

Chile Builds a Foundation for the Future

A resource-rich country deals with scarce commodities: energy, water and skilled labor.

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Cover photo: Andina expansion project, courtesy of Codelco.

Chile: Where Copper is King

Has Chile become a victim of its own success?

Since the late 1990s, Chile has been cementing its much-deserved reputation as a model of stability in a region that has been prone to economic turmoil. In 2013, the country was ranked seventh in the Heritage Foundation's annual Economic Freedom Index, with special mention being made of the efficient judicial system, prudent public finance management and attractive investment code, which encourages entrepreneurial ventures. In 2009, Chile became the first South American country to be granted full membership of the OECD and in the intervening five years it has seen solid GDP growth of 5%, while inflation and unemployment levels are the envy of struggling European nations.

The role that mining, and particularly copper mining, has played in this development cannot be overstated: "It has been estimated that for every dollar invested in mining, between \$7 and \$13 are spent on infrastructure and associated support services. The upshot of all this is that Chile now has one of the best-developed infrastructure systems on the continent," said Colin Becker, partner at PricewaterhouseCoopers.

While the economy is gradually becoming more diversified, with important roles played by the forestry, wine and tourism industries, there is no denying that copper is king. The red metal now makes up some 20% of GDP and 60% of total exports, and with over 28% of the world's reserves, Chile has prioritized the copper trade above all others. The country now accounts for 32% of world

production, with a major proportion of output finding its way to the Chinese construction industry.

Corporacion Nacional del Cobre (Codelco) remains the largest copper producer in the world, although its production has been in decline recently as they are struggling to deal with ever-lower ore grades in their mature mines. In spite of this continued dominance of global copper production, the picture is not entirely rosy for Chile's mining sector: total mining exports in 2013 declined by 6.2% from 2012 levels, and for the first time in many years the country has dropped out of the Fraser Institute's top 10 most competitive mining jurisdictions.

The reasons for this fall from grace are various, and the weight that should be assigned to each is debatable. To some extent, Chile has been the victim of its own success. The decade-long commodities boom that has led to Chilean mining engineers and technicians becoming some of the best paid workers in the world has also caused a sharp rise in production costs, with some estimates putting the increase at 40% in the last five years.

As copper prices continue to retreat to lower levels, the industry is also being confronted by the twin threats of rapidly increasing energy prices and a glaring lack of freshwater supplies. The mining industry is the single largest consumer of electrical energy in the country, and today it is facing a supply crisis, while in all areas north of Santiago demand for water now exceeds supply.



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Junior Exploration

The Struggle to Regain Momentum



After rising steadily for the best part of a decade, exploration activity in the country dropped by some 60% between 2012 and 2013. Photo courtesy of Codelco.

2013 was a historically bad year for juniors looking to raise capital on the markets, and this translated into a climate of inertia amongst Chile's exploration community. After rising steadily for the best part of a decade, exploration activity in the country dropped by some 60% between 2012 and 2013. However, even before the current downturn took hold, Chile had long been seen as a jurisdiction that favored larger companies.

According to Pablo Mir, partner at law firm Bofill Mir & Alvarez Jana Abogados, the roots of the current situation can be traced back to the establishment of the country's mining property system, which was introduced in the 1980s as part of a series of reforms enacted by the Pinochet government. "One of the more controversial aspects of Chile's mining law is that once a company owns a concession they have no legal requirement to develop it. Their sole obligation is to pay an annual license fee. While this highly liberal system helped the industry to develop in the early days by encouraging investment from large foreign corporations, it is now holding the sector back," said Mir. As there is no obligation for concession holders to develop their concerns, it is in the interests of the majors to buy up extensive tracts of land even if they have no intention of exploring them. This has led to the situation today whereby approximately 70% of concessions are owned by a handful of large companies, making it difficult for juniors to get a foot in the door.

"Most of the majors are unwilling to sell as they prefer to explore their own claims, and although land in the hands of smaller firms and private holdings is easier to get hold of, the prices they are demanding are often exorbitant," said Timothy Beale, president and director of Canada-based Iron Creek Capital Corp., a Chile-focused junior explorer that has recently entered into an agreement with Kinross to prove up their 50,000 ha Las Pampas project.

