UNIVERSIDAD DE VALPARAÍSO
FACULTAD DE CIENCIAS ECONÓMICAS Y ADMINISTRATIVAS
ADMINISTRACIÓN DE NEGOCIOS INTERNACIONALES

"RESOURCE-BASED VIEW IN THE CHILEAN COPPER INDUSTRY: PROVIDING A STRATEGIC ANALYSIS OF THE ECONOMIC, ENVIRONMENTAL AND SOCIAL BUSINESS MODEL OF CODELCO"

Autor

ADRIÁN LEONEL PÉREZ ESPINOSA.

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PROFESOR GUÍA: TERESA PINO V., Ph.D.

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"Detaching from the species for ultimate matters is not about hubris, is about love"

Dedications

To..

.. my beautiful mother *Ana María*, for being my cornerstone;

.. my exceptional father *Leonel Arturo,* for being always present in every moment;

.. my smart sisters *Alexandra Zibonett, Dhanya Judith* y *Ana Karen,* for accompanying and guiding me on this lunar trip;

.. my favourite nephew *Eithan Xavier*, for coming to complete my life;

&

.. my youngest nephew *Mariano Alonso,* for being my main center of inspiration and my entire life ..

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.. dedicated to my family that is always present in my soul.

Acknowledgements

.. my sincere thanks and appreciation to the *Dr. Teresa Pino V.,* for persevering with me as my advisor through all the time it tooks me to complete this research, and for encouraging me until the end. I am also totally grateful to the *Universidad de Valparaíso* and the *Flinders University of South Australia*, for providing me the opportunity to develop more critical thinking, and for giving me the chance to grow personal and professionally.

.. my thanks as well to my dear friends *Diego González, Claudia Riquelme*, *Paula Galaz*, *Consuelo Ahumada*, *Javiera Bascur, Camila Peña*, *Nicole* Salas & *Diego López* for always supporting and advising me, and being present in every moment.

Finally, I want to thank to *Ilona Solinska*, for providing me the opportunity to work together and for always encouraging me to do my best.

.. Totally thankful..

Abstract

Since 2011 and onwards, the world copper industry is facing a very complex scenario, causing a progressive drop in the copper price. For this, the incomes and surpluses of the National Copper Corporation of Chile (CODELCO) have suffered a notable decline. In order to discover resources and opportunities within the industry, a case of study was developed through a strategic analysis by illustrating the economic, environmental and social business model of CODELCO based on the triple layered business model canvas (TLBMC). Main findings suggests that CODELCO should evolve from its antiquated business model, to a new one by adding extra value to copper. These findings can help to brigde a gap inside the strategic management (SM) theory by contributing to the current resource-based view (RBV) theory, demostrating that this theory can be helpful identyfing resources and opportunities of companies in order to achieve competitive advantages.

Key words: strategic management, resource-based view, strategic analysis, copper industry, competitive advantage.

Resumen

Desde 2011 y en adelante, la industria mundial del cobre se enfrenta a un complejo escenario, provocando así una caída progresiva en el precio del cobre. Debido a esto, los ingresos y excedentes de la Corporación Nacional del Cobre de Chile (CODELCO) han sufrido un notable descenso. A fin de descubrir recursos y oportunidades presentes en la industria, se desarolló un caso de estudio a través de un análisis estratégico ilustrando el modelo de negocio económico ambiental y social de CODELCO, basado en el Modelo Canvas de Triple Capas (MCTC). Los principales hallazgos sugieren que CODELCO debería evolucionar desde su anticuado modelo de negocio, a uno nuevo agregando valor extra al cobre. Estos hallazgos pueden ayudar a superar una brecha dentro de la teoría de la Administración Estratégica (AE) al contribuir con la teoría de recursos (TDR) demostrando que esta teoría puede ser útil identificando recursos y oportunidades de empresas con objeto de conseguir ventajas competitivas.

Palabras clave: administración estratégica, teoría de los recursos, análisis estrátégico, industria del cobre, ventajas competitivas.

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Introduction

The Strategic Management (SM) has been consolidated within the field of Management and Organizational Sciences during the past five decades, and today is widely used by managers worldwide (Guerras-Martín et al. 2014). According to Molina-Azorín (2014), this field has been consolidated principally through the analysis of the internal influences, specifically the resource-based-view (RBV) theory. So, new several researches have been conducted, however, there is still a lack of studies related to companies inside the copper industry, which has been historically a powerful sector of development of many countries worldwide, and today are facing a complex scenario (Valdes, 2015). So, this research seeks to analyze to the National Copper Corporation of Chile (CODELCO) in order to contribute to the SM literature that has been applied to the practice through several researches over the past years (Killen et al., 2012; Posch et al., 2015; Suarez et al., 2016). Here, previous researches have demostrated the utility of the RBV theory (Almarri & Gardiner, 2014; Molina-Azorín, 2014; Bergquist & Lindmark, 2016; Kim et al., 2015) and the useful of its models and tools in the practice, while another, such as Costa et al. (2013) stated that accumulation and deployment of unique resources does not necessarily increase the firm's profit, and also it does not necessarily lead to higher profits.

Problem Statement

Since 2011 and onwards, the world copper industry is facing a very complex scenario called "the end of the super cycle of high prices", relative to a lower demand for commodities by China, causing a progressive drop in its price. Due to this the incomes and surpluses of CODELCO have suffered a notable decline (CODELCO, 2016). Thus, the formulated questions to be answered through this research are: how can the RBV theory be helpful in order to analyze CODELCO's performance into the current copper industry?; what critical resources and opportunities can CODELCO manage in order to

maintain its incomes and surpluses within the current global copper industry? and; does the current CODELCO's business model show horizontal and vertical coherence?

Objectives

The main objective of this study is to carry out a strategic analysis of the main copper producer worldwide CODELCO in the 2015, according to the (SM) theory, specifically the resource-based view (RBV) theory, in order to discover new factors, capabilities, resources and opportunities that contributes to the achievement of new competitive advantages within the global copper industry. In order to achieve this objective through the research, the following specific objectives are meant to be persued.

Specifics Objectives:

- Identify the main influences of SM according to the literature review.
- Describe the current situation of both global and Chilean copper industry.
- Explore the horizontal and vertical coherence of the CODELCO's business model.

In order to achieve these objectives, it is first developed a literature review of the main SM theory. Second, it is state the main methodology of the research which include the description of corporative profile of CODELCO and its main challenges. Finally, its economic, environmental and social business model is analyzed. Main finding suggests that CODELCO should move from an antiquated extractive/exportive business model, to a manufacturing business model by adding differents kinds of value to copper through the development of international operations derivated from its large potential of internationalization. This way, this research contributes to the existing literature on internal influences by providing an strategic analysis of CODELCO, based on a TLBMC model, which demostrated that they are a great weapon in order to discover resources and opportunities inside many industries, and the most cited articles inside the main scientific journals. So, future research should analyze intervals of time instead only one year.

Chapter I

1. Theoretical Framework

1.1. Strategic management (SM) theory: current streams.

Strategic Management (SM) has been applied in the field of Management and Organizational Sciences in order to search for international business opportunities in many topics from the early 60s (Soloducho-Pelc, 2015). Since then, this discipline has become more consolidated and has been expanding the range of analyzed topics (Suarez et al., 2016) and the research methodologies used in the field (Guerras-Martín et al. 2014). Also, its evolution has been studied over the past 50 years. Hence, Ronda-Pupo & Guerras-Martín (2012) identified the strategy as the necessary actions that the companies take in order to increase their performance through a rational use of resources. In the same sense, Guerras-Martín et al. (2014) recognised that historically the companies achieve competitive advantages through its internal and external influences.

Both influences were historically integrated in mixed methods researches. While the external approach reflected the firm's performance as the result of its conduct influenced specially by the industry type or market size; the internal approach identified the key internal resources that influenced in the success or failure of the companies (Engert et al., 2016). This way, the integration of internal and external methods helped to bridge micro-macro gap and also science-practice gap (Molina-Azorín, 2012; Aguinis et al., 2011) through the creation of several researches in many areas since its formal inception.

Although there are several studies related to SM theory, normally the external influences can not be managed by the organization, so the internal influences represent the first option that can lead to get advantage. In this way, Engert et al. (2016) noticed there is still a lack of empirical studies integrating the corporate sustainability into SM's internal influences. Also, there is the necessity to identify the quality of the borrowed theory (Kenworthy & Verbeke, 2015), it is because some of the current theories still come from other fields and

disciplines. In respect with these disciplines, they have been contributing to the expansion of the field, however, there is the necessity to use just SM theory resources, specially in cases which converge influences of the literature with the practice.

The SM has been applied to the practice through several researches over the past years (Killen et al., 2012; Ruff, 2015; Posch et al., 2015; Suarez et al., 2016). However; the current streams of the literature have developed studies related to three main topics: a) strategic cost management (SCM); b) strategic human resource management (SHRM); and c) strategic environmental management (SEM). These topics were identified by many authors due to its relevance and wide use worldwide; furthermore, many models and tools were also developed through 50 years of SM literature and are still in practice.

On the one hand, the (SCM) seeks to track the cost structure. Therefore, the relationship between environmental costs and financial performance was fully examined, and given as a result that track environmental costs that can be an important tool to help companies reduce costs. In this way, Gliaubicas & Kanapickienė, (2015) identified key factors in the use of the instruments of SCM in Lithuanian companies, such as Activity Based Costing (ABC), Activity Based Managemenet (ABM), Benchmarking (BMKING), Target Costing (TC) and Lyfe Cycle Costing (LCC); also Henri et al., (2016) analyzed the relationship between costs and financial performance. Both scholars claimed the integration of the main SCM practices in the new mixed methods researches, and the use of financial and non-financial environmental performance indicators (EPIs).

These indicators were also applied to the (SHRM) which explored the use of the human resources in a competitive industry, illustrated in eight case study firms in the international hotel industry (Gannon et al., 2015), identifying this resources that are an important factor in order to shape opportunities in the industry, and to achieve competitive advantages. The literature has been mainly focused on senior HR executives instead of the entire organization; consequently current streams should analyze the entire organization as a whole human resource that achieve advantages and contribute to the creation of value.

Most of the cited and main topics related to the creation of value of companies was the sustainability. In this way, the (SEM) was one of the main topics in the current state of the art due to its internal and external conditions. This theory examined the adoption of environmental practices in many companies (Vintró et al., 2014), determining that this adoption can increase the business results; in the same way, the (SEM) and its role for maintaining economic competitiveness in an energy intensive industry was analyzed through conditions that form the basis for environmental development (Posch et al., 2015).

