

A look at Codelco Chile
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1- Introduction

With good reason, the press continues to address the economic situation in which the National Copper Corporation of Chile (Codelco) finds itself, which would be the most complex since its creation in 1976, since it combines a sharp reduction in its production with a high debt, both issues with complex solutions that negatively affect the company and Chile's current and future tax revenues.

This crisis that the company is experiencing has a solution, as Codelco maintains numerous strengths that allow it to recover its production. It currently has the largest global copper reserves and resources, it is one of the companies with a professional and workers team of the best quality in the world in copper mining, it has fulfilled its market obligations impeccably throughout its history, it has delivered to Chile an enormous amount of economic benefits, and it retains the support of Chileans and of the State of Chile.

The purpose of this document is to identify Codelco's problems and challenges, their causes, and to suggest some lines of work.

The company has three important problems that it needs to solve.

First, since 2009 the country became accustomed to Codelco producing between 1.6 and 1.7 million tonnes of copper per year, accounting only for its own divisions¹. In fact, this was the company's long-term production estimate, up to 2045. Therefore, the reduction in production to a figure of 1.4 million tons of copper that occurred in 2022 was a surprise, which turned into an alarm in 2023 when it was learned that production would further drop to about 1.3 million tons.

Máximo Pacheco assumed the presidency of the Board of Directors on March 30, 2022², replacing Juan Benavides who had held this position since 2018.

As discussed in section two, there were several reasons for production reductions in 2022 and 2023. The actions of the management of mining companies are mainly confined to controlling the production and costs, since the investments are decided by the owner or owners, and the price is set by the market. When a mining company reduces its production,

¹ In addition it counts with participation in mining operations with other companies such as Freeport McMoran and Anglo American.

² The executive president (EP) at the time was Octavio Araneda, who was appointed to replace Nelson Pizarro in September 2019, a position he held until August 2023, from which he retired for health reasons. Between 2022 and 2023 there was Andre Sougarret de PE, a position he relinquished in September 2023. Since October 2023, Codelco's EP is Rubén Alvarado.

its costs immediately increase, so it is no surprise that Codelco's costs have risen sharply in 2022 and 2023.

Codelco's cumulative loss of revenue due to the reduction in production in these two years (2022 and 2023) was an estimated 4,400 million dollars. Codelco went from producing 7.7% of the world's mined copper in 2021 to about 5.7% in 2023³.

Second, Codelco increased its debt from \$3.4 billion (currency of the year) in 2006 to \$5.4 billion in 2010, then to \$13 billion in 2015, to \$18 billion in 2020, and to \$20 billion in October 2023 (Mercurio 10-27-23). This constitutes the highest net debt as percentage of equity of the world's large mining companies.

And third, unlike other large global mining companies, for years Codelco has not had a strategy to maintain or increase its market share in the world, an issue that would make it less and less relevant in time to come. In 1971 Codelco produced 8.8% of the world's mine copper, in 1980 it was 11.9%, and in 2023 it would reach about 5.7%. Its long-term strategy is based on maintaining production from 1.6 to 1.7 million tons.

The fact that Codelco remains the world's largest producer of copper mine is fortuitous, as the world's second-largest copper producer, Freeport McMoran, sold a percentage of its shares in the Grasberg mine to an Indonesian state-owned company in 2019, giving it control of the mine. Otherwise, it is likely that Freeport, and not Codelco, would be the world's largest copper producer in 2023. This is a key prestige aspect that weighs heavily in the support that Codelco gets from Chilean citizens.

When assigning responsibilities for what happens in Codelco, it is important to differentiate between the actions of the company's management, led by its board of directors, and the actions of the owner, the State of Chile, represented by the President of the Republic through the Ministries of Finance and Mining.

While the causes of problem 1 lie in the management of the company, the cause of problem 2 lies entirely in the owner, who has extracted practically all of Codelco's historical profits. And the cause of problem 3 lies with both the owner and the management of the company.

