DEVELOPMENT OF THE CHILEAN MINING INDUSTRY – ITS DEPENDENCE OF NATURAL RESOURCES

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Abstract

The resource curse, also known as the “paradox of plenty”, basically states that countries that have natural resources in abundance, particularly in terms of non-renewable resources such as oil and gas and minerals, in the long run tend to have less economic growth and prosperity, than countries with relatively lesser endowments of natural resources.

This research investigates the case of the Chilean economy; its erstwhile saltpeter mining industry and current copper mining industry. The study attempts to answer the research question of whether Chile is still under the resource curse.

Through the facts of the case study, semi-structured formal and informal interviews and extensive literature review, the researcher identified four main outcomes of the resource curse which are true to the Chilean history and current events; plundering of national wealth by political leaders, weak policy enforcements and military challenges to the government and the subsequent threats to the country’s democracy. The results of the case study suggest that, Chile is indeed still under the resource curse.

The researcher draws on economic theory by Joseph Schumpeter in his most celebrated publication, "The theory of Economic Development" to gain understanding into the Chilean reality of economic under development and any other possible factors besides the resource curse, mainly lack of entrepreneurial ambitions by the human capital of the economy. The study contrasts, Schumpeter’s economic theory to Marxist economic theory of total control of nation states’ resources by governments and the Keynesian economic theory of government intervention aimed at supporting growth.

**Key-words:** Resource Curse, Economic development, Environmental regulation, Technological change, Mining industry
Dedication
To my grandparents; Nora and Luis, the ever loyal fan base, and Alicia, who led an exemplary life as a teacher for 40 years, but passed during my stay in the Master program at KTH.

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1 Introduction

1.1 Background

During the year 2015, the organization responsible for enforcing compliance to environmental laws, the Chilean Superintendence of Environment (Superintendencia del Medio Ambiente (SMA) in Spanish) initiated over 140 sanctioning processes, resulting in a total of 44 million USD mostly against mining companies, for environmental violations. Ever since the creation of the Ministry of Environment (Ministerio del Medio Ambiente (MMA) in Spanish) and Superintendence of Environment, not only has the number of fines have increased, but the amount of each fine has become quite substantial too. The biggest and famous cases thus far, have been the cases of the Japanese mining conglomerate (JX Nippon Mining & Metals, Mitsui Mining & Smelting Co., Ltd. and Mitsui & Co., Ltd.) in Caserones, where a staggering fine of 11 million USD was imposed in March of 2015 (La Tercera, 2016), and the Canadian mining company Barrick Gold with a fine of 16 million USD (América Economía, 2013).

This issue raises a lot questions; why does Chile, a country that has always been identified as a heavy mining oriented country, face these environmental challenges with the mining companies. Others have also questioned when the environmental problems began, whether it is a recent development. Considering also that ever since Chile obtained its independence from Spain in the beginning of the 19th century (1810), Chile developed quickly and positioned itself as one of the leading industrialized countries in Latin America, being for instance, one of the first countries to deploy a vast transportation network. In 1835, the American businessman William Wheelwright, initiated the first steamboat service from the city of Valparaíso (Chile) to Callao (Perú) – “The Pacific Steam Navigation Company”. In 1851, Wheelwright built the first railway system in Latin America, between the cities of Caldera and Copiapó (Villalobos, 1991).

1.1.1 Industrial Revolution

During the industrial revolution the “steam power” played a decisive role, from its initial “mechanization” of the cotton industry with a stationary steam engine, to its posterior modification and optimization for use in mechanized transportation (locomotives, steam boats, etc.), where raw materials and metallurgy became imperative. As the perfecting of machine efficiency became more demanding, the need for alternative natural resources became a must, switching from wood to coal for its higher heat of combustion allowed considerable improvement in metallurgy, specifically in iron making. This scenario set in
motion a series of geopolitical strategies by the leading industrialized countries (primarily European countries led by Britain) in order to obtain the much needed natural resources for their booming industries.

The aforementioned targeted Chile as one of the countries/colonies from which to extract the mineral resources (nitrates, copper, steel and coal) (Villalobos, 1991).

The newly formed Chilean republic was in dire need of investments in order to expand its infrastructure and hence solidify its independence, since the threat of being repossessed by Spain was always lurking. It wasn’t until the mid-19th century that Spain finally recognized the sovereignty of Chile, and until then Chile had to rely much on foreign investments.

During the 19th century, foreign direct investments in Latin America were predominant. The British had the largest amount of foreign direct investments in the region and Chile as a Latin American country was no exception in encouraging the investments. The dependence on Britain was extensive, all the way from British engineers, British mining techniques (the Longwall system) and even British miners were at the service of the newly formed republic (Centner, 1942).

