market. They need to have an accurate understanding of price, forward demand and the current buyers and sellers. Without this knowledge, there will be a reluctance to invest.

Risk aversion by investors leads companies down a path of non-traditional sources of debt and equity, which are often structured with greater complexity to mitigate risk. National governments around the globe recognise the challenge and are also stepping up to provide alternate sources of funding. In 2022, Lynas Rare Earths signed a \$US120 million contract with the Pentagon to build a commercial heavy rare earths separation facility in Texas.¹² This commitment doubled to \$US258 million recently as the US attempts to shore up their supply chains¹³ and is the first plant outside of China able to separate heavy rare earths materials.

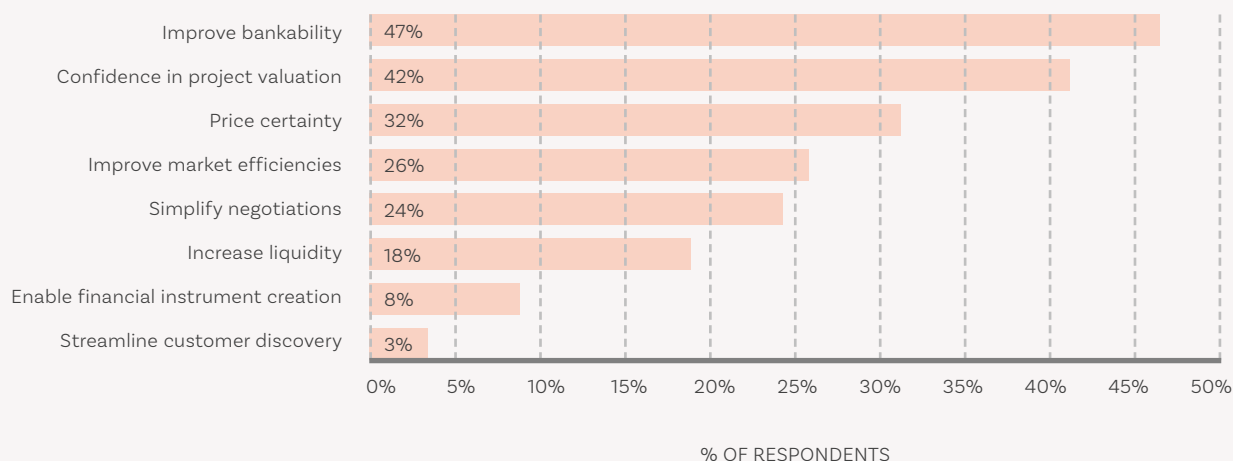
12. Reuters

13. Australian Financial Review



We asked: How would greater price transparency in critical minerals markets encourage investment?

By % of respondents given two options



Forward pricing is a challenge for critical minerals, exacerbated by low liquidity and little certainty around demand and supply. A consideration for banks in financing projects is the volatility of pricing and whether they are able to reasonably predict what the price may look like in the future. This is particularly difficult for rare earths, with prices subject to large fluctuations. For example, praseodymium neodymium alloy reached highs of \$220 a kilogram and lows of \$73.50 within a two-year period¹⁴.

Price transparency does have a role to play in providing a level of confidence. According to our survey data, an important mechanism to improve bankability and create confidence in project valuation is through greater price transparency. For some critical minerals, such as lithium, the understanding of the market is higher, and bankability is less of an issue, although this has not been the case until relatively recently. Price transparency then becomes a vehicle for achieving a fair value for

‘The finance industry needs to become more comfortable with the business, so they are willing to finance with a lower proportion already signed up in offtake agreements.’

DIRECTOR, RESEARCH CENTRE

their product. For others, such as some rare earths, supply chains need further development for financial institutions to understand the buyers, thus transparency becomes a more useful mechanism to assist bankability.

To date, 55% of respondents believe there is currently very low to low levels of price transparency in critical minerals markets. As a clear enabler for broader levels of investment, how can the industry best create and encourage price transparency in critical minerals?

14. Reuters

Encouraging price transparency

Maturation of critical minerals markets will happen, and it will ultimately be driven by one thing - demand.

For the most part, critical minerals are at the beginning of their journey of market maturation. This journey is not a new frontier, with several other commodities having evolved to become fully liquid markets before today. Such historical case studies will help producers, customers investors and traders navigate their way through the turbulence. They are important to reference, but the industry should still explore new and innovative ways to accelerate the maturation process, harnessing new technologies and partnerships to ultimately deliver critical minerals to market faster.

Its also important to note, that not all critical minerals will reach maturity at the same pace. Some, such as lithium, have far more advanced supply chains, resulting in a higher chance of price transparency being achieved in the shorter term. Other critical minerals, such as rare

“There’s as much complexity around the actual marketing and understanding what you’re going to be able to sell, who you’re going to be able to sell it to, and at what price going into the future as there is as finding it and getting it out of the ground.”