Finally, it should be noted that the origin of these three problems experienced by Codelco predate the current administration.

This paper examines in greater depth the three main questions raised concerning Codelco in November 2023, suggests some conceptual solutions, and does not inquire about the company's incursion into lithium production.

2- Production

³ Considering the production of its divisions, which in 2022 was 1,445,700 tons, while the sum of 49% it has in the Abra and 20% it has in Anglo Sur (Los Bronces and El Soldado), which was 107 thousand tons in 2022, making a total of 1,552,800 tons.

35% of Codelco's copper production reduction between 2021 and 2023 originated in El Teniente, 31% in Chuquicamata underground, and 27% in the Ministro Hales mine. There were some mines that increased their production in this period.

The reasons for this reduction are related to mines and not to concentrator plants or oxide treatment plants. The reduction in the feed of its concentrator plants, means that Codelco can only use a fraction of its capacity.

Mineral deposits are immovable, heterogeneous in their geology and geomorphology, anisotropic in their⁴ composition of both valuable metals and unwanted or toxic metals. The resistance behavior of the rock is also heterogeneous and anisotropic. For these reasons, to which must be added the volatility of the price, the exploitation of a copper deposit has much greater risks than the rest of industrial activities.

The general causes of the reduction in production at Codelco would be due to insufficient knowledge of the geomechanical behavior of the deposits, the deficit in the development and maintenance of the mines during the pandemic, and design flaws of some of the structural projects which have been in development during the last decade.

Insufficient knowledge of geomechanics would have resulted in a higher-risk design of Chuquicamata underground, which meant that in 2022 the mine's development plan had to be fundamentally modified, ensuring the stability of the rock deposit and delaying production by several years.

The collapse suffered in the Ministro Hales open pit in November 2021, also generated by insufficient geomechanical knowledge, was much higher than what was forecast, paralyzing the extraction of ore from the pit and forcing the use of other lower quality supplies for the concentrator, which reduces its copper recovery, and therefore production.

At El Teniente there were delays in the development of the New Mine Level, which has compromised the level of production. There have also been surprises with the behavior of the rock massif since in the first half of 2023 there was the largest rock explosion in the history of the mine, and although it did not generate casualties, it was unexpected and negatively impacted production.

In short, Codelco has consolidated world-class knowledge in the exploitation of underground and open-pit deposits in recent decades, and has managed to form teams with the world's best experts in rock behavior, reinforced by the scheduled and regular visit to Chile of the best international experts.

But this is insufficient to ensure that the events that occurred in Ministro Hales, Chuquicamata underground and El Teniente are avoided in the future. This means that much greater efforts must be made in research and development in geomechanics and rock mechanics in order to prevent the recurrence of these problems.

⁴ The properties of the material change with different patterns in different directions.

The company has repeatedly indicated that 2023 is the worst year in terms of production and that from 2024 this would begin to recover to reach a production in the order of 1.6 million tons in 2029.

The question is whether the market will believe these announcements.

To be credible, Codelco should develop a diagnosis of the set of design and management causes that led to the reduction in production, and the solutions that will be adopted to solve them.

More specifically, a finer diagnosis of what happened should be generated, how much was due to management and how much to design (what has been expressed so far by the administration is that management had much more influence than design factors, but not everyone agrees with this diagnosis), a detailed description of the investments and actions that will be carried out in each of its mines, the production goals, and the organizational forms that the company will take to achieve these objectives, including an objective of greater decentralization and accountability of the divisions, the restructuring of the Vice Presidency of Projects (VP), and the Headquarters which possibly grew excessively in past years.

In short, it is necessary to avoid repeating behaviors both in the design of projects and in the management of the operations that led to the current situation. An example of this is that Codelco sometimes takes longer to decide on a project than other companies, re-examines it countless times, delays investment decisions, and this is extraordinarily costly.

