

Lithium Triangle supply chains

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Martín Obaya, expert in Latin American lithium mining and supply chains at the National Scientific and Technical Research Council-Universidad Nacional de San Martín in Argentina, talks to *Nature Energy* about navigating lithium supply and demand, highlighting nuance in stakeholder expectations and the importance of research in this relationship.



What do substantive lithium reserves mean for Argentina, Bolivia and Chile, and their role as suppliers of this critical material in the energy transition?

The Lithium Triangle holds 53% of the world's lithium resources. In the context of growing demand and relative scarcity, governments in this region view this resource as a significant asset, offering leverage to enhance their development strategies. The development narratives surrounding lithium have been amplified by its symbolic importance in the shift towards electromobility. This stems from the fact that lithium is currently irreplaceable in the production of lithium-ion batteries, the technology that remains the industry's preferred choice for electric vehicles.

However, the metaphor of the 'triangle' can create the misconception of regional uniformity, which is far from the reality. Each country follows distinct strategies. In Argentina, lithium is largely treated as a conventional commodity, with its economic contributions expected to come primarily from exports, along with some benefits in terms of taxes and employment, particularly for the provinces where the resources are located. Bolivia, and more recently Chile, have taken a different approach. They view the lithium sector not only as a source of revenue but also as a platform for building domestic technological capabilities, especially in relation to lithium-ion battery production and participation in global value chains.

Despite the high expectations around lithium's role in the energy transition, it's important to recognize that the lithium market remains a niche one when compared

to major commodities like silver, copper, or hydrocarbons. Referring to lithium as 'white gold' or likening lithium-rich nations to the 'Saudi Arabia of lithium' significantly overstates its potential impact on these economies.

Who are the primary stakeholders in Lithium Triangle supply chains, and how well aligned are external actor priorities with those of these three governments?

The primary stakeholders in the Lithium Triangle supply chains include national governments, state-owned enterprises, multinational corporations, and foreign governments, as well as private companies involved in the downstream segments of the lithium-ion battery value chain. However, the alignment of priorities among these actors varies significantly across the three countries due to their distinct political and economic configurations.

In Bolivia, the government has pursued a nationalist strategy by establishing a state-owned enterprise, Yacimientos de Lito Bolivianos, which holds a monopolistic position in the lithium sector. Over the last five years, Bolivia has partnered with Chinese and Russian companies – countries that are geopolitically aligned with Bolivia – to overcome technological challenges. On the opposite end of the spectrum, Argentina has adopted a liberal, market-oriented strategy, allowing multinational companies from China, the United States, Australia, and Canada to dominate the lithium sector. Chile occupies a middle

ground, where the state plays a significant role by partnering with both foreign and domestic firms in lithium production.

In general, external private companies, particularly those involved in downstream battery production, tend to prefer liberal frameworks, such as Argentina's. These models offer greater flexibility to pursue private business strategies, as opposed to nationalist models, which can impose stricter controls on external actors.

When it comes to the priorities of lithium-demanding economies, there seems to be an emerging consensus around the need for a more balanced approach. Governments from these countries, notably those in the European Union, increasingly support the implementation of policies that foster the development of local capabilities and promote economic diversification in resource-rich nations. This perspective aligns with the principles outlined by the UN Secretary-General's Panel on Critical Energy Transition Minerals, which advocates for more equitable and just management of these vital resources.

What role does research play in connecting stakeholders and informing decision-making in the lithium mining sector?

Research plays a pivotal role in bridging stakeholders and guiding decision-making in the lithium sector. One of the primary challenges for countries rich in critical minerals is developing governance frameworks that balance three key objectives: 1) promoting value creation through mining activities; 2) ensuring domestic capture of that value through technology transfer, taxes, and job creation; and 3) guaranteeing that these activities are economically, socially, and environmentally sustainable. These objectives often generate tensions, as they involve competing interests and priorities. Therefore, by understanding these competing dynamics and providing evidence-based recommendations, research can help policymakers build governance frameworks capable of navigating these challenges effectively.

What are we currently missing from research on lithium that will be important for future policy making? What can

research offer to ensure not only social and environmental sustainability, but also economic sustainability for lithium-rich countries?

The challenges surrounding lithium span multiple interconnected dimensions, which require a comprehensive interdisciplinary research approach. From a technological perspective, particularly in brine-based lithium extraction, we need innovative production methods that minimize water consumption, reduce waste, and limit the impact on biodiversity. Advancing in these areas will be critical for mitigating the environmental costs associated with lithium extraction.

On the social front, research must focus on fostering a more harmonious coexistence between mining operations and the

communities living near the salt flats. This involves the development of processes that prioritize territorial planning, shared value agreements, and local capability building. Understanding how to balance community interests with industrial activities is crucial for ensuring social sustainability.

In terms of economic sustainability, a major research gap lies in how to build lithium-related capabilities that extend beyond the mining sector itself. Upstream, this requires developing a robust supply chain around mining activities, particularly through the local provision of knowledge-intensive services. Downstream, the key issue is increasing participation in battery cell production. However, this will require systemic solutions, as supply-side measures alone are

insufficient. International experience shows that a prerequisite for developing a battery manufacturing industry – one that processes local lithium resources – is the existence of a large domestic electric vehicle market. Lithium-rich South American countries face constraints in developing such markets compared to wealthier regions. These include the significant price gap between electric vehicles and internal combustion engine vehicles, limited financial resources for subsidies, and the need for substantial investment in charging infrastructure.

Interviewed by Silvana Lakeman

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