A second underlying factor that has hindered the development of a local exploration industry is the lack of finance available in the country for mining operations. "Although it might seem counterintuitive given the predominant role played by mining in the economy, there is a serious disconnect between Chilean finance and Chilean mining," said Felipe Swett, partner and business director at Asset Chile, one of the few local financial institutions with a high level of mining expertise.

As a result of this, there are no wholly owned Chilean exploration companies and unlike in Peru, where the Lima Stock Exchange is developing into a dynamic center of mining activity, the Santiago

stock exchange is almost entirely devoid of mining companies. "This situation exists in part because the largest miner, Codelco, is state owned and has no third party shareholders, and also because the major private mining companies in the country are foreign corporations," said Asset's president, David Gallagher.

Nevertheless, for those companies that have been able to secure financing, now is certainly a good moment to be planning new exploration campaigns as the drop in demand has pushed down drilling prices by up to 25%. There is renewed optimism in the industry that a similar effect will be observed in property prices.


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New Copper Projects

The Great Investment Discrepancy



Brass completed the basic and detailed engineering for the tailings pump station and distribution pipeline. Presently, the system is in pre-operational phases: mechanical completion, pre-commissioning, commissioning, and start-up. Photo courtesy of Brass.

After the boom of the previous decade, which saw a huge amount of investment in new major projects in Chile, the scramble to build seems to have subsided for the time being. Now, there is considerable debate regarding the next decade's investment projections. According to the official project portfolio published by Cochilco and frequently referred to by government figures, total investment in the mining sector

between 2013 and 2021 will amount to \$112.6 billion.

However, closer examination reveals that several of the projects included in this estimate have been put on hold indefinitely or even cancelled, while several more are still at the discussion stage and have not been given the green light by the boardroom. This impressive figure also masks the fact that these investments will not serve to

increase Chile's production capacity by any significant margin. In fact, the next wave of investment projects will only be sufficient to maintain today's capacity.

"When we look at new greenfield projects, the total level of concrete investment is closer to \$30 billion, which is still an immense sum and a considerable achievement for the sector. Beyond this initial \$30 billion it is true that there are further opportunities under consideration, but to refer to them as guaranteed investments is highly misleading," said Joaquín Villarino, executive president of Chile's Mining Council.

Part of the reason for this drastic difference in opinion is the tendency for projects to overrun and deadlines to be broken. "Look at the recent personnel shifts in the top echelons of the major mining companies around the world and you will see that many of these were the result of poorly executed projects... As an industry, we can do better than this," said Claude A. D'Cruz, senior vice president Americas at Worley Parsons. This is partly a result of the heightened levels of activity, which left engineering contractors stretched to the limit and without sufficient time to carry out adequate front-end work. However, some blame it on the prevailing EPCM model of project management, by which one major contractor was responsible for delivery of the total project. "It is true that this approach gives the client an overarching guarantee for their project, but it is unclear if it can really help save time and cut costs. In the long term I believe we will see a return to the old way of doing things, with a variety of specialized contractors working together to deliver the total project," said Andres Osorio, commercial manager for STM.



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Andres Osorio, commercial manager for STM.

Codelco has already returned to this model and now divides projects into a series of component parts that are subcontracted to a range of different firms. The state-owned copper giant is embarking on an ambitious \$27 billion investment package comprising five so-called structural projects: the greenfield mine, Ministro Hales, the transition to underground mining at Chuquicamata, the development of a new mining level at El Teniente, the expansion of Radomiro Tomic and the large expansion of Andina. "It is an ambitious program, but given that the company has perhaps suffered from under-investment in the past, we believe that in order to meet our production and profitability targets, the best course of action is to carry out all these projects simultaneously," said Codelco President and CEO Thomas Keller.

Perhaps the most closely observed of these projects is the Chuqui Underground Project, which will see one of the country's oldest active mines make the transition from open pit to subsurface operations. The \$3.83 billion project is one the most expensive underground transitions ever attempted and will require the services of more than 3,000 workers during the construction phase, adding another 50 years to the mine's useful life, eventually generating some 4,500 long-term jobs. Although the initial investment may be high, the eventual payoff will be significant: the pit is now 850-m deep and trucks are using more than 3,100 liters of fuel per day on the 11-km route to the surface. The shift to block caving will instill a new level of operational efficiency and prevent transport costs from escalating any further.

