

Securing Mineral Supply: Backwards Vertical Integration for Technology Companies

By Christian Gaona

Abstract

The demand for minerals has increased with the growing production of standard technologies, such as EV car batteries, wind turbines, and solar panels. However, major mining companies need help to satisfy the demand at the current rate, leading to inconsistent and expensive supply chains and environmental and geopolitical concerns. Technology companies should consider backward vertical integration strategies to mitigate against risks associated with supply chain issues, which would merge upstream processes essential to companies' value chains. By doing so, they can mitigate the mine's health, safety, and ecological impacts by employing the latest mining technologies. BVI can increase production rates, reduce costs and risks, stabilize the supply chain, and provide cleaner and more sustainable mining methods. By nearshoring mineral supply and employing the latest technologies, companies can expedite production, decrease transportation costs, and control the supply, providing them with a strategic advantage in the market. This article explores how tech companies are best suited to provide the capital and skill sets to overcome the risks associated with mineral extraction and ensure a cleaner, sustainable energy future.

Discussion

Everything around us is composed of minerals that were once mineral ore in the earth before it became a finished product that you might be reading this article from now. Since minerals are necessary for everyday technologies consumers eagerly adopt, demand has skyrocketed globally. Companies require minerals to manufacture these technologies, like EV car batteries, wind turbines, and solar panels. However, tech companies like Alphabet, Apple, and Tesla face a dilemma; major mining companies need more supply to satisfy demand at the current rate. This dilemma leaves companies with an uncertain, inconsistent, or prohibitively expensive supply chain; lawmakers are left grappling with global resource extraction's geopolitical and environmental consequences. Tech companies may mitigate these risks by considering backward vertical integration (BVI). BVI is merging upstream processes essential to a firm's value chain that still needs to be linked. For example, Tesla needs lithium to manufacture its EV batteries. Tesla could acquire and merge a lithium mining firm into its business model along the value chain.^{1 2}

¹ Xiaowen Huang, Jing Liang, Shilei Yang, and Jing Zhu, "Forward or backward: The Impact of Vertical Integration Direction on the Bullwhip Effect," *International Journal of Production Research* 60, no. 22 (2022): <https://doi.org/10.1080/00207543.2022.2051765>.

² Alex Coman & Michael Naor & Anat Wiznizer, "Vertically Integrated Supply Chain of Batteries, Electric Vehicles, and Charging Infrastructure: A Review of Three Milestone Projects from Theory of Constraints Perspective", *Sustainability*, Vol. 13, Iss. 7 (2021). <https://doi.org/10.3390/su13073632>.

Despite potential environmental and social risks in taking over mineral extraction, major technology firms are best suited to provide the capital and skillsets to overcome it. Doing so could stabilize the supply web, increase (production rates, health, and safety measures), and decrease (costs, risks, # of accidents). By integrating mining, companies can control production and ore mining methods and, by extension, mitigate the health, safety, and ecological impacts of a mine by employing the latest mining technologies. For example, drilling is done by human mine operators, determining the ore quality and drilling blast holes to extract it. With innovative technologies and techniques, miners now more than ever can control these various aspects more easily. However, a mining company may need more immediate financial resources to overhaul and implement these technologies. A large technology company could overhaul the implementation of automated EV drill rigs that would eliminate most of the human error involved with drilling by utilizing the latest software and potentially remove the operator entirely while increasing productivity and reducing environmental and social risks. The Syama Mine in Mali implemented automated EV mining equipment (AEVME) beginning in 2015, which increased efficiency while decreasing risks. The mine increased its ore production by 15% while reducing its cost of production from \$881.00 per ounce to \$746.00 per ounce. Although there are higher costs to purchase and implement AEVME (short term), the overall savings for the mine were 30%. The increase in efficiency is due to a 24-hour mining operation with decreased downtime, as mining equipment can run for 22 hours without stopping production. In comparison, traditional human-operated mining equipment can only operate for up to 16 hours and is more costly. AEVME is more affordable and safer. Still, additional factors of AEVME led to the increased efficiency of the Syama Mine.³

AEVME has been developed to reduce transportation and related costs with fossil fuel-dependent equipment. Mines are typically in rural areas where diesel is used to power equipment. Dependency on diesel increases production costs and emits fumes that can harm mine operators—potentially impairing their ability to work safely. Using AEVME instead of diesel-powered equipment will make mining safer and reduce production costs by removing operators from the mine. Tech companies could use their significant market capital to implement AEVME that relies on batteries, thereby eliminating the dependency on diesel. Moreover, a firm can build onsite renewable energy sources to power the mine to further reduce the carbon footprint and costs incurred by reliance on fossil fuels. Although the extraction of minerals is seldom discussed, there is enormous potential in the broader policy context. Mining is an industry many of us interact with indirectly every day as consumers. Every product we touch has been touched by a miner first in its upstream process. To ensure a cleaner, sustainable future for tomorrow, green minerals are required to construct renewable energy assets—and how we mine those minerals matters. By integrating mining into a large tech company, we could better fulfill our initiatives while meeting the current demand rate for these minerals. The sooner we meet that demand, the sooner we can attain a clean, sustainable energy future.