One of the issues that has been under discussion is how much Codelco needs to disclose about the diagnosis and its action plans, including changes in the company's management structure and the way in which its new investment projects are developed. This is for reasons of competitiveness. One of the arguments in favor of not disclosing detailed plans is that other miners don't. Indeed, some of the most pressing problems suffered by several of the world's largest private copper mining operations in the last 30 years were not disclosed, did not come to light, and remain in the memory of a large handful of professionals and executives, but unfortunately not in written form.

The case of Codelco is different; More information should be disclosed, not only because it is a public company, but also because the recovery of production to the levels of long-term plans will take many years and the company cannot withstand being in the eye of the storm for such a long period, since this undermines its international credibility and consumes executive resources that should be occupied with management and not with justification of its actions.

Other experts have suggested that, as a result of what happened, Codelco should be reorganized into separate companies, or into two companies, one with highly profitable assets, as Grupo Mexico did when it created Southern Peru Copper Corporation (SPCC). There are also those who suggest maintaining the current structure but incorporating divisional boards that provide a counterweight in decisions at that level.

Finally, there are those who suggest that the problem that caused the drop in production originated from inexperienced boards and that it would be necessary to reform the board to get around the current situation.

Separation into independent companies as well as board reform can be evaluated, but it would be too premature to implement either of these solutions now.

Regarding a deeper reorganization of Codelco, it is worth remembering that the structure follows the strategy and not the other way around. Changing the structure without being clear about the reasons and diagnoses for which it is modified is not logical.

3- Codelco's debt

Codelco's high debt is due to the fact that the State of Chile, i.e. its owner, contributed only 7.1% of the 83.7 billion dollars (2022 currency) invested between 1977 and 2022, from the State's⁵ own resources,⁶ while private industry typically contributes between 20% and 30% of total investment from its own resources. Codelco received minimal reinvestment between 1977 and 1989. After that, it did not receive resources from the Treasury until 2009 and, subsequently, it only received resources between 2014 and 2018.

How did Codelco manage to invest \$77.8 billion with purely its own resources between 1977 and 2022 without borrowing more than it has so far?

The answer is that Codelco was allowed to use depreciation to invest, which it can still do, but now this is no longer enough.

Until 2000, Codelco's mines were so rich in high-grade ores⁷ that production costs were very low, requiring small concentrator plants, much less energy, less fuels, fewer reagents, less equipment and fewer spare parts. Codelco's profits were extraordinary.

Of the assets that Codelco sold⁸, none of them were authorized for use in its investment.

In short, while two to three decades ago having cost overruns in the construction of new mines could be easily avoided due to the high richness of minerals, today this is not possible, since mine designs are much more adjusted to make them globally competitive.

The other reason that made it possible to pay for these investments was that until 2000 it was not necessary to make structural changes to Codelco's mines, that is, it was not necessary to transform Chuquicamata into an underground mine, nor was it necessary to make a new mine level (NNM) much deeper in El Teniente, nor was it necessary to modify the production structure of Andina, nor was there any need to reschedule production at the Salvador mine. Mine maintenance and development was also much less expensive than in

⁵ Own estimate.

⁶ According to Máximo Pacheco in Clapes UC seminar, September 26, 2023, this figure was not 7% but 3% between 1971 and 2022.

⁷ In 1976 the average grade of Chuquicamata that fed its concentrator plants was 2.38% (Codelco's Manual of Basic Statistics), it was 1.46% in 1989, 1.11% in 1999, and it is 0.82% in Chuquicamata underground in 2022. At El Teniente, these values were 1.55% in 1976, 1.36% in 1989, 1.16% in 1999, and 0.86% in the New Mine Level in 2022. In addition, the depth of the mines increased, adding costs to the extraction of the rock.

⁸ It sold relevant assets in 1995, 1997, 2008, and 2012.

2022. What these structural transformations meant for Codelco was a much more capital-intensive investment than had been done before. Between 1985 and 1990 the capital intensity invested by Codelco was 0.32 million dollars (2022 currency) per ton of copper produced, while between 2010 and 2022 the average investment was 1.9 million dollars (2022 currency) per ton produced.