Named after Alejandro Hales, one of the architects of Chile's modern mining industry, the Ministro Hales mine is located in Chile's II Region and has been under construction since 2011. The pre-stripping operation, which was carried out between April 2011 and August 2013, was the largest undertak-

ing of its kind ever seen and entailed the removal of 228 million mt of waste material. Over its initial 14 year lifespan, the mine is expected to produce an average of 170,000 mt/y fine copper and a further 300 mt/y of silver. There is further potential to develop an underground operation at the site that would extend the mine life by 50 years.

Staying in Region II, one of Chile's largest greenfield projects in development is the Sierra Gorda copper project. A joint venture between KGHM International and Japanese companies Sumitomo Metal Mining and the Sumitomo Corp., the mine will be the Polish copper producer's first major operation in Latin America. "Initial production is set to be 110,000 mt/d, which will then rise to 190,000 mt/d in 2017, with the opportunity to carry out several further expansions and bring in an SX-EW plant as well. We then hope to develop some other deposits on the property that will increase the mine life by another 10 to 15 years," said Derek White, CEO of KGHM International.

In addition to the primary copper production, the operation will also deliver a significant secondary production of molybdenum, opening the door for KGHM to become one of the world's leading producers of the metal. Seawater will be pumped to the site via a 143-km seawater pipeline running from the

coast to the pit. The saltwater will be used for first-stage processing and will then be passed through a reverse osmosis plant to create fresh water for use in the molybdenum plant.

Another interesting project that is fast approaching production is the Pampa Camarones copper mine near the northern city of Arica. Although it is a relatively small mine by Chilean standards, its shareholders make it a noteworthy development: the project represents the first foray into mining by Korean technology giant Samsung, which owns 51% of the operation and plans to integrate the copper production into its existing supply chain. Once the mine goes into production there are plans to rapidly increase output to 12,000 mt/y and eventually to 24,000 mt/y. This is still a fairly modest figure by Chilean standards but is perhaps representative of the shape of things to come. From a geological standpoint it is unlikely that there are many deposits of the scale of Colahuasi or Escondida left to discover, while the prospects for mid-size mines are far more promising. "There are a great number of companies developing projects in the range of \$10 million to \$100 million while many of the multi-billion dollar projects are now on hold," said Pampa Camarones' vice president for operations, Daniel Berrios.

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A New Direction for Codelco

Interview with Thomas Keller, CEO and President, Codelco

Would you agree that a certain tension has developed between Codelco's long-term investment needs and the more short-term budget requirements of the state of Chile?

It is true that this tension exists, but it is nothing new: as a state-owned company we always have to fight hard for funds, and this has been the reality since Codelco's inception. This situation has perhaps attracted more attention today because of the sheer size of Codelco's current investment program. The mining industry's loss of momentum came as no surprise to us: for the past 15 months we have been working on establishing a robust platform to improve Codelco's competitiveness. In the future we will contain cost escalation by increasing asset utilization, improving our contractual arrangements with third parties and by boosting productivity. The board of directors has defined a very clear financing strategy, which is centered around preserving our investment grade and, thus, maintaining a

reasonable debt level. The retention of profit that has been requested by Codelco reflects this financing strategy. While actual profits retained have from time to time fallen short of our expectations, government authorities have been in general supportive of our investment program.

It has been predicted that Chile's human capital deficit could run up to 64,000 people in the next years. How does Codelco plan to combat this skilled labor shortfall?

We believe that the size of the skilled labor shortfall is being very much overestimated because it has been predicated on the execution of many projects that are not firm and that will be either postponed or shelved. Still, it is true that the mining industry in Chile did not fully anticipate the impact that the mining boom would have on the labor market. As a result, labor costs have risen very significantly over the past few years. Today, however, the major mining companies are involved in



a number of initiatives to address this situation. Perhaps the most significant measure being taken at an industry level is through the Consejo Minero's Consejo de Competencias Mineras scheme. This skills council approach essentially follows the Australian educational model and will have an important and positive impact on the industry. The number of students enrolled in courses at technical institutions in geology, mining engineering, and metallurgy has grown exponentially over the past year. Admittedly this has happened slightly too late, but we are now catching up very rapidly.