1.1.1. The internal influences of the SM theory.

The (SEM) was one of the conditions that form the basis for strategic environmental development. This condition was an essential part of the internal influences of the SM theory that was studied by many authors through the past years, and historically has contributed to the current literature. Here, current streams were composed by three main theories that were mixed with researches related to internal influences: the corporate social responsibility (CSR), the dynamic capabilities (DC) and the resource-based view (RBV).

The (CSR) was one of the main topic cited in the internal influences of the SM theory. It was examined by Engert et al., (2016) who explored the integration of CS into SM theory through a literature review of scientific journal articles. Also, Bergquist & Lindmark, (2016) explored the investment in environmental technology as source of competitive advantage in the CSR theory through a case study of a Swedish company. Both exemplars determinated that invest in environmental technology can be useful and helpful for the companies to create value and could be a source of competitive advantage.

Another source of competitive advantage was the (DC) which was analyzed in the current stream of the field. The role of the (DC) in the internal influences was investigated (Lin & Wu, 2014). Then, a framework was developed based on DC that helped in the strategic decision (Barros et al., 2016) and finally, provided a framework that incorporate resources and capabilities in order to achieve competitive advantages (Kim et al., 2015). The main conclusion was that the (DC) theory can help to improve the performance of companies.

However, the most cited theory was the (RBV) which claimed the utility of valuable, rare, one of a kind and non substitutable (VRIN) resources. First, the impact of the distribution of unique resources on profits was analyzed (Costa et al., 2013). Then, Almarri & Gardiner (2014) gave an overview of the supporters and opponents of the RBV theory. In the same way, the (RBV) theory showed how the influence of the individual actions and interactions between individuals on firm can create value (Molina-Azorín, 2014), and Talaja, (2012) tested the main resource based on view propositions as shown in the Table 1.

Although many authors claimed the utility of the (VRIN) resources of the companies, there was another one that believed that it was in a wrong way. Here, scholars stated the utility of (VRIN) resources (Almarri & Gardiner, 2014; Molina-Azorín, 2014; Bergquist & Lindmark, 2016; Kim et al., 2015), while another, such as Costa et al. (2013) stated that accumulation and deployment of unique resources does not necessarily increase the firm's profit, and also that achieving competitive advantage does not necessarily lead to higher profits. However, it was demonstrated that the use of the firm's resources has led to maximize the potential of many companies, as well as the environmental technologies and the human resource management could be the best source of competitive advantages (Gannon et al., 2015; Talaja, 2012). So, the (VRIN) resources can be widely analyzed according to the current stream of models and tools of the SM theory.

Table 1. RBV cited theory.

Exemplars	Findings	Limitations	Future researches
Almarri & Gardiner, 2014	The use of the RBV theory can help to the maximization of the firm's potential	It is limited to PM research; and its support can be seen as subjective	It should utilize case of studies to collect data on RBV utilization in research and practice
Costa et al., 2013	The accumulation and deployment of unique resources does not necessarily increase the firm's profits	It is focused in a duopoly models	It should be setting with more than two competitors
Joyce & Paquin, 2016	The new CANVAS model develop more robust and holistic perspectives on sustainability.	It is just a simple tool; and it does not explore in innovations	Explore whether this model can help to validate another business model

Molina-Azorín, 2014	Multilevel research can help to analyze influences and relationships between micro and macro variables	The lack of information related to the strategies in the practice	It should implement new multilevel researches and innovate in the methods used
Talaja, 2012	Companies with more valuable and rare resources achieve higher levels of sustainable competitive advantage and performance	Replicate this study in another companies from another country could lead to generalize the results	It should include empirical research of imitable and non-substitutable resources and capabilities

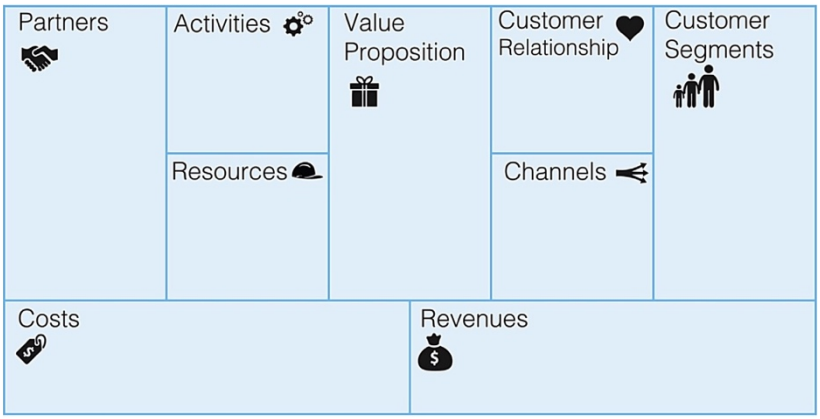
Source: own elaboration (2016).

One of the main tools that seek for internal resources was the triple layered business model canvas (TLBMC) proposed by Joyce & Paquin, (2016), which develop more robust and holistic perspective on the environment and to transform companies for sustainability. This model is represented in the Figure 1 and potrays basically an adaptation of the canvas model proposed by Osterwalder, (2010). This model added two new layers, one environmental and another social, that together create value to the companies and also it creates two new dynamics for analysis: horizontal coherence and vertical coherence.

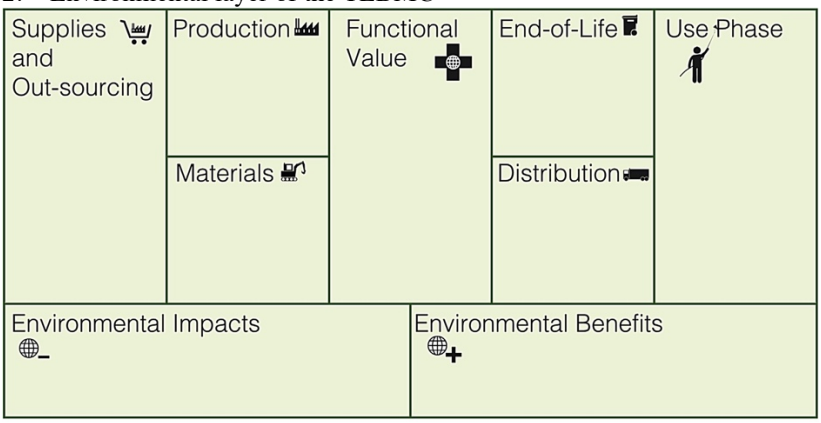
The economic layer describes how an organization creates value through nine basic blocks that show the logic of how companies can make money. Its nine blocks includes: Value proposition, Resources, Activities, Partners, Customer segments, Customer relationship, Channels, Costs, and Revenues; the environmental layer builds on life cycle perspective of environmental impact accross indicators and over the full life-cycle of a product or service. Its nine blocks includes: Functional value, Materials, Production, Supplies and outsourcing, Distribution, Use phase, End-of-life, Environmental impacts, Environmental benefits and; the social layer builds on a stakeholder approach and its nine blocks includes: Social value, Employee, Governance, Communities, Societal culture, Scale of outreach, End-users, Social impacts, Social benefits.

Figure 1 The triple layered business model Canvas (TLBMC)

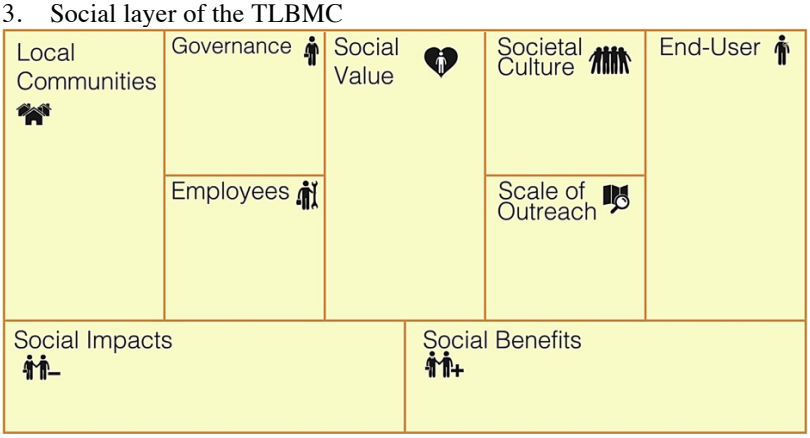
1. Economic layer of the TLBMC



2. Environmental layer of the TLBMC



3. Social layer of the TLBMC



Source: Joyce & Paquin, (2016).

In order to be competitive and get opportunities in the current industry, it was necessary for many companies to became more efficient and to adapted new tools and analysis in order to achieve new competitive advantages. Then, several new researches were conducted; however, there is a lack of studies related to the mining sector, with special focus in the copper industry, which has been a powerful sector of development of many countries worldwide (Valdes, 2015).

1.2. The global copper industry (GCI): an overview.

Copper remained as main functional mineral through the principal ages due to its unique properties such as malleability, ductility, conductivity of both electricity and heat, and the ability to withstand corrosion (Elshkaki et al., 2016); nowadays, developed countries have been using copper as an essential and main raw material for all major industries such as infraestructure, wiring, transport, and specially in eletronic equipment (Radetzki, 2009). The quick expansion of these key sectors, the increasing of global population and the transitition to a more sustainable society have made the global demand for copper to keep growing for the past 50 years (International Copper Study Group, 2015), and today, more than 19 million tons of copper are produced anually, in which Chile is the largest world producer with almost 5.8 million tons (Reichl et al., 2016; O'Connell et al., 2016).

In 2015 the global consumption increased to 1.8% from 2014 reaching 22 million tonnes, in which the largest consumer of refined copper of the world was China with apparent usage of almost 9.9 mllion tonnes (50%), followed by European Union 14%, the U.S. 8%, Japan 5%, Russia 3%, South Korea 3%, and others 17% (Mining Council, 2016). Here, the equipment was the largest copper end-use sector last year, followed by building construction and infraestructure. In addition, according to the International Copper Study Group (ICSG), (2015) about 56% of China's refined copper was used for infraestructure development and construction, consumer goods (27%), industrial equipment (6%), transportation (6%), and others (5%).

However, today the world copper industry faces a complex scenario, called “the end of the super cycle of high prices”, relative to lower expectations for economic growth of China, the main consumer of copper, and as a result there is a lower demand for commodities. Consequently, in 2015, the price of the refined copper on the London metal exchange (LME) averaged 2,49 cents per pound (c/lb), a decrease of 20% over the previous year, when the average reference price stood 3,11 c/lb. During the period 2003-2015 the average copper price was 3,00 c/lb (Valdes, 2015) and was stated that recovery scenario will be by 2020 affecting to mining countries as Chile, that was the largest producer worldwide.