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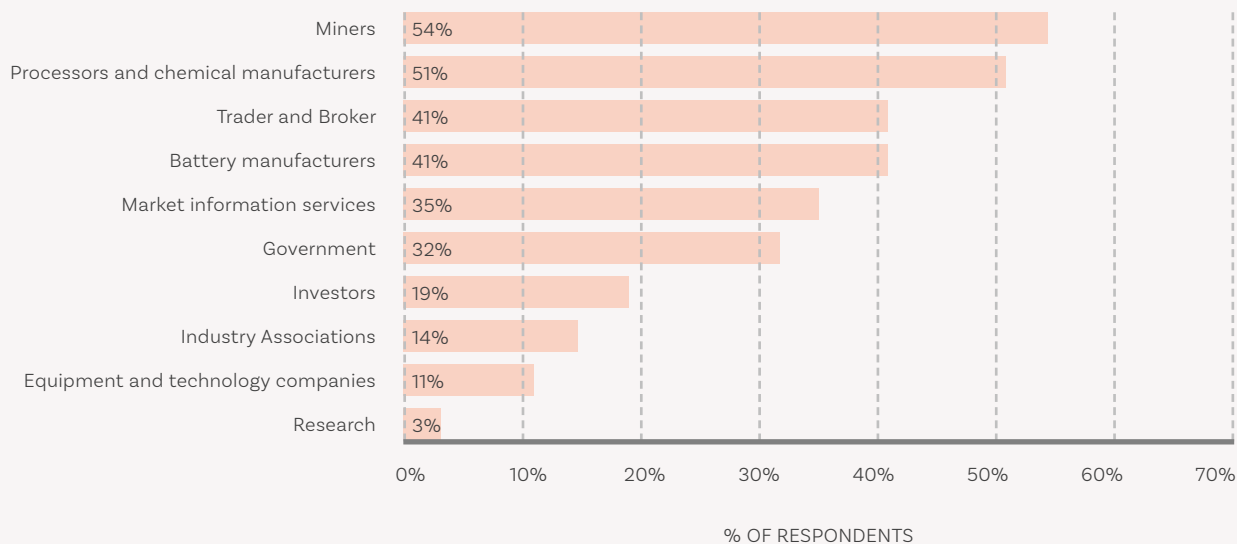
earths, have such small volumes of trade, and are complex in both product specifications and needs, making price transparency a lot more difficult.

According to our survey data, miners and manufacturers are in the best position to drive price transparency. The benefits that price transparency bring about are directly relevant to these stakeholders, both of which have the greatest need for project financing, to diversify risk and for the ability to forecast pricing and supply.



We asked: Who is in the strongest position to drive increased price transparency in critical minerals markets?

By % of respondents given three options



Traders and brokers also have a significant role to play. They likely have the most experience in this space already, having seen several other commodities evolve from opacity to commoditised market exchanges in the past. Emerging technologies such as AI, which is far more efficient in collating information, updating

information, and forecasting, can play a role in helping traders and intermediaries accelerate the market evolution process. If harnessed correctly, technology could be the final piece of the puzzle in helping facilitate greater price transparency in the market.

A critical minerals marketplace

Marketplaces have played a foundational role in the evolution of commodity markets for decades. In 2012, GlobalOre was founded by some of the largest players in iron ore, including BHP and Rio Tinto. Price transparency had become critical in contract negotiations as industry wanted to know the price for iron ore was genuine. As a result, a marketplace was selected as the most effective vehicle to deliver such information.

“Transparency was important because if the industry was going to accept a spot price for iron ore, they wanted to believe that it was a genuine price... the ability of a trading platform to actually show people trades that were genuine between a seller and a buyer was of value...”

DIRECTOR, MINING COMPANY

STAGES OF MARKET PRICING EVOLUTION

Pricing mechanisms go through several stages of evolution before becoming fully liquid markets



As it currently stands, there are several platforms that have begun facilitating trade for critical minerals outside of long-term contracts, however these are yet to develop traction, or are bespoke. The most notable of these is Pilbara Minerals' Battery Materials Exchange, a digital auction platform providing interested parties the ability to acquire current and future unallocated spodumene concentrate via a spot market price. As a single seller platform, Battery Materials Exchange isn't accessible to other sellers and cannot provide market price transparency.



The benefits of a marketplace

Visibility of price and supply

A marketplace that offers spot, benchmark or index pricing information provides much-needed visibility into critical minerals market dynamics. In opaque markets, generalist investors are less likely to participate, deterred by perceived risk of information asymmetry and volatility. A marketplace that offers price discovery encourages broader participation, enhancing liquidity and fostering a fairer market environment.

Seamless access to buyers and sellers

Currently, price discovery relies on individual negotiations rather than clear market signals, necessitating the development of deep ‘on the ground’ relationships and significant time spent conducting customer discovery. A marketplace may eliminate much of the cumbersome and inefficient requirements of accessing buyers and sellers, especially for new entrants into the market.