How do you evaluate the threat posed to the international copper trade by substitution from other materials?

Copper producers have faced the threat of substitution for many years. In fact, in certain areas copper has already been displaced by other materials, such as in the case of high-tension electricity cables and radiators. This threat will continue and the challenge is to defend our markets by improving our performance in existing applications and by identifying and promoting new uses for copper. We have indeed been successful in finding new applications for copper and intensifying the use of copper in other markets. One of the areas in which Chile has been leading the world is in making use of copper's antibacterial properties in such diverse areas as hospitals and metro stations. Copper is associated with some of the most relevant trends in the transition to a modern society: increased energy efficiency, the "democratization" of information technology, and of course urbanization in emerging economies. Copper is thus the metal of the future.

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Power Supply Shortfalls

The Rush to Meet Demand

Ask any miner in Chile what the single most serious challenge they are facing today is and they will invariably reply “energy costs”. While Chile may be a world leader in copper production, its power generation capacity has struggled to keep pace with growing demand, resulting in extremely high electricity rates. A recent survey commissioned by the Mining Council demonstrated that amongst fellow mining countries, Chile’s energy prices are second only to those of the Democratic Republic of Congo. With a minimal endowment of fossil fuels, the country has long relied on hydroelectric generators powered by its many rivers to meet demand in the South, and thermal plants that burn imported coal and, increasingly, natural gas in the North. There are four operational electricity systems in Chile, the two most important of which are the Central Interconnected System (SIC), which accounts for 75.8% of total installed capacity, and the Greater Northern Interconnected System (SING), which accounts for 23.3% of installed capacity and supplies the majority of the country’s large mining operations.

The difficulties are by no means shared equally between the two grids, with the SING currently in far better shape than its southern cousin. Energy costs in the north have actually stabilized somewhat over the last year thanks to new power stations coming online, although it is unclear how long this will last: “The situation is still quite precarious, and we believe that a small increase in demand could cause a sudden spike in prices,” said José Ignacio Escobar, general manager of Mainstream Renewable Energy, which is currently developing 3,300 MW worth of wind and solar plants that will supply both grids. However you choose to interpret current investment forecasts, several major mining projects are going to come online in the north in 2014, and these will constitute more than just a small increase in demand. Yet, there are no corresponding power generation projects scheduled for the development over the same period. In recent years, a number of power projects in Chile have in fact been suspended or put on hold, generally because of difficulties securing environmental permits, although in some cases community resistance has been the deciding factor.

Some, such as the colossal HydroAysén dam in Patagonia, have attracted international attention. However, it is not only these headline-grabbing mega-projects that have been halted. In Chile’s III Region, which is seeing the fastest growth of mining activity in the entire country, 80% of conventional energy projects slated for development have been stalled, creating an extremely delicate situation. The previous government’s failure to implement a coherent energy strategy has had a tangible effect on foreign investors’ perception of the country: “The inability to accurately project energy costs when developing a multi-billion dollar investment is a huge stumbling block for the sector, and is resulting in a slowdown in the flow of new projects,” said Sebastián Pinto, general manager for Latin America for Orica.

So what is to be done?

Over time, a certain distance has arisen between mining companies and energy providers: the former accuse the latter of charging exorbitant prices, while the latter berate the former for their unrealistic expectations and refusal to accept market rates.

This has led some mining companies to take matters into their own hands and experiment with developing their own in-house

generation capacity. This year, the solar plant at Antofagasta Minerals’ El Tesoro mine came on stream. The plant, Chile’s first Concentrating Power Project (CPP), was developed by Abengoa Solar and reduces the amount of fossil fuels used in processing by 50% while reducing CO₂ emissions by 10,000 kg/y. Elsewhere, Barrick’s Punta Colorada wind farm in Coquimbo generates 20 MW for the SIC, and Collahuasi is now developing the country’s largest solar plant, which will eventually provide 13% of the mine’s needs during the day.