1.2.1. The copper industry as agent of development in Chile

Chile is considered one of the freest countries for trade in Latin America, due to it has the largest network of trade agreements, both bilaterally and with regional groups. Chile has 20 Free Trade Agreements (FTA) with more than 60 countries covering 90% of the world GDP, and was the main world destination for investment in Greenfields (Organisation for Economic Co-operation and Development (OECD), 2015). Also, Chile has maintained solid macro-micro economic rates for decades. In 2015, the GDP reached $241,2 billion, the GDP growth rate 2.1%, the GDP per-capita $13.400 and inflation rate reached 4.3% (Central Intelligence Agency (CIA), 2016), showed Chile as the most stable country in the region.

Copper has been present in the country since Andean cultures, the Atacameños or Diaguitas that exploited the mineral very early in the north. The industry was progressively growing, and later in the 20th century several mines were opened, such as: El Teniente in 1905, Chuquicamata in 1915 and Potrerillos in 1927, being these main the operations worldwide for a long. These centers were controlled by foreign capitals, specially from the U.S., producing in 1971 the Nationalization of Large-Scale Copper Mining in which the assets and facilities owned by foreign companies became property of the Chilean State (CODELCO, 2016).

Since then, the mining sector became the strongest, biggest and most relevant economic activity of the country, and it has been known as a powerful agent of development during the past 10 years due to three main indicators boosted by the copper produced in Chile: a) the gross domestic product (GDP); b) the foreign direct investment (FDI); and c) the main mining exportations (Valdes, 2015). This indicators represented an overview of the current state of the mining in the country.

In 2015, mining GDP decreased 14,1%, reaching US$21,670 millions that represents only about 9% of the total. However, the mining has been the major driver of the development of the country, being represented in 14.3% in average each year of the total GDP of the country since 2006 to date (Mining Council, 2016); in reference to the FDI, the mining sector has attracted an average of US$1.799 millions each year since 2006. In 2015, the total actual FDI reached almost US$2.718 millions, in which the mining sector reached almost 553 millions, representing only a 20,4% of the total FDI (Ocaranza, 2016); and finally, the mining sector represented more than 50% of the total country's exports during the past decade. In 2015, the mining exports decreasing 17% from the same period in 2014, reaching US$33,469 millions FOB, equivalent to 55% of total Chilean exports. According to the National Customs Service, (2016), from this total, the copper exports reached 49%, and it was mainly exported to countries within Asia and Europe (National Customs Service, 2016), being the North of Chile the main center of operations.

The total Chilean mine production was divided between two main actors; on the one hand, the State of Chile represented by CODELCO, that was the main producer of copper worldwide (O'Connell et al., 2016) reaching a total production of 1.8Mt, and concentrated approximately 9% of the total world copper reserves; and on the other hand, the private mining, composed principally by 25 international companies that in 2015 reached about 4Mt (COCHILCO, 2016c). So, both actors were affected by the plumit of the copper price.

This drop has caused serious troubles in CODELCO, to illustrate, in its 45 years of history, its operations have contributed surpluses by almost US$104 billions to the State of Chile (CODELCO, 2016). However, since 2011, the Corporation has been exposed to the

volatility of the industry and nowadays, the end of super cycle of high copper price has affected the surpluses and incomes of the company (Mining Council, 2016). As a result, there is a necessity to apply an strategic analysis, according to the main influences of the theory in order to seeking for resources and opportunities, and to discover new innovative processes or business models that help to the creation of value for the company within the industry.

In reference to this, there are theoretical and practical implications in analyzing the internal influences of CODELCO. So, the theoretical implications can lead to full a gap inside the SM theory by contributing to the (RBV) theory; and the practical implications can lead to identify resources, capabilities and opportunities for CODELCO in the current copper industry in order to achieve competitive advantages.

Chapter II

2. Methodological Framework

The methodological framework for this study is a qualitative method mixing both descriptive and analytical process in a case study of the main copper producer worldwide CODELCO. The internal influences of CODELCO are analyzed according to the (SM) theory, specifically the RBV's models, covering a period of analysis of 2015, in which the main sample of this study is CODELCO for the following reasons: a)it is the largest producer worldwide reaching almost 1.8Mt; b)it concentrated approximately 9% of the total global reserves; and c)during its 45 years of history, the operations have contributed surpluses by about US$104 billions to the State (ICSG, 2015).

For the collection of the relevant information to the develpoment of this study, secondary data is collected from scientific documents, annual surveys of companies, market analysis and statistical data, where various electronic search tools have been used such as, Science Direct, EBSCO, SCOPUS and other electronic resources such as Google Scholar, using keywords as a strategic management, resource-based-view, strategic analysis, copper industry, competitive advantages among other keywords.

In the first place, a description of the company's profile is presented. This includes relevant information, such as: constituent elements, operations both national and internationally, sales, the suppliers and its global presence; furthermore, the main challenges of the company such as the high cost production, the drop in the copper price and the drop in the incomes and surpluses of CODELCO is also presented.

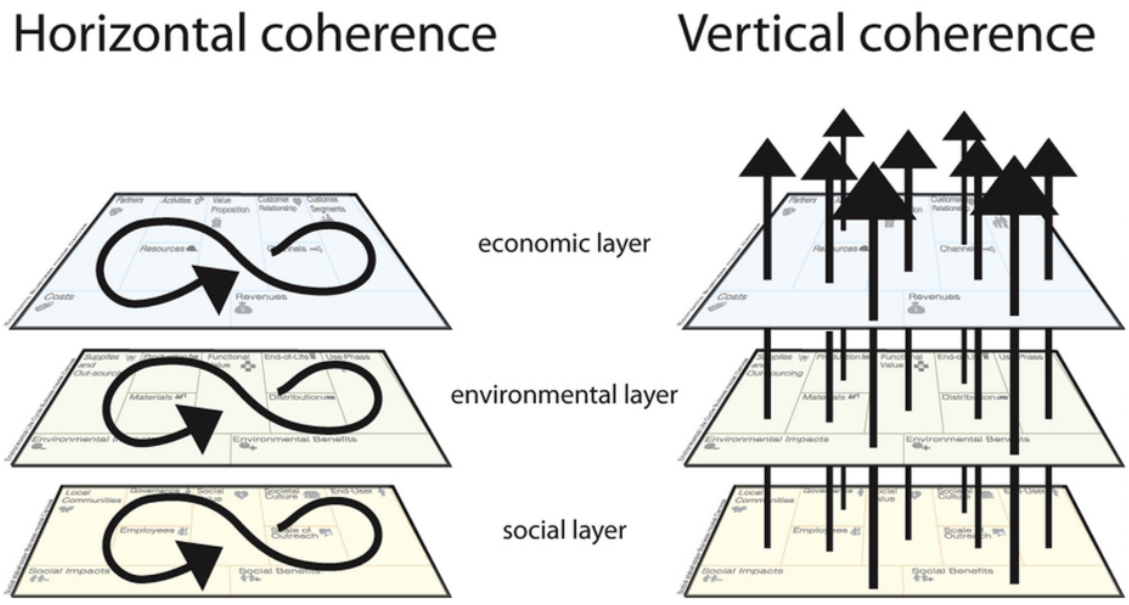
Secondly, the internal environment of CODELCO is analyzed according to one of the RBV's tool called the Triple Layered Business Model Canvas (TLBMC), which analyzes the busines model of company by three layers: a)the economic layer and its nine blocks: Value proposition, Resources, Activities, Partners, Customer segments, Customer relationship, Channels, Costs, and Revenues; b)the environmental layer and its nine

blocks: Functional value, Materials, Production, Supplies and outsourcing, Distribution, Use phase, End-of-life, Environmental impacts, Environmental benefits and; c)the social layer and its nine blocks: Social value, Employee, Governance, Communities, Societal culture, Scale of outreach, End-users, Social impacts, Social benefits. All of them create value through its layers and is widely used worldwide.

For CODELCO case, the triple canvas layers share public information, such as company reports, articles and other public data. In particular, the environmental data comes from (CODELCO, 2016) which extracts the carbon footprint data. The social layer data comes also from the same report.

Finally, it is applied the analysis of horizontal and vertical coherence. The horizontal coherence includes the exploration of an organization's economic, environmental or social impact, by highlighting key actions and relationships. On the other side, vertical coherence includes the components of each layer connected to their analogs in the other layers, further clarifying key actions and connections and their impacts across layers.

Figure 2 Horizontal and vertical coherence analysis



Source: Joyce & Paquin, (2016).

Chapter III

3. CODELCO's business model

3.1. Description of CODELCO's corporative profile.

The main company responsible for the extraction, processing and subsequent export of copper and its subproducts is the National Copper Corporation of Chile (CODELCO), that was created with the Nationalization of Copper on July 11th, 1971, dictated by Eduardo Frei Ruiz-Tagle, and it was formalized by the Decree Law 1.350 published on Official Diary on April 1976 (Library of the National Congress of Chile (BCN), 1976).

CODELCO is an autonomous entity wholly controlled by the State of Chile, and is related to it through the Ministry of Mining. Its core business is the exploration, development and exploitation of copper mineral resources and byproducts, their processing to convert them into refined copper, and trading in the country or abroad. This task is performed through eight divisions located between the Region of Antofagasta and the Region of Libertador General Bernardo O'higgins as shown in Table 2 (CODELCO, 2016). In addition, Codelco has 4 Subsidiaries, located in the U.S., England, Germany and China, and globally sales representatives of copper and mollybdenum (Valdes, 2015). Furthermore, the company concentrates approximately 9% of world reserves of copper and it has a heritage that by the end of 2015 amounted to US$9,733 million. CODELCO also has assets of US$33,444 million, and its sales revenue totalled US$11.694 billion in 2015; in the same period CODELCO produced 1,8Mt of fine copper and delivered surpluses to the State of Chile for US$1,075 millions (CODELCO, 2015).

Its main products are: grade A copper cathodes, copper concentrate, copper calcine, molybdenum, silver, anode slime, sulphuric acide, wire rods (semi-finished product) and; the management and administration is exercised by a Board, consisting of the following: Three directors appointed by the President of the Republic; two CODELCO employee representatives, elected by the President from a shortlist drawn from candidates proposed for each position by the Copper Workers' Federation and jointly by the National

Association of Copper Supervisors and the Copper Supervisor's Federation and; four members designated by the directors appointed by the President of the Republic from a shortlist drawn from candidates proposed for each position by the Senior Public Management Council, with a favourable vote of four fifths of its members.