1.1.2 Saltpeter Industry

Together with the expansion of the transportation network (railroads and steamboats) an influx of heavy industrial machinery started, thus setting the stage for a period in the second half of the 19th century which eventually consolidated Chile’s position as a major mining country – the Saltpeter industry exploitation.

Saltpeter (sodium nitrate) is a compound that has various uses, from the manufacture of fertilizer to gun powder, and is found in a form of “salt” within mineral deposits called “caliche”. The Chilean “Big North” (Norte Grande in Spanish) is a vast extension in northern part of Chile where the largest deposits of caliche can be found.

Historically, the saltpeter extraction was a modest industry exploited by Bolivia, Chile and Perú. Their main patron was Britain, who financially and technologically supported the Bolivian and Chilean “calicheras” (saltpeter offices). Over time, the mineral resource received worldwide importance due to its various uses and become a highly priced commodity.

In 1879, due to Bolivian taxation policies, Chile was dragged into a military confrontation with the Peruvian-Bolivian Confederation, which resulted in the re-drawing of the borders in favor of Chile. Perú had to forfeit the region of Arica and Bolivia the region of Tarapacá, thus losing the access to the Pacific Ocean. With the newly acquired territories, the Chilean
economy boomed, increasing its coffers with taxes derived from the new acquired territories and becoming the biggest exporter of saltpeter in the world (54% of world supply) cementing what was later called Chile’s Nitrate Age. Thanks to the revenues generated from the saltpeter industry, the Chilean government set in motion the modernization of the country.

However, many historians claim that this era set the scene for what modern economists (Auty, Sachs, Stiglitz, etc.) called the “Resource Curse”. Despite having tremendous economic success thanks to the incomes derived from the saltpeter industry, Chile suffered a series of adverse episodes, the Chilean Civil War of 1891, the stagnation of the overall Chilean economy due to its high dependence and revenue monopolization of the saltpeter industry (lately coined “Dutch Disease”). The last straw that broke the camel’s back was the development of synthetic saltpeter by German chemists at the wake of WWII, which killed the market for the natural saltpeter and Chile’s worldwide monopoly of the natural resource (Brown, 1963).

### 1.1.3 Copper Industry

Entering the 20th century, copper took a predominant role in the Chilean economy. The rise and development of copper industry share similar characteristics with the saltpeter industry, but its impact in the Chilean economy was determined by one main difference. Copper, until well into the 20th century, did not have any significant economic importance as compared to the saltpeter. In the second half of the 19th century, copper was already an important Chilean export product; however, in those days the industry was not as vibrant as it is today, as it was based on the extraction of a large number of small deposits with very high concentration of copper in the ores, requiring high labor force.

It was with the rather unexpected boom of the electrical industry and the development of innovative technologies from the USA, that allowed extracting and exploiting copper ores with rather low concentrations (1% - 2%) in a profitable way. In 1911 copper extraction was initiated in Chuquicamata, today the world’s biggest open pit copper mine (Ministry of Mining 2016). Ironically, Chuquicamata is located in the region of Tarapacá, conquered in the Pacific War against the Peruvian-Bolivian Confederation.

Unfortunately, “history repeated itself” in the Chilean copper industry. Despite being a very lucrative industry, foreign investments were predominant, especially from the USA, with its giants Anaconda Copper Company and Kennecott Copper Corporation. The prevailing taxation laws favored the foreign companies to the detriment of the Chilean state, as the
mining companies paid very little taxes. This led to a series of reforms initiated in the 1950s with the so called “Chilenization of copper” where the Chilean government sought to gain control over the foreign-owned mining companies, creating the state-owned mining company, CODELCO. The process ended finally with the nationalization of most of the mining industry in 1971, led by the Dr. Salvador Allende.

Unfortunately, this led to big political tensions between the Chilean and the US government, since these events occurred during the height of the Cold War and the democratically elected socialist government of Salvador Allende generated animosity in the American counterpart, Richard Nixon, since several of the Allende’s policy reforms conflicted with US interests. The aforementioned political tension led finally to the 1973 Chilean coup d’état, which resulted in the death of Salvador Allende.

The Chilean economy, since the 1970s had been experiencing a downward spiral with chronic inflation, falling GDP, diminishing foreign-exchange reserves, etc., but in the mid-1980s the military junta, with the guidance of the “Chicago Boys”, a group of Chilean economist trained at the University of Chicago under Milton Friedman, put in motion a series of free-market, neoliberal and fiscally conservative policies, that led to the “Chilean Neoliberal Era”. During this period, the Chilean economy experienced an exponential growth and received praises and admirations worldwide – the so-called “The Miracle of Chile” (Villalobos, 1991).