Although these projects have an obvious appeal to mining companies with the necessary capital to bring them to fruition, many in the energy industry are skeptical of their long-term value: “They served as a good example of the possibilities that exist for mining companies to make use of renewable energy, but in the future the industry will need large-scale projects capable of supplying multiple consumers. We do not see private plants for own-consumption playing an important role in the future,” said Escobar of Mainstream.

A third way?

Hidromaule is a developer and operator of small hydro plants that currently runs three operations in the San Clemente region, which provide a total of 41 MW for the SIC. General manager, Carlos Weber, believes that what is really needed is a greater level of coop-

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Carlos Weber, general manager, Hidromaule.



Alejandro Palma J., general manager, SRK Consulting Chile.



Roy Betinol G., P.E., president and general manager of Brass Chile.

eration between miners and smaller energy suppliers. "We believe that the best form of collaboration is to enter into long-term supply contracts with [the mines]. Unfortunately, most of the miners are not willing to pursue this option as they are not willing to pay the market value of electricity," said Weber.

Given that most of the sites suitable for large-scale hydroelectric projects are already taken or, in the case of HydroAysén, blocked by the courts, it makes sense for heavy users to start negotiating with the smaller providers. While no single generator would be able to provide a mine with all the energy it requires, by coming to arrangements with a spread of different power companies, miners would be able to control their costs in the long term."

"If Hidromaule could enter into a 10-year contract at a fair price, then we would be in a strong position to develop our next 40 MW of capacity and thereby increase our overall level of supply. If this

process were replicated with a great number of similar size producers then we would start to see much more investment in developing new capacity and in the long term that would help to bring prices down. However, today this is not happening and so prices will remain high," said Weber.

Quenching Northern Chile's Thirst


The Atacama desert is a vast wilderness that covers some 40,000 square miles of northern Chile, bridging the gap between the coastal mountains and the Andes. The desert sees an average yearly rainfall of approximately 15 mm per year, although in certain areas no rain has been recorded for more than 400 years, making it the driest hot desert in the world. Yet, ironically, its vast metallic and non-metallic mineral wealth has made it a hub for water-intensive resource extraction since the 1880s, when British and American miners first flocked to the region, attracted by the rich nitrate fields.






Until recently, mining operations drew from aquifers high in the Andes or made use of salt lakes within the desert itself for their water, but as a result of the mining industry's meteoric growth over the past two decades, increased competition from other users and a prolonged drought, fresh water is fast becoming northern Chile's most scarce resource.






One option that has frequently come under discussion in recent years is the construction of a so-called "water highway" that would transport immense quantities of river water from the country's well-hydrated southern regions. Although attractive, the engineering challenges associated with moving water over such great distances are substantial and, as of yet, there has been little concrete development in this regard. The chances of such a project coming online before the next decade are slim.





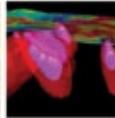
The more practical alternative is to make use of Chile's extensive coastline and bring seawater to the mine via a high-volume pipeline and then construct an onsite desalination plant. There are already a handful of operational plants in the region, the first of which was BHP Billiton's Planta Coloso, which provides fresh water for the Escondida Mine.





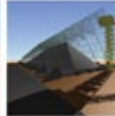
However, desalination is not without its drawbacks: "It is a very costly, energy intensive process, especially when you consider the quantities required for mining applications. Most of the pipes we work with to transport slurry are between six inches and 10 inches in diameter, but the seawater pipelines can range up to 42 inches or 48 inches in diameter. These projects require thousands of liters per second to be pumped up several thousand meters of elevation," said Gregg Hodges, general manager of Ausenco Chile, an Australian EPCM contractor with a particular focus on pipelines, tailings systems and heap leaching.



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Although miners may balk at the costs involved, salt water is often the only realistic option for greenfield projects. "The major companies are going to have to live with the increased cost. Their margins will undoubtedly suffer a reduction, but if the alternative is to write the project off altogether then it becomes a very easy decision to make between making slightly less profit or making no profit at all," said Alejandro Palma, general manager, SRK Consulting Chile.