The agreement reached between Codelco and the Ministry of Finance in June 2022 that 30% of Codelco's profits between 2021 and 2024 would be allocated to reinvestment is a step forward, but insufficient to finance the structural investments that Codelco must execute to complete the transformation of its deposits and that would exceed 4 billion dollars per year from 2024 to 2030 (speech in LME, October 2023).

30% of Codelco's after-tax profits between 2018 and 2022 amounted to US\$823 million (US\$2022 currency), which would have financed 4.5% of the total investments made (US\$16,681 in 2022 currency), including structural projects. In the remainder of this decade, it is highly likely that 30% of Codelco's profits will be less than the 5% of the investments that Codelco needs to carry out, since the corporation will be producing less than its historical average, and therefore will have higher costs and lower profits.

Codelco's very high taxation⁹, much higher than that of private industry, makes it impossible for the company to pay the debt with the cash generated¹⁰ by its operations, since its regime production will not recover until 2029, the year in which its debt will be much higher than the current one.

These are the aspects that Moody's Investor Service considered on October 4, 2023 when downgrading Codelco's risk rating from A3 to Baa1 for European credit instruments and global bonds. In addition, Moody's downgraded the company's Basic Credit Assessment from baa3 to ba2 with a negative connotation.

The other two major credit rating agencies, S&P, maintained Codelco's rating at A- for the long-term at the national level and Fitch downgraded it from AAA to AA+. S&P also said it would not revise Codelco's rating in the near future. It is indicative that single-producer companies (only copper or other metal) such as Freeport, Antofagasta Minerals, and Southern Peru Copper Corporation, to name a few, none have an A rating, which is reserved for BHP and Rio Tinto as multi-commodity and multi-geographic producers.

Codelco is the only single-producer copper company with A classification. The reason for this is that the company is considered to have a long and impeccable historical record, and also has the support of the State of Chile, however this is not written in any decree or legislation.

In short, if the scheduled set by Codelco until 2029 to recover its production is maintained and with the copper price scenario forecast for the next 5 years by most international

⁹ Codelco pays a 10% ad valorem royalty on its sales, then pays the old royalty tax approved by Congress in 2010, plus a 25% first-category tax, plus a 40% excise tax on state-owned enterprises. From 2024 it will begin to pay the Royalty agreed in the 2023 Law, which is substantially higher than that of the 2010 Law.

¹⁰ In 2018, Codelco's after-tax profits were US\$189.7 million, in 2019 they were US\$14.5 million, in 2020 they were US\$256.8 million, in 2021 they were US\$2,051, and in 2022 they were US\$361.6 million (2022 currency).

companies and investment banks, Codelco will continue to increase its debt when executing its structural projects, which are essential for the future. In an adverse price scenario, Codelco will have to increase its debt more quickly than expected to meet its commitments and continue investments. Neither of these two alternatives is convenient, even if the company is backed by the State, as Codelco de facto is.

It is imperative that the Government resolves this debt problem before the situation can become more pressing.

What are some alternatives at hand?

A first alternative is to commit the State to financing 100% of the investment that Codelco needs between now and 2029, valued at approximately 4 billion dollars per year, from tax funds. The company's pre-tax earnings would not be sufficient to fund such an investment if the future price is comparable to the recorded price from 2018 to 2020. Only a price higher than that of 2021 would allow investments to be financed with pre-tax profits.

A second alternative is for the state to now reinvest about half of its current debt in the company.

A third alternative is to incorporate third-party capital into current operations (divisions), such as the Fund that Norway or Saudi Arabia have, or even funds from private companies. This would require amending a constitutional law and transforming Codelco into a joint venture, an action that would possibly be widely rejected by public opinion and also by the Corporation's unions.

It is clear that these alternatives cannot be suggested or promoted by Codelco, since it is not within the company management duties to tell the owner what to do with its profits.

That is why it is up to us Chileans to take action.