Table 2. National operations of CODELCO

Division	Type	Operation	Location	Products	Output	Workforce
Radomiro Tomic	Open-pit mine	Since 1997	Calama, Antofagasta	Grade A copper cathodes	315.747 tonnes	1.287
Chuquicamata	Open-pit mine	Since 1915	Calama, Antofagasta	Grade A copper cathodes	308.625 tonnes	6.342
Gabriela Mistral	Open-pit mine	Since 2008	Sierra Gorda, Antofagasta	Grade A copper cathodes	125.009 tonnes	566
Ministro Hales	Open-pit mine	Since 2010	Calama, Antofagasta	Copper calcine and concentrate	238.305 tonnes	772
Salvador	Open-pit and underground mine	Since 1959	Diego de Almagro, Atacama	Grade A copper cathodes	48.582 tonnes	1.352
Andina	Open-pit and underground mine	Since 1970	Los Andes, Valparaìso	Copper concentrate	224.264 tonnes	1.699
El Teniente	Open-pit and underground mine	Since 1905	Machalí, O'higgins	Copper anodes	471.157 tonnes	4.750
Ventanas	Smelter and refinery	Since 1964 smelter, and since 1966 refinery	Puchuncavì, Valparaiso	Copper cathodes	-	953

Source: CODELCO, 2016.

The large number of inputs and services used by CODELCO in their production, makes vital the relationships of trust and competitiveness between suppliers and the corporation. During 2015 the consumption of goods and services increased to US$7,076 million, of which US$2,038 were goods and US$5,038 were services. In 2015 Codelco worked with 3,718 suppliers, of which 3,483 were local suppliers and 235 with international suppliers. The total amount allocated was US$ 6.945 billion; this amount included long-term electricity and fuel contracts (CODELCO, 2016).

The Corporation has also several subsidiaries and associated companies involved in creating value for CODELCO. Currently it owns or has rights to 52 companies (see appendix 3) which operate both nationally and internationally in various areas: mining, trading, health and pensions, investment, research and technology, electrical, new uses for copper, processing plants and ports. Of the total universe of Subsidiaries and Affiliated Companies, 73% are national and 27% international, where the main countries in which they are located are: Brazil, Ecuador, England, United State, Germany and China. Of the total of 14 international companies, 9 belong to the category of trading companies, three are mining companies and 2 of them are investment companies (CODELCO, 2015).

Figure 3 International operations of CODELCO

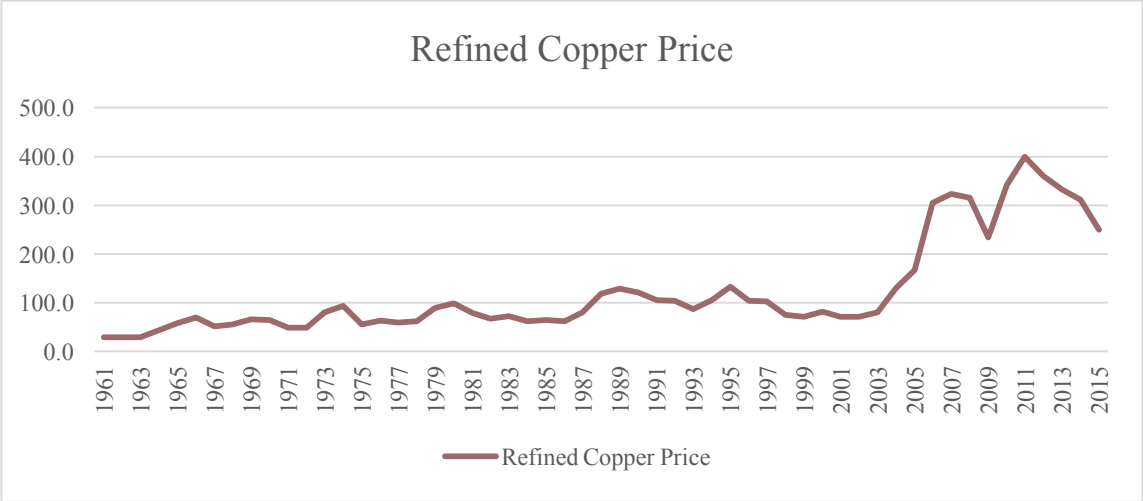
Source: CODELCO, 2016.

3.1.1. Description of the main challenges of the Corporation

The deposits of CODELCO, have complex challenges for the continuity of its operation. Among them are: a) the drop in copper prices; b) the high cost production and; c) the drop in incomes and surpluses of CODELCO. Added to this, some of its industrial and facilities infrastructure have a long history of use, have suffered a strong depreciation process is fast approaching toward obsolescence, and in many cases do not meet the high standards of 21th century mining (CODELCO, 2016). This way, these factors have affected the economic performance of the Corporation and, in effect, the Chilean state surpluses.

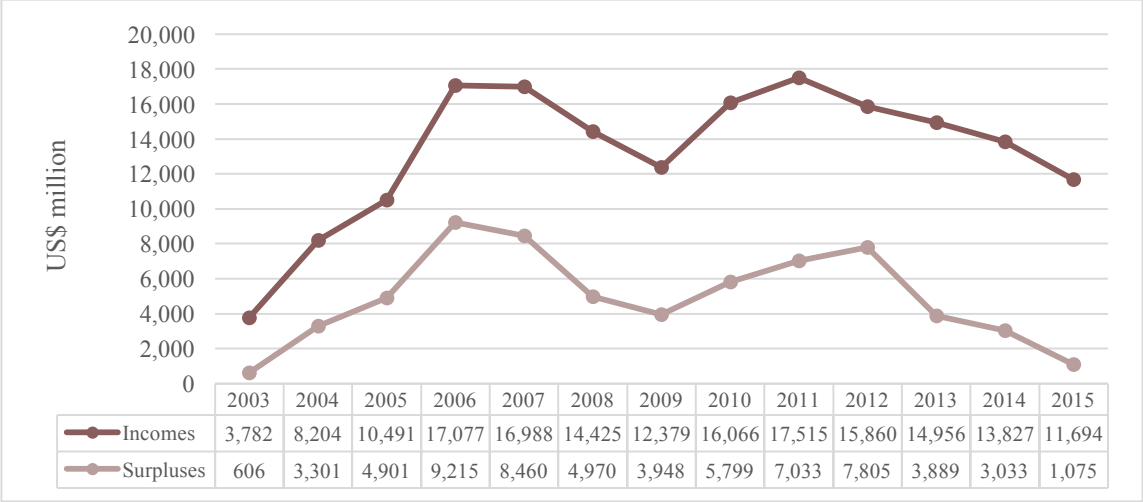
Refering to the copper prices, in 2015, on the London Metal Exchange (LME) it averaged 2,49 cents per pound (c/lb), a decrease of 20% over the previous year, when the average reference price stood 3,11 c/lb. It can be explained due to the low consumption of commodities by China and the volatility of the industry (Valdes, 2015). For this, the figure 4 reflects the copper prices between 1961 and 2015, illustrating this volatility; in terms of costs, it faces a complex scenario due to the age of some of the divisions of Codelco, which today exhibit lower ore grades, which implies a higher cost of production. Likewise, the increase in energy prices has also had an impact on the final cost of production. So, Compared to 2014, in the analyzed period, total costs and expenses showed a decrease of 12% from 230.6 c/lb to 203.0 c/lb. Meanwhile, the net cathode cost decreased by 8% from 213.3 c/lb to 196.9 c/lb. The direct cost (C1) of the year reached 138.7 cents per pound of copper, which is 8% less than in 2014 (150.4 c/lb). C1 is the kind of cost that the global mining industry uses to test the management of different companies; because of this drop in copper prices, combined with low consumption of commodities by China, the surpluses and revenues of Codelco suffered a notable decline. On the issue of sales revenues of Codelco, these totaled US$11,694 million, representing a decrease of US$2,133 million compared to 2014. As for the surpluses, they reached US$1,075 million. However, this surpluses compared to US$3,033 million generated in 2014, the result meant a decrease by 65% (CODELCO, 2015) respect 2014 as shown in figure 5.

Figure 4 LME Refined Copper Price (1961-2015)



Source: COCHILCO, (2016a).

Figure 5 Evolution of incomes and surpluses of CODELCO (2003-2015)



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Incomes	3,782	8,204	10,491	17,077	16,988	14,425	12,379	16,066	17,515	15,860	14,956	13,827	11,694
Surpluses	606	3,301	4,901	9,215	8,460	4,970	3,948	5,799	7,033	7,805	3,889	3,033	1,075

Source: CODELCO, (2016).

The copper price was directly related with the incomes and surpluses of CODELCO, this way, and since its beginnings, CODELCO was exposed to the volatility of the copper industries, however, 2015 was the worse year of the company in terms of its indicators, as example, in the 2008 crisis, that was reflected in 2009, the incomes achieved 3.9US$M, however in 2015, the incomes and surplues were US$1.0M, a 74.4% less than 2009.

3.2. Internal analysis: The triple layered business model Canvas (TLBMC).

3.2.1. Economic layer of CODELCO's TLBMC

3.2.1.1. **Customer Segments:** Companies normally serves one or two main big customers. In this way, CODELCO creates value principally to the following segments: a)Asian trade companies and; b)European commodities companies, as shown in appendix 2.

3.2.1.2. **Value Proposition:** It seeks to solve customer problems and satisfy customer needs with value propositions. For this, CODELCO's main value proposition is high end quality refined copper cathodes; blister and anodes and copper concentrate.

3.2.1.3. **Channels:** Value propositions are delivered to customers through communication, distribution, and sales channels. In reference, CODELCO use mainly its subsidiaries and sales representatives in all of its international export operations.

3.2.1.4. **Customer Relationships:** Customer relationships are established and maintained with each customer segment. In this case, CODELCO has a personal assistance relationship through its sales representatives that give the opportunity to interact with their own personal.

3.2.1.5. **Revenue Streams:** Revenue streams result from value propositions successfully offered to customers. Principally, CODELCO get its revenues through the sale of the following products: a)copper; b)molybdenum and; c)others minerals. For copper the physical revenues comes from blister and anodes, copper concentrate and refined copper.