Tech companies are significant consumers of minerals critical to their bottom line, and their adoption of the latest technologies sometimes parallels national interests. In 1990 the United States was once the number one producer of minerals globally but now ranks seventh. Many critical minerals are needed to manufacture innovative technologies primarily produced in foreign markets, even if the technologies are manufactured in the United States. If the mineral supply is disrupted, consumer goods will cost more, especially green technologies. For example, if BYD (a Chinese tech company) were to secure a lithium deposit before Tesla, then BYD would have a strategic advantage to produce EVs and control price because it controls the lithium necessary to make the product. By

³ "Syama Mine," RML, <https://www.rml.com.au/assets/syama-mali/>.

extension of BYD, China increases its already-dominant control over the lithium market globally. A company considering BVI could mitigate this risk by nearshoring mineral supply and employing AEVME to expedite production. Tesla has been sourcing minerals in North America that are critical to manufacturing their EVs. By having their minerals close to the market, they can decrease transportation costs incurred, secure supply, control the price of the mineral, and reduce uncertainty resulting from geopolitical tensions. The US should support initiatives that empower private companies to secure minerals needed to develop green technologies by supporting legislation similar to the American Inflation Reduction Act (AIRA).^{4 5 6}

AIRA provides economic incentives for companies to source minerals and domestic production of renewable energy assets. The act incentivizes firms by giving tax credits, grants, and increased loan funding to secure supply chains, increase domestic manufacturing, and penalize firms for products not produced by carbon-free means. This act could mean that firms would increase domestic manufacturing to attain tax credits but increase mineral demand domestically to reduce costs that would burden consumers. Unfortunately, there are problems with the policy. For example, the act requires firms to source 50% of critical minerals domestically or from US allies and increase to 80% by 2026 to make EV batteries. The dilemma is that any vehicles produced before the act's passage have been made in foreign markets at a lower cost. Private firms would be disqualified from receiving tax credits for these vehicles already produced, which means the EV price might remain unchanged. Furthermore, private firms face the dilemma of adjusting their supply chains to receive the maximum tax incentive, which will take time. Until then, consumers may bear the higher EV cost to help the firms transition in line with the policy. Moreover, existing mineral extraction regulation, leasing, and permitting is overdue reform in the US to meet this industry transition. If a streamlined process doesn't exist, firms will be delayed longer, running counter to the objective of AIRA.^{7 8 9}

Policy Options

When private firms consider these specific challenges in sourcing minerals domestically, the carrot needs to be bigger. The bill doesn't consider those ambiguities of the mining process, such as permitting, conscious mining methods, and Mining Law reform. Mining production is delayed because mining laws and regulations are dispersed among several agencies. New initiatives should go beyond the scope of AIRA to consolidate mining laws and regulations under one agency to expedite mine production and regulation enforcement, incentivizing companies to source minerals domestically. There is a precedent of such a federal agency, the US Bureau of Mines, dissolved in 1995. Initiatives to re-establish the bureau have failed due to a previous lack of domestic mineral

⁴ Xiaofei Du and Bingcan Li, "Analysis of Tesla's Marketing Strategy in China," in 2021 3rd International Conference on Economic Management and Cultural Industry (ICEMCI 2021), edited by Atlantis Press (2021), pp. 1679-1687.

⁶ Xieshu Wang, Wei Zhao, and Joël Ruet, "Specialized vertical integration: the value-chain strategy of EV lithium-ion battery firms in China", *International Journal of Automotive Technology and Management* 22, no. 2 (2022): 178-201.

⁷ Congress.gov. "H.R.5376 - 117th Congress (2021-2022): Inflation Reduction Act of 2022," August 16, 2022. <https://www.congress.gov/bill/117th-congress/house-bill/5376>.

⁸ Erik Dietzenbacher & Richard Jong-A-Pin & Kailan Tian, "Global value chain participation and its impacts on industrial upgrading", *The World Economy*, Vol. 45 (2022). DOI: 10.1111/twec.13209.

⁹ Igogo, Tsisilile. 2022. "America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition". United States. <https://doi.org/10.2172/1871491>. <https://www.osti.gov/servlets/purl/1871491>.

demand. The AIRA guides increased demand, but policy is needed for mining law and regulation reform. Given the incentives of the AIRA, a tech firm could realize more benefits today if they were to nearshore upstream processes with American allies and vertically integrate those processes. By nearshoring and vertically integrating with a US partner, a firm could potentially produce within the ambiguity of AIRA at an accelerated rate of production to access those tax credits while producing goods at a lower cost than in the US until reform is passed that would further incentivize private firms to produce domestically.¹⁰

Conclusion

Aside from this example in the US, absent regulation, BVI would reduce production costs by having all upstream processes under the control of a firm to produce at a set rate near or within the borders of their consumer markets. The result is potentially decreasing production and consumer costs while increasing its strategic advantage over a firm's competitors. Suppose consumers demand greener/climate-conscious technologies and markets are transitioning with climate change. In that case, firms should consider BVI to provide these technologies at an affordable cost parallel with market demand and climate policies globally.

¹⁰ "Interior Department Launches Interagency Working Group on Mining Reform." U.S. Department of the Interior, press release, n.d. <https://www.doi.gov/pressreleases/interior-department-launches-interagency-working-group-mining-reform>.

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