4- Codelco around the world

A goal of every global mining company is to increase or maintain, but in no case lower, world market share.

In 2011, Codelco's executive president pointed out that in 2019 Codelco would produce about 2.2 million tons in 2019. In 2015, production was projected to exceed two million tonnes in 2023 and to remain above this level until 2039.

By the end of 2017, the projections had already dropped and Oscar Landerretche, Chairman of the Board since 2014, was reflecting on the possibility that Codelco would set itself a strategic goal in the long term, to stop being the world's leading copper producer, and rather be a large production company with very low costs and high efficiency and productivity. This strategic goal was never consolidated nor was it widely known to the public.

Subsequently, Octavio Araneda, executive president since the departure of Nelson Pizarro in 2019, showed the future production of Codelco's divisions until 2045 remaining at levels of between 1.6 and 1.7 million tons.

Why can't Codelco, with its current mines, increase production more than the levels pointed out by Octavio Araneda in 2021 (April, CRU Conference)?

The nationalization of copper in 1971 included the mines of Chuquicamata, Salvador, Andina and El Teniente, which were called the Great Copper Mining (GMC). These mines increased their production based on expansions of their deposits from 571 thousand tons in 1971 to reach a maximum production of 1.32 million tons in 2001, and subsequently began to reduce their production to 862 thousand tons in 2022. Codelco's production was able to reach what it was between 2009 and 2021 thanks to the new Radomiro Tomic, Gabriela Mistral and Ministro Hales mines, which began production in 1997, 2008 and 2014, respectively. In addition, it incorporated 49% of El Abra into production from 1996 and 20% of Anglo American Sur from 2013.

Codelco also tried to develop a mine in Ecuador, enterprise that did not progress due to a dispute with the Government of Ecuador, and the purchase of deposits in Africa and Mexico was analyzed, an operation that ultimately did not prosper.

Of the mines that are 100% owned by Codelco, the only one that has prospects of being able to increase production substantially is Andina, which in fact could even quadruple its modest 2022 production of 170 thousand tons, despite being the largest copper deposit in the world. This is a technological and environmental challenge because this mine is located in the Andes mountains at the head of the Aconcagua valley in the Valparaíso Region, it is close to several glaciers, and greater production would require expanding the Ovejerías tailings deposit that is 25 kms from the northern exit of Santiago. A fraction of this expansion would be included in the company's structural investments projected to 2045.

The other mine that can be expanded in production is Radomiro Tomic, which can be built a concentrator plant. This is contemplated in the structural plans until 2045, but it should be noted that this alternative has already been delayed for more than 10 years, due to the company's lack of definitions, perhaps due to a lack of capital or human capital to face so many large projects simultaneously.

Codelco's other mines, especially the two underground mines, have technological limitations for their expansion, even though they have reserves for more than 50 years. For now, there is no possibility of expanding the production of the Ministro Hales and Radomiro Tomic mines with respect to what is already included in the structural projects until 2045.

Finally, Codelco has not, according to public knowledge, discovered large deposits that it has not yet developed. It has its own exploration projects and with other companies (e.g. Rio Tinto and BHP), although they remain prospects for now. That could change in the coming years, but we don't know.

In short, if production is to grow in 10 years from now or more, Codelco would have to buy existing deposits, or mines that are already in operation. To carry out this strategy, it has the law that allowed it to tender the El Abra deposit in 1993, and it will require partners to contribute capital either as minority or majority shareholders, as appropriate. It is obvious that partners such as the Norwegian Sovereign Wealth Fund or others should not be controlling as they would not be able to build and operate a mine. On the other hand, it is not difficult for Codelco to get partners for copper projects in Chile, where having Codelco as a partner in copper production may be an advantage.

Growing Codelco's market share in the long term is indispensable if we truly believe in this company. Of course, the other two problems must now be addressed with greater urgency, the recovery of the production levels pre 2022, and the reduction of debt, while maintaining the structural investments that must be made.