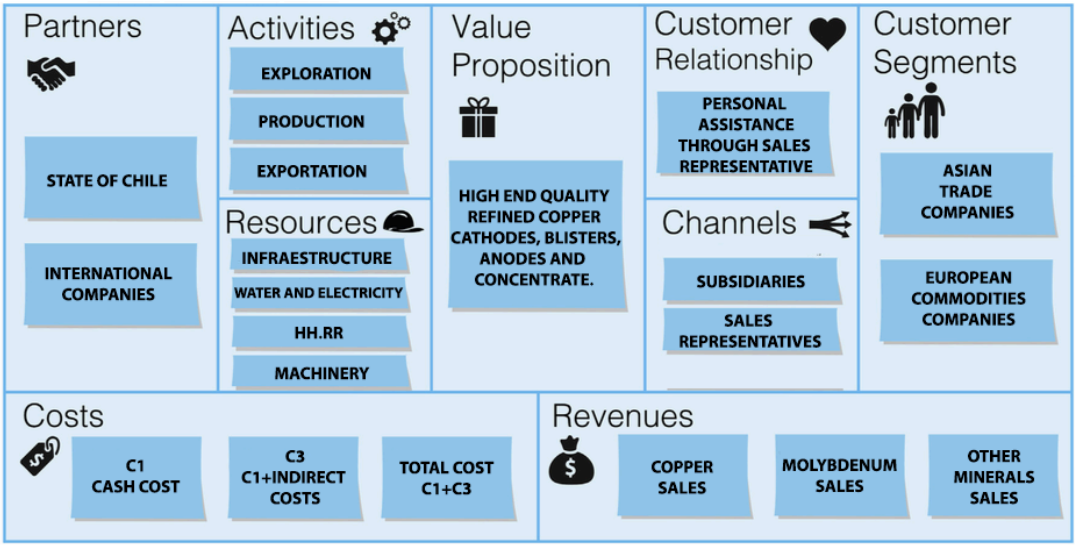
3.2.1.6. **Key Resources:** Key resources are the assets required to offer and deliver the previously described elements. In this case, the key resources for CODELCO are: infraestructure, water and electricity, HH.RR., machinery.

3.2.1.7. **Key Activities:** .. by performing a number of key activities. As example, the exploration, production, and posterior exportation of the refined copper.

3.2.1.8. **Key Partnerships:** Some activities are outsourced and some resources are acquired outside the enterprise. This way, the main partnership of CODELCO is the State of Chile, followed by international trade, manufacturing and technology companies.

3.2.1.9. **Cost Structure:** The business model elements result in the cost strucutre. For CODELCO's business model, this structure is as following: a)C1, which refers to the direct cost incurred by the company, as example, the mining process, refinery and smelter, transport among others; b)C3, which includes direct cost, the amortization and depreciation plus the indirect cost such as I+D, exploration, taxes and interest and; c)total costs that include C1+C3.

Figure 6 Economic layer of CODELCO's TLBMC



Source: adapted from Joyce & Paquin, (2016).

3.2.2. Environmental layer of CODELCO's TLBMC

3.2.2.1. **Functional value:** The point of defining the functional value is to clarify what is being examined in the environmental layer. As example, the functional value of CODELCO is 2.2 millions tonnes of refined copper consumed by customers in a period of one year.

3.2.2.2. **Materials:** Materials refer to stocks used to render the funcional value. For CODELCO, it does not apply due to the copper is mainly exports as concentrate in large bulk vessels and, for the cathodes A, they are mainly stacked each other with slings.

3.2.2.3. **Production:** It may involve transforming raw or unfinished materials into higher value outputs. For CODELCO, the industrial processes to extract, proccess and export the copper, specially in the smelting facilities generates emissions of carbon dioxide (CO2), dioxide of sulfur (SO2), arsenic (As).

3.2.2.4. **Supplies and outsourcing:** It represent all the other various material and production activities that are necessary for the functional value but not considered 'core' to the organization. For CODELCO, this could included the international business, the finances, marketing and, all the others quantitatives areas of the corporation.

3.2.2.5. **Distribution:** It involves the transportation of goods, and represents the physical mans by which the organization ensures access to its functional value. For CODELCO, distribution involves the production, manufacturing and, subsequently shipment of copper, thousands of kilometres to Asia or Europe, producing large amounts of carbon footprint due to the shipment method used (maritime).

3.2.2.6. **Use phase:** It focuses on the impact of the client's partaking on the organization's functional value, or core service and/or product. For CODELCO the use phase consists of three elements: a)the production and exportation of the copper; b)the manufacturing of the copper by added value through the creation of wires, tv

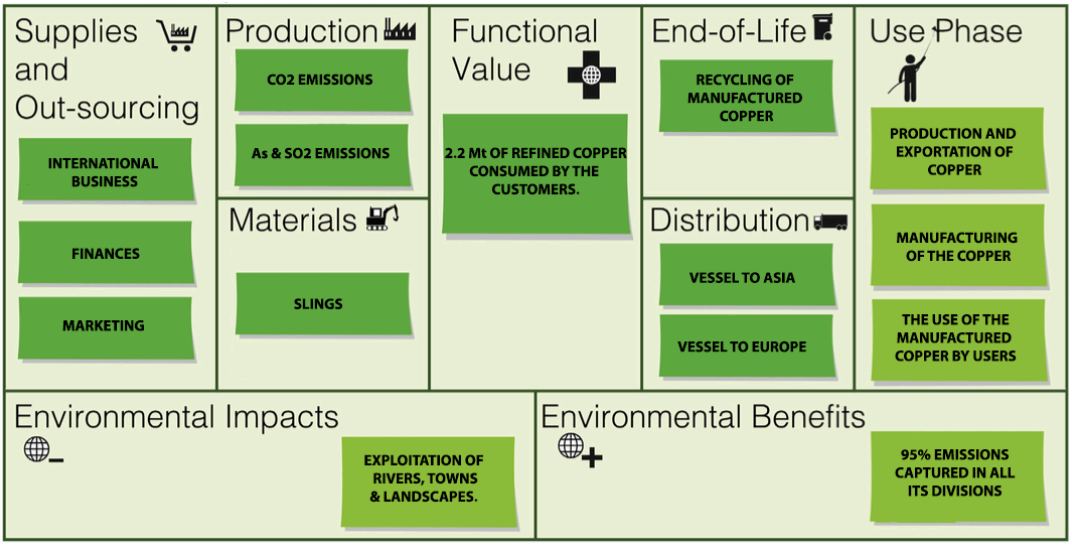
or techonological devices, and; c)the use of the manufactured copper by the end-user.

3.2.2.7. **End-of-life:** It is when the client chooses to end the consumption of the functional value. For CODELCO, end-of-life starts when the end-user finally decided to recycle the manufactured copper.

3.2.2.8. **Environmental impacts:** The environmental impacts component addresses the ecological costs of the organization's actions. For CODELCO, the critical necessity of water and electricity for its main operations produces several impacts, specially in the areas located in the north, forced to deal with the severe conditions of the desertic climate by exploiting the rivers, the towns and all its landscape.

3.2.2.9. **Environmental benefits:** It encompasses the ecological value the organization creates. For CODELCO, to reach 95% of the emissions captured in all its Divisions, motivated by a change in the system regulations.

Figure 7 Environmental layer of CODELCO's TLBMC



Source: adapted from Joyce & Paquin, (2016).

3.2.3. Social layer of CODELCO's TLBMC

3.2.3.1. **Social value:** It speaks to the aspect of an organization's mission which focuses on creation benefit for its stakeholders and society more broadly. For CODELCO, its core competencie is developing long term value from mutually benefical relationship with Asian and European companies.

3.2.3.2. **Employees:** It provides a space to consider the role of employees as a core organizational stakeholder. Based on CODELCO's annual report, the corporation give direct employment to 19.117 persons. its rapid employee growth since its founding, that some 43.9% of its employees are concentrate for in the north of Chile, in Calama city.

3.2.3.3. **Governance:** The governance component captures the organizational structure and decision-making policies of an organization. In this way, the main policies and decision of CODELCO are review by the board of nine directors, and finally approved by the State of Chile, represented by the Ministry of Finance.

3.2.3.4. **Communities:** While economic relationships are built with business partners, there are social relationaship built with suppliers and their local communities. CODELCO has been developed relationships with local communities through the past 10 years, and today, it can be seen in the concept of "sustainable, virtuous and inclusive mining".

3.2.3.5. **Societal culture:** The societal culture component recognizes the potential impact of an organization on society as a whole. This way, CODELCO's strong corporate social responsibility practices and programs can be interpreted as a culture of accountability and proactiveness.

3.2.3.6. **Scale of outreach:** It describes the depth and breadth of the relationships and organization builds with its stakeholders through its actions over time. For CODELCO, its outreach is deep and diversified when creating additional social

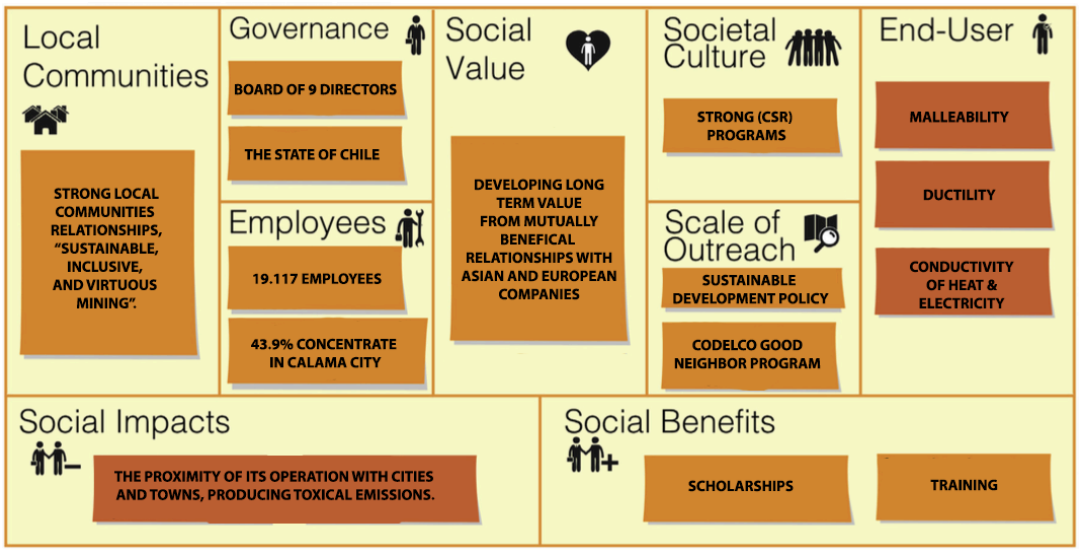
programs such as the Sustainable Development Policy and; the CODELCO good neighbor program.

3.2.3.7. **End-users:** The end-user is the person who consumes the value proposition, and it contributing with his/her quality of life. So, CODELCO seeks to provide value in terms of malleability, ductility, and conductivity of both electricity and heat boost.

3.2.3.8. **Social impacts:** The social impacts component addresses the social costs of an organization. For CODELCO, negative impacts could stem from the proximity of its operations with the main cities of production. In this way, the GEI emisionss could a important factor of illnes of society. Due to this, Chuquicamata's town was closed and all its people should move to Calama.