In this light, it is easy to understand why construction of desalination plants is booming: estimates from the Spanish water firm Aqualogy suggest that by 2016, Chile's total desalination capacity will have increased from approximately 120,000 m³/d to nearly 650,000m³/d.

The associated flurry of activity in pipeline development has also led to a high concentration of expertise within Chile's engineering community. "Given that energy costs are so high here, Chile is now moving into a position of worldwide leadership in the field of innovative, low-energy water pumping solutions, which combine large flow rates with very high pressures... The only other country in the world that has developed such large-scale water pipelines is Saudi Arabia, and they do not have to deal with mountainous terrain, so this is a good example of Chil-



Richard Araya, general manager, Golder Associates.

ean needs acting as a motor for innovation, said Roy Betinol, P.E., president and general manager of Brass Chile, a company that works with the engineering and design of pipeline systems for transporting fluids with a specialty in handling slurry.

Although expensive pipelines and complex desalination facilities may be the standard for the mines of the future, many existing operations that acquire their water from more traditional sources are taking steps to decrease their current water usage and minimize losses: "Conventional tailings and waste-water systems can be immensely wasteful so we are often able to help our

clients conserve and retain a significant amount of water through the use of thickening processes," said Maria Eugenia Parot, president of Golder Associates Chile.

It is true that the thickening process becomes considerably more complicated when applied to very large mines of the scale that is commonly seen in Chile, but recent developments in technology have rendered it a feasible option for all but the most extensive tailings ponds. Aside from using more efficient tailings facilities, miners should also seek to improve their on-site water systems: "By ensuring that there is no cross-contamination between clean and waste water it is possible to substantially decrease the amount of water that needs to be treated and cleaned," said Parot.

This relatively small measure has a direct impact on operational costs and can help a mine to make the best use of precious fresh water reserves. According to the company's general manager, Richard Araya, this is only one of the many areas in which Golder Associates can assist mines in controlling costs: "We have capacity in integrated management of mine waste, water management, ground engineering, environmental and social assessments and permitting, integrated monitoring programs and closure services," said Araya.

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Innovation in Chile

Preparing the Mines of the Future

Cathode removing robotic solution for Anglo American Norte project, developed by the robotic subsidiary of High Service, MIRS. Photo courtesy of High Service.

On January 14 of last year, former President Sebastián Piñera declared 2013 to be Chile's Year of Innovation. This declaration formed part of a \$1 billion public spending initiative spearheaded by the Chilean Economic Development Agency (CORFO), which seeks to promote innovation across key sectors, including mining.

Given the advanced age of many of Chile's mines, this focus on innovative approaches is of pivotal importance: "Mineral deposits are locked increasingly deep into the earth, bringing a whole new set of challenges to the mining community. We cannot keep moving entire mountains to recover small percentages of minerals, so there will

have to be a systemic change in the way we look at extraction," said Rodrigo Undarraga, general manager of Proinsa, Chile's only manufacturer of steel cables.

However, this philosophy is nothing new for Chile, which has long gone against Latin American mining's entrenched reputation for conservatism: "For decades Chilean mining has been an early adopter of new technologies, and you can find the latest innovations across all stages of the production chain in operation here", said Juan Carlos Olivares, general manager of Chile's Association for Mining Equipment Providers (APRIMIN).

For evidence of this, one need look no further than the mine sites themselves, where many operators are investing in automated transport solutions to boost operational efficiency. Codelco has advanced even further down this path and is currently in the early stages of integrating robotic solutions into its smelting and refining facilities.

The technical knowhow behind these robotic systems comes from another Chilean company, High Service, which was established in 1999 to develop and commercialize new technologies for mining processes. "The mining industry has developed considerably over the years, but this development has always been rather linear, and has usually come in the form of improve-

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The company has developed many different technologies like the proximity warning system FleetSafety® for collision avoidance in mine operations, the smart wear sensor SSD® for the online prediction of liner wear in SAG and Ball mills, and a large portfolio of R&D projects. In 2007 along with Codelco, Nippon Mining & Metals, and Kuka Roboter, High Service created a spin off enterprise, called MIRS. The new company is now focused in the development and marketing of new robotic solutions for the different mining process from Mine to Metal.