Efficiencies in commercial negotiations and execution

A digital commercial communications platform will create efficiencies in negotiations and contract execution. With digital contracts, general terms and conditions and customer and buyer verification (KYC) built into the platform, the speed and accuracy of transactions is increased, benefiting all parties involved.

Evolution of futures markets

The development of an online trading marketplace for critical minerals can serve as a steppingstone for the evolution of futures/derivatives markets. Futures markets allow participants to hedge against the risk of adverse price movements. By enabling the development of futures contracts for critical minerals, the marketplace would provide risk management tools, potentially attracting more market participants.

Reduced risk of market distortion

Critical minerals markets are currently highly concentrated in very few geographies. A decentralised market control model on an online trading platform facilitates market equilibrium by allowing supply and demand to dictate prices, minimising the risk of artificial price distortions. Furthermore, consolidating resources on a single platform strengthens the negotiating position of buyers and sellers, particularly under a geopolitically fragmented market.

“If you’re trying to start up a trading platform for price discovery, that’s all well and good. But you’ll never get price discovery until you’ve got liquidity and you can’t get liquidity unless you let people trade in a way in which they’re comfortable.”

DIRECTOR, MINING COMPANY

Criteria for a successful marketplace

A marketplace doesn't come without its challenges. The critical minerals industry, characterised by its complex trading dynamics, presents significant challenges for external entities seeking to enter the market.

For those looking at building an exchange, industry feedback indicates critical mass of buyers and sellers, global reach, and publication of benchmark pricing as the top three critical components required for a successful marketplace.

What characteristics are key for an efficient critical minerals marketplace?

RESPONDENTS ASKED TO RANK ALL CHARACTERISTICS.

1.	Critical mass of buyers and sellers
2.	Global reach
3.	Publication of benchmark pricing
4.	Settlement infrastructure
5.	Trust, security and governance
6.	Product traceability
7.	ESG scores
8.	Contract standardisation
9.	Transaction confidentiality
10.	Various sales mechanisms (fixed price, auction etc)

Critical mass of buyers and sellers

Given the low volume of trades, establishing a critical mass of participants on a marketplace is essential to ensuring accurate price discovery. Digital marketplace providers currently operating in critical minerals are in the early stages of development. The concentration of buyers and sellers cannot be split across several exchanges – success requires the commitment to one or two. First mover advantage is therefore enormous.

Global reach

Critical minerals deposits are scattered across the world. Australia is particularly rich in lithium, China is known for its dominance in rare earths, and the Democratic Republic of Congo accounted for more than two thirds of global cobalt production in 2022¹⁵. Global reach is therefore paramount to the success of a marketplace. There must be the possibility of trade across countries - without this a marketplace will struggle to meet the needs of industry.

Publication of benchmark pricing

Benchmarks are fundamental when it comes to determining the price of commodities. The industry need for critical minerals benchmarks is highlighted by the fact it was ranked as the third key characteristic of an efficient marketplace. Benchmarks assist in more transparent negotiations (there is less asymmetrical information), as well as providing some clarity on forward pricing. An exchange that can achieve enough liquidity to provide accurate and trusted benchmarks will go a long way in closing the knowledge gap in the critical minerals industry.

¹⁵. Statista

Conclusion

As global pressures surrounding the energy transition continue to grow, so too does the demand for critical minerals. The industry must therefore turn its attention to accelerating the delivery of metal to market, or risk experiencing structural supply deficits that threaten the world's ability to combat climate change.

This is no easy feat. There are many interrelated elements that can contribute to supply side deficits. In the case of critical minerals, one of the central issues slowing the proliferation of investment is the lack of mature market mechanisms.

As it currently stands, access to accurate market information is limited, buried in long-term, opaque commercial agreements and offtake contracts between buyers and sellers. In order to encourage a broader pool of investment, critical minerals markets need to evolve to provide greater access to price and trade information. Greater transparency, coupled with a greater volume of trade, will assist in fairer pricing, increased confidence in project valuations and improved bankability.

To achieve greater price transparency, industry incumbents will have to reconsider how business is currently conducted. Greater collaboration from all stakeholders across the value chain is required, particularly with the sharing of information,

as well as an openness to adopt new technologies and processes.

Marketplaces have proven a viable vehicle to enhance price transparency and market maturity in other commodities. For a marketplace to be successful requires the participation from a critical mass of buyers and sellers, something that may prove difficult in markets typified by low trade volume and monopolised by few players. Attracting a critical mass of participants also requires striking a delicate balance between the interests of buyers and producers. This delicate balance requires thorough negotiations, building trust with market participants, and designing a platform that maintains confidentiality, while providing sufficient information for market participants to make informed decisions.

If a critical mass of participants and a global reach is achieved, a successful marketplace could be the key that accelerates price transparency in critical minerals markets, enabling the publishing of trusted benchmark pricing information and spurring the investment required to finance the next wave of critical mineral projects.





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