3.2.3.9. **Social benefits:** These are the positive social value creating aspects of the organization's action. For CODELCO, it may include the large quantity of benefits for all its workers such as: scholarships and, training.

Figure 8 Social layer of CODELCO's TLBMC



Source: adapted from Joyce & Paquin, (2016).

3.3. Results of CODELCO's TLBMC analysis.

3.3.1. Horizontal Coherence

For CODELCO, its business model is built on one main vector. This is the sell of refined copper as raw material to asian and european trade and manufacturing companies. At the economic level, this model represent an antiqueated way of mining business, which consisted principally in to explote, produce and sell the raw material (copper, gold, iron) without any added value, through the same channels, partners, cost and revenues. This produces dependence from main customers due to the relation offer/demand; at the environmental level, this model still continues with high CO2, As & SO2 emissions and, the exploitation of rivers, towns and landscapes; however, the 95% of emissions were captured in all its division and the recycling of manufactured copper as end product can support CODELCO's model and; at the social level, CODELCO actively supports the local communities, employees and the society through its strong programs such as the sustainable development policy and the CODELCO's good neighbor program. In the same way CODELCO's business model is supported due to its give scholarships and training to all CODELCO's personal. A simple analysis of this vector demonstrate opportunities for improving economic, environmental and social inefficiencies of the business model.

3.3.2. Vertical Coherence

The alignment of each layer component across the canvas layer provides a vertical coherence. With CODELCO, one may see a lack of alignment across the layers in terms of the connection among its social impacts, environmental impacts and the costs. These costs should be reduce due to the current end of the high prices of the copper. However, it does not can be still possible through the exploitation of rivers, towns and landscapes as illustrated the the Chuquicamata' case, which in 2004 produced the massive movement of chuquicamata's families to Calama, due to the town was declared satured zone. Opportunities here may include work with international suppliers in order to reduce its total costs without recurre to exploite and contaminate the main cities of production.

Chapter IV

4. Conclusions and discussions

4.1. Conclusions

Due to the drop in the copper price since 2011, the incomes and surpluses of CODELCO have suffered a notable decline (CODELCO, 2016). So, through a case of study based on the RBV theory, it is demostrated that this theory can be helpful by analyzing CODELCO's business model in the current complex scenario of the copper industry. So, through this analysis it was identified that the economic business model of the company should evolve from an antiquated extractive/exportive industry, to a manufacturing industry by adding differents kind of value to copper through the development of international operations derivated from its large potential of internationalization and opportunities within the industry. Furthermore, it identified that there is a clear horizontal coherence among the three CODELCO's business model layers. However, there is the necessity to evolve its economic layer as soon as possible. In the same way, there is a lack of vertical coherence due to its social and environmental impacts, so, the corporation need to improve some of its main factors, such as: the value proposition, its costs and revenues.

4.2. Discussions

These finding can help to brigde to full a gap inside the SM theory by contributing to the RBV theory, as similarly was shown in the study made of Vintró et al., (2014) and Posch et al., (2015) that concluded that the SM theory can be useful for companies. So, this research identified that the RBV theory can be helpful by identifying and analyzing the current economic, environmental and social performance of many companies inside the industries. However, while the TLMBC offers an approach for analyzing and conceptualizing CODELCO's business models, there are also some clear limitations to consider. Its main limitation is that it is a simply tool, and can result very subjective. In the same way, another limitation is that only one year of operations is analyzed, therefore future research should analyze a interval of time, such as from 2008 crisis to nowadays.

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Appendices

Appendix 1. Literature review

1.1. Strategic Management (SM) literature:

Exemplars	Theoretical approach	Focus	Methodology	Findings	Limitations	Future researches
Gliaubicas & Kanapickienė, 2015	SCM	Examine the key factors in the use of the instruments of SCM in Lithuanian companies	A literature review	-SCM usage is more frequent in companies that experience a high level of competition intensity -SCM is higher in companies using strategies	It could be a unspecified financial accounting information	It should integrate the main SCM practices in the new mixed methods researches
Henri et al., 2016	SCM	Examine the relationship between environmental costs and its financial performance	A qualitative analysis on 319 Canadian manufacturing firms	-Track environmental costs can be an important tool that help companies to align its resources with short and long tactics; and it can help to reduce its total costs	Only one aspect of structural cost management was examined	It should design and use of financial and non-financial environmental performance indicators (EPIs)
Posch et al., 2015	SEM	Analyze the internal and external conditions that form the basis for strategic environmental development	A case of study of the Austrian paper and pulp industry applying a hybrid method	-The SEM is important for maintaining economic competitiveness in an energy intensive industry	It was studied in only one industry	It should combine of and internal analysis with an analytic hierarchy process

Vintró et al., 2014	SEM	Examine the adoption of environmental practices in small and medium sized companies in the surface mining industry in Catalonia (Spain)	A survey of 41 items concerning environmental management systems an environmentally sustainable practices	-The adoption of environmentally sustainable practices will increase the business results	It only considered mining companies from Catalonia and two specific mining sectors	Conduct similar studies in different countries and different mining sectors, to compare results and to validated the scientific knowledge
Gannon et al., 2015	SHRM	Explore the use of human resources within a highly competitive and complex industry	A literature review of eight case of study of firms in the international hotel industry	-Human resources are an important factor in order to shaping opportunities within the industry and to get competitive advantages	It was focused on senior HR executives instead the entire organization	It should analyze the entire organization as a whole human resource that achieve advantages
Aguinis et al., 2011	SM	The integration of micro and macro research methods and theories in the SM literature	A literature review	-Such integration will help bridge not only the micro-macro gap but also science-practice gap in management	It does not consider too much discussions.	It could address additional key theories that have the potential to integrate both method
Guerras-Martín et al., 2014	SM	Analysis of the evolution of the main approaches of the SM from its origins to nowadays	A literature review	-Strategic management has been evolving over the past fifty years. -Companies get competitive advantages through its internal and external factors	Its studied does not presented studies related to both approaches	New researches should focus in the connection between both approaches

Kenworthy & Verbeke, 2015	SM	Propose a new framework to assess the quality of theory borrowing in the SM field	A literature review of main SM journals	-Current empirical work should be derived directly from observing and studying SM phenomena, not from borrowing concepts derived from the study of phenomena unrelated to SM practice	The development of the model step by step	It core design should be concepts derivate exclusively from SM theory
Killen et al., 2012	SM	The application of SM theories to Project Management and Project Portfolio Management research	A literature review and four research experiences	-The SM has a broad potential for further researches related to the application of SM theories to PM and PPM researches	It can result very generalizable.	It should integrate the SM theories into PM and PPM in order to provide a wide range of researches
Molina-Azorín, 2012	SM.	Determine whether the use of a mixed methods approach is a predictor of article impact in the field	A content analysis based on articles published in the Strategic Management Journal from 1980 to 2006	-Mixed methods play an important role in the diversification of the SM literature	It is concreted in only one context, a macro-oriented journal	This kind of analysis should be carried out in other organizational fields
Ronda-Pupo & Guerras-Martin, 2012	SM	Extend the reflection on the evolution of SM through the analysis of the strategy	A co-word analysis	-The strategy can be seen as the most important definition in the SM literature; and this definition can help to form new research subfields	It cannot be a consensus regarding this definition	It should include the influence of the business schools on the development of strategies

Ruff, 2015	SM	Analyze the current state of practice of a corporate foresight unit within a multinational automotive company in the SM literature	An auto-ethnographic account of the development and implementation of the corporate foresight unit at Daimler	-SM help to develop foresight unit that contribute to the companies to its maturation and adaption to dynamically changing organizational environment	It is develop can be widely generalizable	They should develop new practice researches in different industries focusing in internal corporate foresight unit
Soloducho-Pelc, 2015	SM	Analyze and identify the elements of areas of the strategy that are associated with the search for opportunities for development in the SM process	A research technique called Paper and Pencil Interview based on 150 Polish companies	-The increased level of innovations and competitiveness is achieved through the inclusion of the search for opportunities in the strategic planning	There is a lack of practice information	It is important to examine the company practice through process of create, select or include opportunities in the strategic planning
Suarez et al., 2016	SM	Examine the role of the strategic planning process in excellence management systems (EMSs)	The Partial Least Squares (PLS) technique with a sample of 225 Spanish firms	-Strategic planning must design and implement schematic key processes and established alliances with main the suppliers and partners	It assumes the linearity of relationships between the latent variables	It should design a schematic key process; and involve and train people who participate in their execution

SCM: strategic cost management, SEM: strategic environmental management, SHRM: strategic human resource management.

1.1.1. Internal influences literature:

Exemplars	Theoretical approach	Focus	Methodology	Findings	Limitations	Future researches
Bergquist & Lindmark, 2016	CSR	Explore the investment in environmental technology as source of competitive advantage in the CSR theory	Case of study of a Swedish company called Boliden during the interwar period	-Invest in environmental technology can be useful and help to the companies to create value and could be a source of competitive advantage	The context is old and does not represent the current situation	Re-evaluate the situation of the company and examine how new technologies can still contribute to create value
Engert et al., 2016	CSR	Explore the integration of CS into SM based on the literature review	A literature review of 114 peer-reviewed scientific journal articles	-There is still a lack of empirical studies integrating CS into SM. -The RBV and MO should be included while planning and implementing strategies	It can be seen as a subjective research	New researches should focus on the practice than the theory
Barros et al., 2016	DC	Develop a framework based on DC that help to family firms in the strategic decision making process	A literature review of family firms	-The use of these mechanisms allows the creation of value for firms. -SM can help to companies to learn about its interaction with the environment	It approach cannot be apply to another kind of firms	The analysis of the family's VRIN resources and their effects on the specific learning mechanisms used

Kim et al., 2015	DC	Provide a framework that incorporates resources and capabilities	Miller and Shamsie's classification scheme for resources	-Resources and capabilities can help to achieve sustainable competitive advantages. -Efficacy of executing service innovations is supported by internal and external resources	The research focused in only one kind of services	Explore the current service-oriented economy through new bundle of innovator researches
Lin & Wu, 2014	DC	Investigate the role of dynamic capabilities in the internal influences	-A qualitative analysis with a sample of the top 1000 Taiwanese companies	-Dynamic Capabilities can mediate the firm's valuable, rare, inimitable and non-substitutable (VRIN) resources to improve performance	Survey data come from a single country and cannot be generalizable	It should understand how dynamic learning capability is built owing to its crucial role in mediating resources on performance
Joyce & Paquin, 2016	RBV	Propose a new canvas business model that generate economic, environmental and social value	A case of study of Nestlé Nespresso based on a literature review	-The new CANVAS model develop more robust and holistic perspectives on sustainability. -The model can help to transform organizations for sustainability	It is just a simple tool; and it does not explore in innovations	Explore whether this model can help to validate another business model
Almarri & Gardiner, 2014	RBV	Give an overview of the supporters and the opponents of RBV theory	A literature review	-RBV allows to alignment with strategy, to identify the value of resources and to required capabilities for competitive advantage.	It is limited to PM research; and its support can be seen as subjective	It should utilize case of studies and questionnaires to collect data on RBV utilization in

