Looking for Transformative Innovation in the South

The Case of the Chilean Mining Sector

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1 Context

Development must achieve more than economic growth, it must promote solutions that are environmentally friendly, preserve biodiversity, and promote social inclusion and equality. This case study examined an initiative to broaden perspectives on the development of copper mining and its related industries in Chile.

National System of Innovation (NIS) — In Chile, the Comisión Nacional de Investigación Científica y Tecnológica (CONICYT), under the Ministry of Education, supports the development of advanced human capital and scientific and technological research ; whereas, Corporación de Fomento de la Producción (CORFO), under the Ministry of Economy, fosters productive development. Together, these agencies manage the largest portion of the public budget allocated to science, technology, and innovation (STI). The Consejo Nacional de Innovación para el Desarrollo (CNID) provides strategic guidelines to promote innovation, and acts as an advisory body to the president. The Council of Ministries for Innovation was established to coordinate public action for the support of innovation. Expenditure on R&D was about 0.39% of GDP in 2013.

Most CONICYT funding is allocated to scientific research projects (lasting 2–3 years) that are selected based on excellence criteria and on topics defined by the researchers. This mechanism, which fosters curiosity-driven research, has been in place since the 1980s. Starting in the 1990s, new funding instruments were created for longer-term research in priority areas and for interdisciplinary proposals, but budgets for these

activities were relatively small. Finally, the government recently created a Strategic Investment Fund (FIE) within the Ministry of Economy to finance public and collective goods that may have a strategic impact developing new competitive sectors.

2 Empirical Approach and Main Findings

Copper mining as a development factor in Chile — Copper and its by-products represent more than half of the country's total exports. The industry is driven by substantial foreign investments, and mining is dominated by large companies. The main one is CODELCO, a state-owned enterprise responsible for 30% of total copper production. The relevance of copper for the Chilean economy is clear, but its contribution to national development has been a matter of controversy. Although special taxes are applied to copper exploitation, the impression remains that mining firms make excessive profits. The impacts of mining activity on the environment and neighbouring communities have also been a source of tension. Mining activity requires moving huge amounts of soil and makes intensive use of water, which leads to air and groundwater pollution. Conflicts with neighbouring communities, particularly indigenous peoples over environmental impacts or because of the use of water resources, have resulted in an increasing number of lawsuits.

The link between mining activity and the development of a national goods and services supply industry emerged as a public-policy issue toward the end of the past decade. The experience of countries, such as Australia, which were able to develop a broad spectrum of companies that exported machinery, equipment, and engineering services linked to mining activity, was a source of inspiration.

Agreement on mining as a platform for Chilean development — Three elements have prevented Chile from making more decisive progress in terms of innovation : the lack of agreement on whether or not the State should promote selective policies ; the division and lack of trust among policymakers and the scientific community regarding the orientation and the role of science in development ; and the excessive focus of innovation policy on financing mechanisms, and the scarce attention to standards and regulation that can drive change.

CNID sought to overcome these elements by reaching broad agreement that would focus efforts on economic sectors for national development. Copper mining was a natural candidate. The nature of copper mining makes it difficult to generate technological breakthroughs in existing operations. Decisions on technology are made when exploitation is planned, and there is little scope to test new technologies because the costs of interrupting operations are too high. Therefore, companies seek to use proven technology. To broaden local development, it was necessary to address the technological challenges of new operations, whether they were new deposits or expansions of those in existence.

Conversations with the mining companies identified their willingness to advance the development of local technology. To help develop a strategic agreement that would benefit all parties, CNID established a commission to provide the government, and the country as a whole, with proposals for public and private stakeholders to ad-

dress the challenges of mining and its contribution to national development. In 2014, representatives of various stakeholders, including indigenous peoples, scientists, environmental non-governmental organizations, mining companies, local suppliers, and labour unions, presented a document to the government that reaffirmed that Chile's development needed the mining sector, but that it was imperative for the mining companies to change the way they were running their businesses, particularly regarding their relationship with neighbouring communities and local suppliers, and the impact of their activity on the environment.