HighService Headquarters are located in Santiago, Chile, with technical offices located in Antofagasta, Calama, Salamanca and La Serena.



Hugo Salamanca, general manager, High Service.

ments of existing processes rather than any fundamental rethink of how the basic steps should be carried out. The mines and plants have got bigger, but we still keep doing things in the same old ways... we feel that the time is ripe for a disruption of the established conventions," said general manager, Hugo Salamanca.

The company has carried out several pioneering projects, including a cathode stripping system for Anglo American that comprises three robotic arms working together to deliver a process capacity of 200 plates per hour, far exceeding the capabilities of a human.

This type of experimental research is admittedly rather rare in Chile, but the country is home to a growing culture of practical, grassroots innovation. Santiago based electrical engineering firm IDT is emblematic of this philosophy. The company started off as a small operation building rectifiers for the production of copper cathodes in general manager Patricio Lagos' garage, but, over 18 years it has grown into a \$20 million operation that continues to invest 3% of revenues into R&D: "Today we have over 12 technologies registered under international patents in the USA, Argentina and South Africa. However, our research is not focused on cutting edge technical breakthroughs that only benefit a few people; instead we focus on developing solutions to real, everyday problems faced by the mining industry," said Lagos.

Their products have been well received on the Chilean market and now 42% of the country's copper cathodes are produced using IDT's rectifiers. This success has not gone unnoticed and in November 2013 the company was acquired by General Electric. Now GE plans to take IDT's patented technologies to far-flung locations and build the company into a worldwide market leader.

Chile's mining sector is adapting well to the possibilities presented by the convergence of high technology and heavy industry. How-



Patricio Lagos, general manager, IDT.

ever, there is much room for improvement, and a recent OECD investigation found that the number of Chilean companies dedicated to research is relatively low. This is perhaps unsurprising given that the study uses other OECD members such as Japan and Sweden as a benchmark. Nevertheless, the measures suggested by the researchers – the establishment of a dedicated ministry of innovation, forging closer ties between academia and industry, and a reexamination of current innovation policy – are sound. Hopefully, the report will serve as a stimulus for the new government to take concrete measures that will foster growth in this valuable area.



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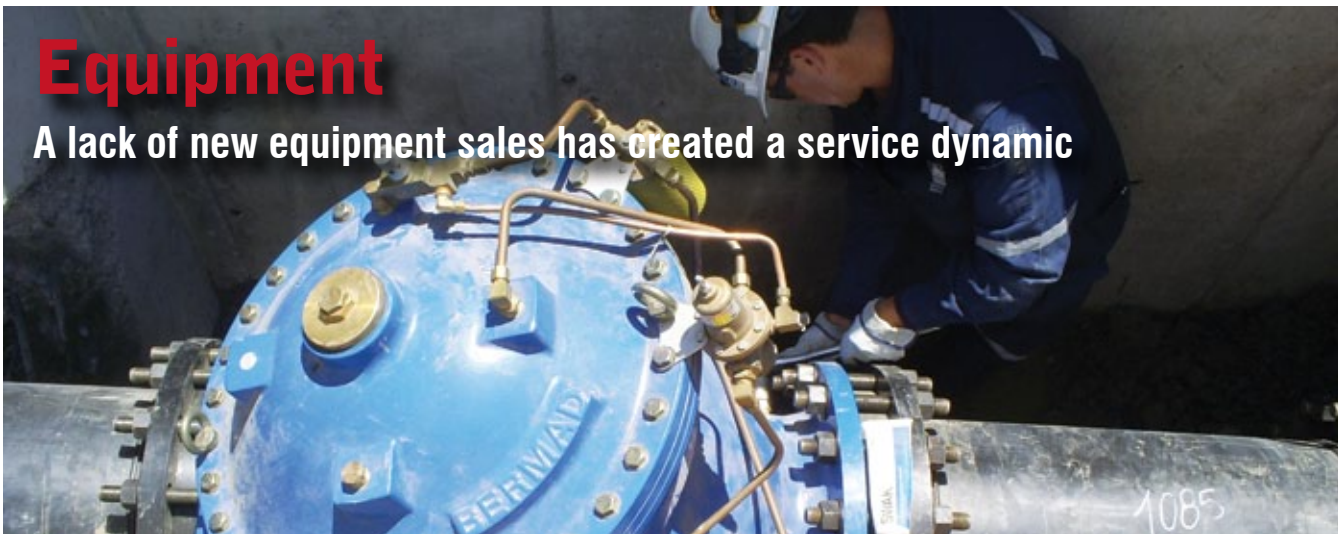