				-The use of the RBV theory help to the maximization of the firm's potential		research and practice
Costa et al., 2013	RBV	Analyze the impact of the distribution of unique resources on products and profits	A game-theoretic model	-Accumulation and deployment of unique resources does not necessarily increase the firm's profit -Achieve a sustainable competitive advantage does not necessarily lead to higher profits	It is focused in a duopoly models	It should be setting with more than two competitors
Molina-Azorín, 2014	RBV	Examine the microfoundations literature indicating its usefulness and the main characteristics	A systematic literature review and examining of several works	-Multilevel research can help to analyze influences and relationships between micro and macro variables	The lack of information related to the strategies in the practice	It should implement new multilevel researches and innovate in the methods used
Talaja, 2012	RBV	Test the main resource-based view propositions	An empirical analysis on 265 large and medium-sized Croatian companies from all industries	-Companies with more valuable and rare resources achieve higher levels of sustainable competitive advantage and performance	Replicate this study in another companies from another country could lead to generalize the results	It should include empirical research of imitable and non-substitutable resources and capabilities

CSR: corporate social responsibility, DC: dynamic capabilities, RBV: resource based view.

Appendix 2. Top 10 customers of CODELCO 2015.

Nº	Customers	Country	Activity	Industry	Revenues
1	Trafigura Pte Ltd.	Singapore	Trafigura is one of the world's leading independent commodity trading and logistics houses.	Trade	US$97,2bn
2	Ls-Nikko Copper Inc	South Korea	LS-Nikko copper is the global leader with the world-best metal producing technology.	Refinery	US$5,9mn
3	Maike Metals International Ltd.	China	Maike mainly engages in commodity trading.	Trade	DI
4	Mitsui & Co., Ltd.	Japan	Its essential business model is trading business for exports, imports and local transactions.	Trade	US$43,0mn
5	Glencore International Ag.	Switzerland	It is a leading integrated commodity producer and trader, operating worldwide.	Commodities	US$41,1mn
6	Nexans France	France	Manufacturer of copper and optical fiber cable products.	Manufacturing	DI
7	Louis Dreyfus Commodities Meta	Switzerland	Leading merchant and processor of agricultural goods.	Commodities	US$64,7mn
8	Ocean Partners UK Limited	UK	It provides successful trading services to miners, smelters, and refiners.	Services	US$1,5mn
9	Mri Trading Ag	Switzerland	It is a leader in international trading of metal concentrates, minerals and petroleum.	Trade	DI
10	Southwire Company	USA	It is a leader manufacturer of wire and cable.	Manufacturing	US$4.3mn

Source: own elaboration (2016).

Appendix 3. CODELCO's subsidiaries and affiliates

3.1. Mining companies

Nº	Trade Name	Incorporation Date	Country	Partners (%)		
				Codelco	Others	Total
01	Agua de la Falda S.A	25/07/1996	Chile	43,28	56,72	100,0
02	Anglo American Sur S.A	31/07/2007	Chile	29,50	70,50	100,0
03	Cobrex Propescçao Mineral S.A	14/01/2013	Brazil	51,00	49,00	100,0
04	Codelco Do Brasil Mineraçao Ltda	14/09/2001	Brazil	100,0	-	100,0
05	Cia.Contractual Minera Los Andes	16/05/1996	Chile	100,0	-	100,0
06	Compañía Minera Picacho	26/09/1994	Chile	100,0	-	100,0
07	Exp. Mineras Andinas S.A	29/07/2004	Chile	100,0	-	100,0
08	Exp. Mineras Andinas Ecuador	19/12/2012	Ecuador	100,0	-	100,0
09	Inca de Oro S.A	11/06/2009	Chile	34,00	66.00	100,0
10	Santiago de Río Grande S.A	02/10/1998	Chile	100,0	-	100,0
11	Soc. Contractual Minera El Abra	28/06/1994	Chile	49,00	51,00	100,0
12	Soc. Contractual Minera Purén	23/09/2003	Chile	35,00	65,00	100,0

3.2. Trading companies

Nº	Trade Name	Incorporation Date	Country	Partners (%)		
				Codelco	Others	Total
01	Chile Copper Limited	29/03/1971	UK	100,0	-	100,0
02	Codelco Group (USA) Inc.	21/12/1992	USA	100,0	-	100,0
03	Codelco Kupferhandel GmbH	27/03/1981	Germany	100,0	-	100,0
04	Codelco Metals Inc.	18/12/1992	USA	100,0	-	100,0
05	Codelco Services Limited	16/08/1988	UK	100,0	-	100,0
06	Codelco Shanghai Co. Ltd.	02/11/2011	China	100,0	-	100,0
07	Codelco USA Inc.	04/12/1974	USA	100,0	-	100,0
08	Copper Parterns Investment Ltd.	01/02/2006	Bermuda	50,00	50,00	100,0
09	Deutsche Giessdraht GmbH	09/04/1975	Germany	40,00	60.00	100,0
10	Inversiones Mineras Nueva Acrux SpA	16/08/2012	Chile	67,80	32,2	100,0

3.3. Port companies

Nº	Trade Name	Incorporation Date	Country	Partners (%)		
				Codelco	Others	Total
01	Complejo Portuario Mejillones S.A	18/03/1997	Chile	100,0	-	100,0

3.4. Health & pension companies

Nº	Trade Name	Incorporation Date	Country	Partners (%)		
				Codelco	Others	Total
01	Asoc. Garantizadora de Pensiones	18/06/1927	Chile	96,69%	3,31%	100,0
02	Centro de Esp. Médicas Río Blanco Ltda.	30/06/2009	Chile	100,0	-	100,0
03	Centro de Esp. Médicas San Lorenzo Ltda.	02/11/2010	Chile	100,0	-	100,0
04	Clínica Río Blanco S.A.	01/12/2004	Chile	100,0	-	100,0
05	Clínica San Lorenzo Ltda.	24/11/1981	Chile	100,0	-	100,0
06	Isapre Chuquicamata Ltda.	04/02/1982	Chile	100,0	-	100,0
07	Isapre Río Blanco Ltda.	05/05/1983	Chile	100,0	-	100,0
08	San Lorenzo Isapre Ltda.	17/04/2006	Chile	100,0	-	100,0
09	Sociedad Ejecutora Proyecto Hospital del cobre Calama S.A.	11/04/1997	Chile	100,0	-	100,0

3.5. Processing plants

Nº	Trade Name	Incorporation Date	Country	Partners (%)		
				Codelco	Others	Total
01	Planta Rec. de Metales SpA	03/12/2012	Chile	34,00	66,00	100,0
02	MOLYB Ltda.	19/05/2011	Chile	100,0	-	100,0

3.6. Investment companies

Nº	Trade Name	Incorporation Date	Country	Partners (%)		
				Codelco	Others	Total
01	Codelco International Limited	2000	Bermuda	100,0	-	100,0
02	Codelco Technologies Limited	2000	Bermuda	100,0	-	100,0
03	Innovaciones en Cobre S.A.	2008	Chile	100,0	-	100,0
04	Inv. Mineras Los Leones SpA	20/08/2012	Chile	100,0	-	100,0
05	Inversones Gacrux SpA	05/10/2011	Chile	100,0	-	100,0
06	Inv. Mineras Acrux SpA	16/09/2011	Chile	67,80	32,20	100,0
07	Inv. Mineras Becrux SpA	06/10/2011	Chile	100,0	-	100,0
08	Soc. de Inv. Copperfield Ltda.	2001	Chile	100,0	-	100,0

3.7. Research & technology companies

Nº	Trade Name	Incorporation Date	Country	Partners (%)		
				Codelco	Others	Total
01	Biosigma S.A.	31/05/2002	Chile	66,70	33,30	100,0
02	Ecometales Limited	22/08/2000	Chile	100,0	-	100,0
03	Instituto de Innovación en Minería y Metalurgia S.A. (IM2)	24/09/1998	Chile	100,0	-	100,0
04	Kairos Mining S.A.	12/12/2006	Chile	5,000	95,00	100,0

3.8. New uses of copper & molybdenum

Nº	Trade Name	Incorporation Date	Country	Partners (%)		
				Codelco	Others	Total
01	Comotech S.A.	03/12/2012	Chile	48,20	51,80	100,0
02	Copper for Energy S.A. (C4E)	22/09/2010	Chile	41,30	58,70	100,0
03	Ecosea Farming S.A.	17/07/2008	Chile	91,32	8,680	100,0