The agreement — After 3 months of debate and negotiations, *Mining : A Platform for Chilean Development* was submitted to the president. The document presented a vision for developing a sustainable and inclusive mining industry capable of improving the quality of life for present and future generations. This vision was translated into a set of goals to be achieved by 2035 and a detailed action plan. A short-term agenda, including actions to be initiated during the government's mandate, was part of the document.

The document stated a number of goals to be reached by 2035 : export a minimum of 130–150 billion tons of copper and other minerals in the next 20 years ; position 80% of this production in the first two cost quartiles of the global industry ; have 250 suppliers exporting world-class technology and knowledge-intensive services for a total of USD $10 billion per year ; establish Chile as a worldwide leader in sustainable mining ; reduce the demand for fresh water and energy, and greenhouse gas (GHG) emissions, compared to the base year projected (2010) ; and accomplish a zero net biodiversity impact during the period.

To fulfil these goals, an action plan was prepared to address strategic priorities and layout initiatives that needed to start in 2015. Ten commitments adopted by the signatory institutions were publicly endorsed by the president : create a public–private entity (a council) to promote and supervise actions needed to fulfil the vision and goals of the action plan ; promote dialogue to build a shared vision of mining's future ; build and finance collaborative R&D initiatives by mining companies and their suppliers to address relevant technological challenges ; expand and enhance the ongoing program for the development of world-class mining providers ; produce a major productivity study of the mining sector ; improve the regulatory framework for free, ex-ante, and informed consultation with indigenous peoples and initiate dialogue on matters questioned by them concerning regulation ; strengthen the availability of geological information and improve the access to mining property to create a database on mineral exploration and geological resources ; fortify the capacities of environmental institutions, by designing and implementing a program for the accreditation of laboratories and environmental services, developing environmental standards, regulations, and recommendations, establishing world-class research centres to analyse the state of the environment and ecosystems, and launching a plan for strategic environmental assessments in locations declared a national priority ; propose standards of conduct for all actors in the mining industry in relation to labour, production, and social and environmental issues ; and conduct studies cofinanced by mining and electricity (ge-

neration and transmission) companies to determine the energy requirements of the mining industry.

Implementing the agreement — It is important to highlight some important changes that took place in 2015. The significant drop in the price of copper had a strong effect on the Chilean economy, particularly fiscal income, and structural reforms initiated during 2014 put pressure on public expenditure. The drop in the price of copper also affected mining companies, which reduced expenses and personnel.

The group that developed the action plan, plus the ministers of Economy, Environment, and Mining and executives of CORFO and CONICYT, formed the *Consejo de Alianza Valor Minero* (AVM) as a permanent public–private association to promote the implementation of the agenda. The AVM has become an important actor for establishing dialogue with the government's highest political authorities (the Ministry of the Interior), civil society actors, mining companies, and the judicial branch to explore alternative ways of dispute resolution.

Progress achieved — Four areas linked to innovation and the development of scientific and technological capacities were reviewed : increase the development of suppliers ; enhance cooperative R&D programs of mining companies ; increase the number of mining researchers ; and strengthening capacities in environmental institutions.

Parallel to the creation of the AVM, CORFO established a set of strategic programs to foster competitiveness in selected sectors with public and private participation. One of these sectors was mining, and to avoid duplicating efforts, work to develop suppliers and a shared R&D agenda was undertaken within the same framework by adding the CORFO director to the AVM board. The strategic program for mining promoted by CORFO is executed through Fundación Chile and called Alta Ley.