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Equipment

A lack of new equipment sales has created a service dynamic



Calibration of a 16-inch Bermad pressure reducing control valve in a startup for Codelco Teniente. Photo courtesy of Bermad Andina.

After several years that were characterized by a philosophy of growth at any cost, the tide has turned for Chile's mining sector and the new name of the game is efficiency. As such, mining companies are increasingly demanding more from their equipment and from their equipment providers. "In Chile right now, the trend is to outsource any area that is not the core business so as to improve efficiency and reduce costs wherever possible," said Pablo Cruz, general manager of fleet management specialists, Empresas Relsa.

It is no longer sufficient to simply sell machinery, equipment suppliers are now expected to provide optimization services, a

range of tailored maintenance strategies and even investment consulting for their customers.

SKC Maquinarias, part of the Chilean SigdoKoppers conglomerate, is currently Chile's third largest equipment supplier and represents several leading brands including Volvo, Sandvik Mobile and Manitou. The company has carved itself out a substantial niche providing equipment solutions that specifically cater to the often-overlooked small and mid-size mines: "The larger equipment providers have to split their concentration between the large mining and the smaller operations, whose needs are often very different. In our experience it is difficult to achieve a good balance between these different requirements, and the larger providers tend to focus more on the big contracts and provide a lesser after-sales service to the smaller clients," said general manager, Marcial Larenas.

Given the growing role played by the small to mid-size operations, SKC Maquinarias is currently seeking to educate the market and bring the type of advanced maintenance services demanded by the major miners to the mid-size producers.

This focus on controlling costs does not, however, imply that miners are simply looking for the cheapest products on the market: "Unlike customers in certain industries, mining clients are definitely prepared to pay for quality. Their primary concern is not the initial outlay itself, but the promise of operational security. Through our products we offer miners the confidence that their processes will not be disrupted by unscheduled maintenance and lengthy downtime," said Ignacio Sanchez, general manager for fresh water transport specialists, Bermad Andina.

This trait goes some way towards explaining why equipment providers that specialize in extremely basic, low-cost machinery have struggled to gain traction in the market.

Conclusion

At the time of publication, Chile is still adjusting to life under a new government led by President Michelle Bachelet, who enjoyed a landslide election victory last year. While it is still early to gauge what impact her new policies will have on the sector, major upheavals are highly unlikely. Aside from a hike in corporation tax from 20% to 25%, which will be applied across all sectors, there has been no mention of an increase to royalties payments or any suggestion that her administration will be taking a particularly harsh line with mining projects. In fact, Bachelet has

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Marcial Larenas, general manager, SKC Maquinarias.

emphasized the strategic nature of mining for Chile and has stated repeatedly that the industry must recover its competitive edge. While the details of her political program remain vague, statements claim that the government plans to help the domestic industry by bringing down electricity rates and taking measures to stimulate exploration activity.

Today, Chile is, without doubt, one of the most well-developed and exciting mining jurisdictions in Latin America, boasting enormous proved and probable reserves of copper and precious metals that are still awaiting development. While there is a constant need for qualified technicians, the country is home to a high concentration of expertise in almost all aspects of mining, and domestic service providers are able to compete with the largest multinational firms. Nevertheless, the high price of copper that the country has enjoyed in recent years has led to unfeasible operational costs and has propagated a culture of complacency. Now that the boom times have come to an end, miners, service providers and government bodies must work together to rationalize the price environment to ensure that Chile continues to enjoy its status as one of the world's leading mining destinations.



Ignacio Sanchez D., general manager, Bermad Andina.



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