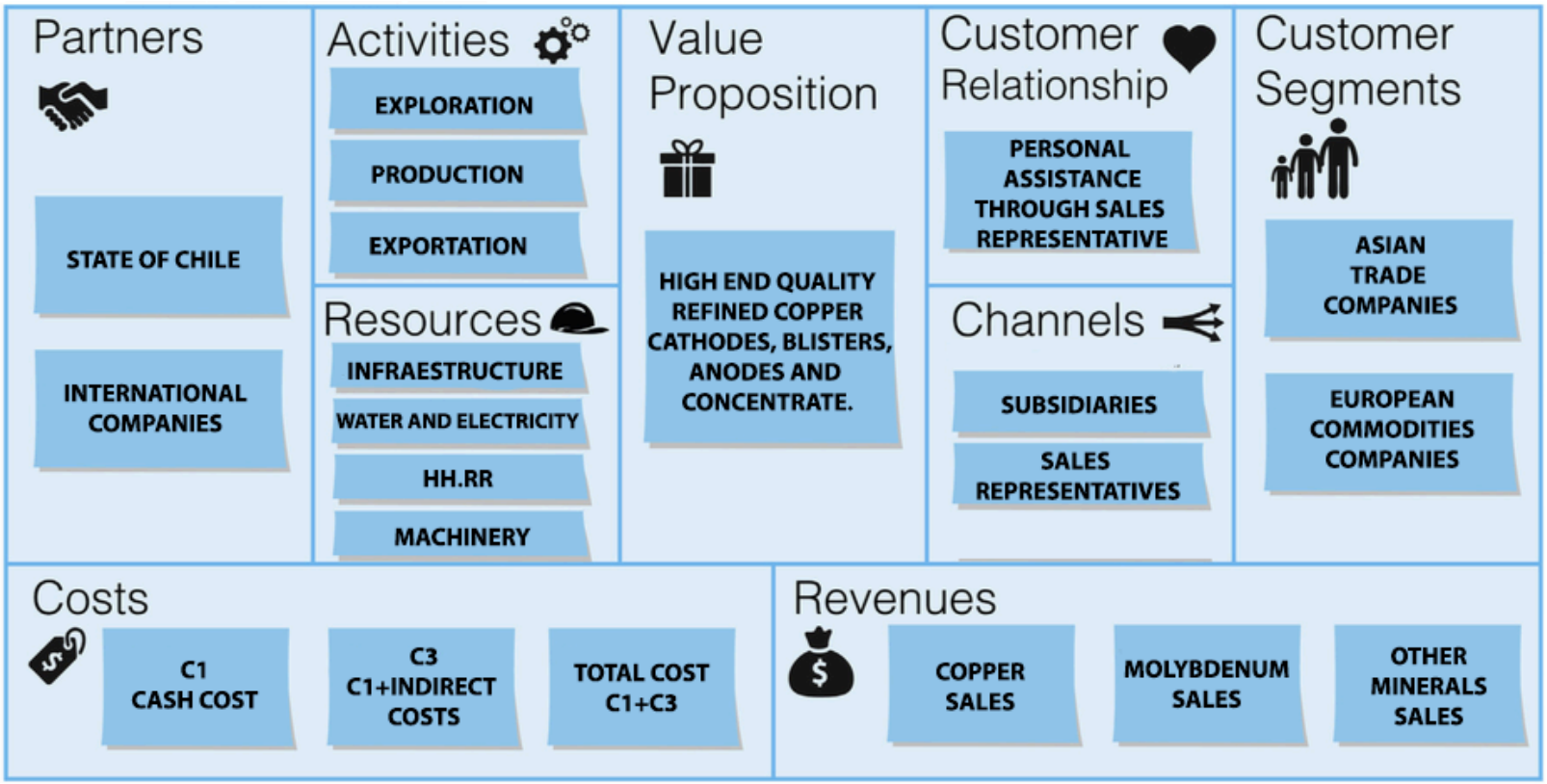
3.9. Electricity companies

Nº	Trade Name	Incorporation Date	Country	Partners (%)		
				Codelco	Others	Total
01	Central Elécrica Luz Minera SpA	03/12/2012	Chile	100,0	-	100,0
02	Energía Minera S.A	15/06/2008	Chile	100,0	-	100,0
03	GNL Mejillones S.A	31/01/2007	Chile	37,00	63,00	100,0

Source: CODELCO, (2016).

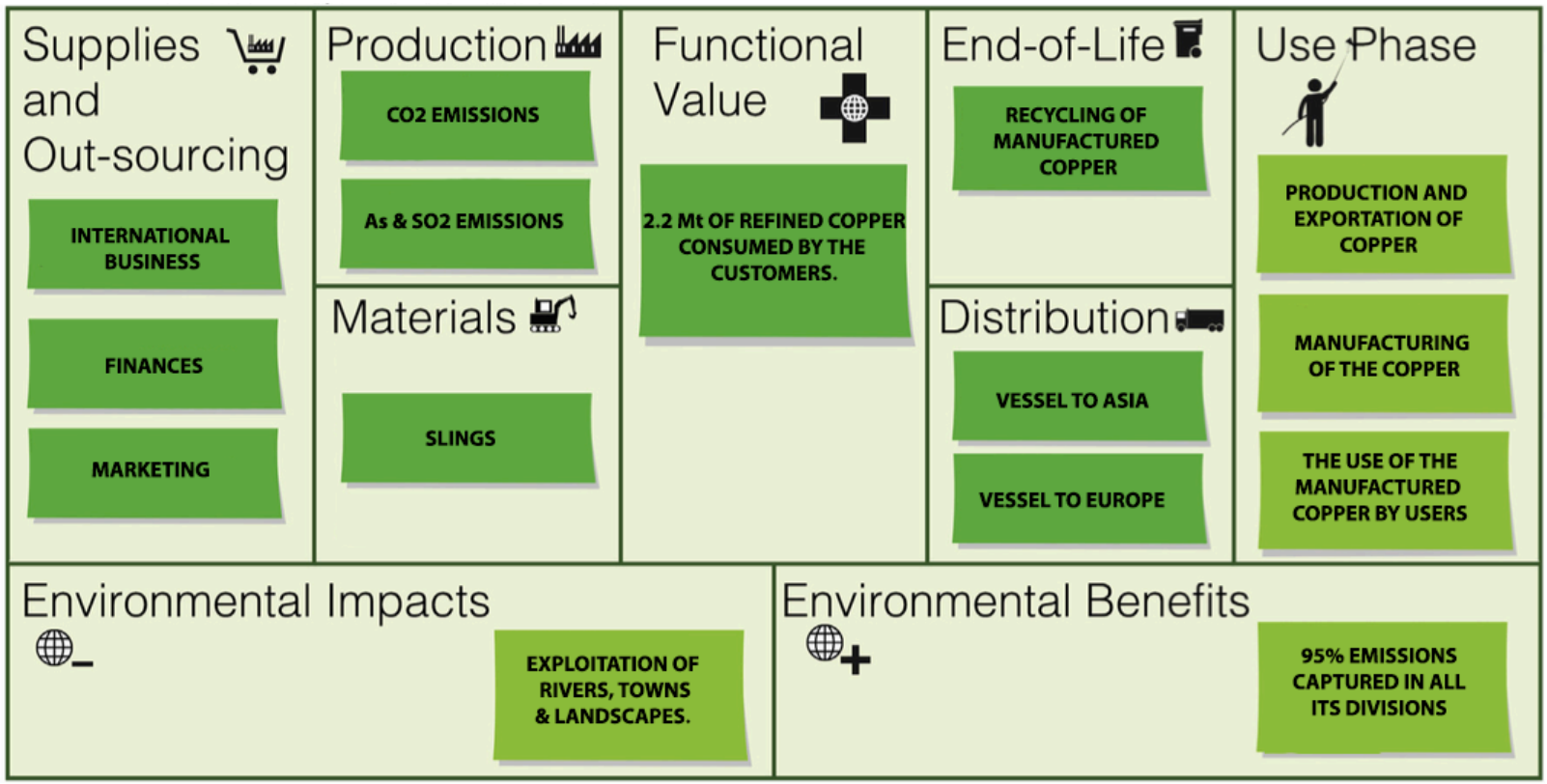
Appendix 4. CODELCO's TLBMC

4.1. CODELCO's business economic layer



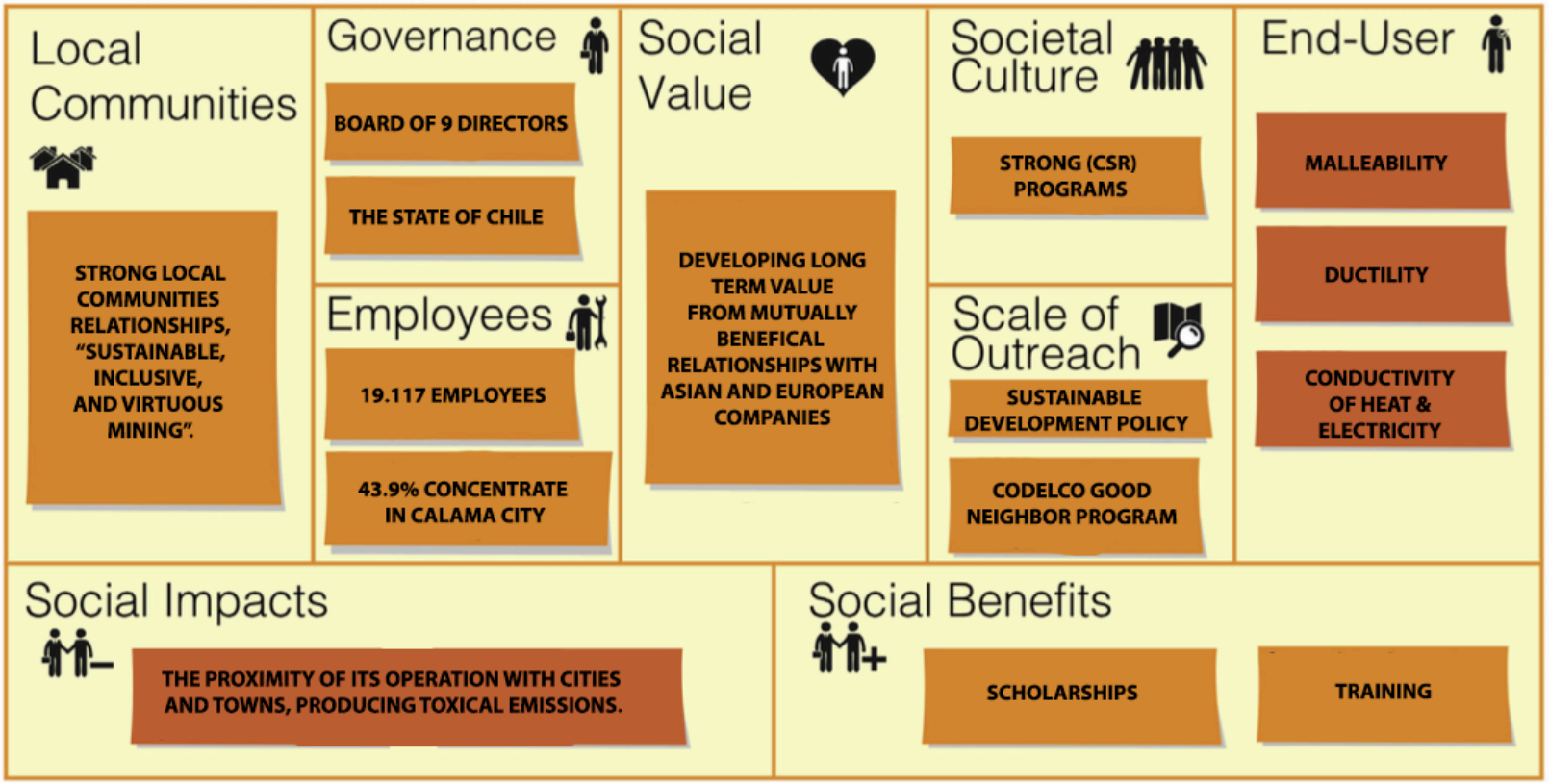
Source: adapted from Joyce & Paquin, (2016).

4.2. CODELCO's business environmental layer



Source: adapted from Joyce & Paquin, (2016).

4.3. CODELCO's business social layer



Source: adapted from Joyce & Paquin, (2016).