Alta Ley maintains a technology roadmap that defines the challenges and gaps faced by the sector. To that end, the sector's stakeholders were convened to create a steering committee for the process. This approach has faced two problems : it is a lengthy process and some participants lost interest ; and the mining companies (particularly the multinational companies) have their own ideas of the issues that should be addressed. As a result, companies have reduced their level of representation in Alta Ley, which has reduced the possibilities for addressing challenges and modifying relationships between mining companies and local suppliers. Those in charge of Alta Ley have realized this situation. In response, a project has been prepared to achieve real-time monitoring of environmental impact and structural stability on tailings. As well, mining companies are supporting projects aimed at two issues that are not part of their core business : recycling tires, batteries, and motor oil ; and dust abatement. None of these activities involves a great challenge in terms of technological innovation. A more promising possibility may come from CODELCO, which is working jointly with CORFO to promote the automatization of underground mining. Likewise, a commission has just been established to evaluate foundries and refineries, with the goal of assessing the potential us of solar energy.

The largest contribution of public funding was expected to strengthen capacity for environmental evaluation of large investment projects (including mining). Two ini-

tiatives are important in this regard : building capacities to guarantee the quality of water, air, and soil quality measurements ; and generating baseline studies to characterize ecosystems to have a common framework for evaluating the impact of investment projects (). Both initiatives have faced several issues. Fiscal adjustments and budget reductions have reduced funding for these projects, and there have been issues with preparing the projects because the Ministry of Environment does not have the technical capacities to undertake such a large task in addition to its regular duties. The 2016 budget does include additional resources for financing approximately 25 new researchers (US $3.5 million).

3 Main messages for policy and practice

Although still at an early stage, some lessons and challenges can be highlighted.

Leadership — The Commission's access to key stakeholders in the public sector, in companies, and in civil society undoubtedly helped maintain the participation of different stakeholders. Likewise, it was important to open up new spaces for dialogue with actors who were not part of the initial effort, but who have a very relevant role to play, such as the judicial branch. The active presence of former President Lagos in the initiative also helped attract participation.

Collaboration — Joint work between the AVM team and the CNID has sustained the attention of the different ministries and public-sector services regarding the tasks they must execute to achieve the established objectives. In several cases, this collaboration has provided technical and political support to public agencies to build their capacity to contribute.

Technical Weakness — Despite efforts to support collaborating agencies, technical capacities were over-estimated. The Ministry of Environment, for example, did not have the necessary technical teams to prepare the proposals to be submitted to the FIE. The agencies in charge of fostering STI (CORFO and CONICYT) are important in terms of their relationships with the private sector and the research community, and CORFO is currently working on too many fronts at once, which weakens its contributions.

Coordination — The ability of public institutions to work in a coordinated manner has proven to be more difficult than expected, and demanded greater energy from the AVM and the CNID. One reason for this is the lack of central coordination. For example, CONICYT and CORFO are part of different ministries that have not established as a first priority making progress to a common agenda.

Resource restrictions — The sharp drop of copper prices negatively impacted the ability of government and mining companies to finance activities outlined in the Platform. Progress has been made, albeit at a slower pace. The stakeholders understood that this program had long-term objectives and would face challenges along the way. Unfortunately, funding challenges occurred at the beginning of the effort and delayed the attainment of early victories.

Together, these challenges have slowed implementation of the innovation agenda for mining. Some obstacles are temporary and are being addressed through corrective measures. The structural challenge is modifying the conceptual framework within which the public sector defines its role in catalysing innovation. The traditional approach has corrected for market failure through specific interventions and, to a limited degree nurtured coordination among innovation actors. This case study highlights an integral approach that recognizes and strategically incorporates stakeholders' interests, particularly those of mining companies, and mobilizes political support. Mining companies do not need financial support to advance a powerful R&D agenda — they need to be induced, or pushed to do so. To date, Chile's experience is limited in these regards, although by organizing a continuous dialogue among different actors, this experience may prove critical to supporting an innovative mining industry supported by Chilean society.

Related Resources

CNID. 2014. *Mining : A Platform for Chile's Future : Report to the President of the Republic of Chile Michelle Bachelet*. Comisión Minería para el Desarrollo, Consejo Nacional de Innovación para el Desarrollo, Santiago, Chile. www.cnid.cl/category/comisiones/mineria