Today, several criticisms have been made regarding the measures behind the miraculous growth of the Chilean economy; the negative social impacts such as a social inequality gap in the Chilean society; the privatization of the education system, hence the sub-sufficient public schools, privatization of the health system, etc.

1.2 Research Question and Aim

The following research is focused on doing a thorough review of the historical past events in the Chilean mining industry, in order to identify the factors that made Chile to become one of the most important copper producers in the world. it also investigates the possible reasons behind, though being a major player in the copper mining industry, the country has not been able to break out of the “developing” status; and finally why the overall Chilean mining industry has not been able to incorporate the necessary technology to add value to its copper exports. As it was exposed briefly in the introductory section of this research, Chile has had a historic opportunity to re-live a second economic super-cycle with its copper industry,
hopefully taking into consideration the “lesson learnt” from its previous experiences with the boom of the saltpeter industry in the 19th century.

Hence, in light of the aforementioned, it is unfortunate that for the last 30 years Chile has been exporting no more that raw copper concentrate and Blix copper production, without any additional added value. Subsequently, this research seeks to investigate the following research question:

**Does the Resource Curse still hold true for Chile in its mining industry?**

### 1.3 Outline of the thesis

Not considering the present chapter, this thesis work is structured as outlined as follows:

- **Literature review:** In this chapter, the revision of the key concepts such as Resource Curse and its different manifestations, e.g. Dutch Disease, economic Volatility, etc., in natural-resource-based economies is presented, together with a detailed outline of possible outcomes that can result from the Resource Curse.

- **Methodology:** In this chapter, the research strategy used for this research is outlined

- **Empirical findings:** In this chapter, the result of the research of the Chilean mining industry, from its beginnings to its present days, supported by the interviews / informal conversations with the local expert is presented.

- **Discussion:** In this chapter, the findings obtained in this research will be analyzed and discussed together with supporting economic theory.

- **Conclusions & Limitations:** In this chapter, the final conclusions, based on the outcome of the previous chapters, will be exposed.

- **Suggestions:** in this brief chapter, possible solutions in order to overcome the Research Curse will be presented.

- **Further Research:** In this chapter, a series of measures or future research topics will be presented.
2 Literature Review

This research is primarily based mostly on the review of existing literature regarding the “Resource Curse”, its different characteristics and how it has affected the development of countries around the world in the latest decades.

2.1 The Resource Curse

Also known as the “paradox of plenty”, the resource curse is a phenomenon that basically states that countries that have natural resources in abundance, particularly in terms of non-renewable resources such as oil, gas and minerals, in the long run tend have less economic growth and prosperity, than countries with relatively lesser natural resource endowment (Auty, 1993).

This concept first emerged in discussions in the 1950s and 1960s, and the term ‘resource curse’ was coined by British economist Richard Auty in 1993. Prior to Auty’s first exposition of his resource curse thesis, the understanding of development of a country was primarily conditioned on the existence of abundant natural resources. As a matter of fact, Norton Ginsburg, economist of the University of Chicago, stated that countries that exploited their natural resource endowments more effectively per capita, tended to be more developed than those countries that were less effective in the extraction of their natural resources. This went hand-in-hand with the explanation that countries with large populations had a considerable advantage over smaller countries, since it could always count on its own internal market (Ginsburg, 1957).

Over time, the amount of evidence indicating the totally opposite was piling up, indicating that countries coming out of the WWII era and where natural resources was scarce or less than abundant, started to show clear signs of progress and development. A clear example is the case of Japan vs. Australia, where even today, the income per capita of Japan is higher, even though the per capita resource of Australia is 150 times larger than that of Japan (Auty, 1993).

Auty goes even further claiming that countries that have strong dependency on mineral resources have under-performing economies due to the high costs involved in the mining activities. The mining activities are very capital intensive resulting in a tendency to depend on foreign investments; thus lowering the employment ratio of local forces (Auty, 1993).
Another characteristic is that in nowadays societies where extraction and processing of natural resources occur, is not fully integrated in the “economic dynamism”; meaning that where the raw material was extracted is far from where the material is processed into a tradable good (Laestadius & Nuur, 2010).

Important questions arise regarding how the “paradox of plenty” or wealth generation based on natural resources is different to other forms of generating wealth, and according to Humphreys, Sachs and Stiglitz (2007), in their collaboration “Escaping the Resource Curse”, note two main differences. Firstly, the natural resource does not need to be “produced”, rather it must be extracted (independently how difficult it is to extract it) and normally the resource wealth generation, as a process, stand independently from other economic process in society, hence no linkage to other production sectors, leaving the resource based processes confined to “enclaves”. Secondly, many natural resources, particularly the no-renewable resources, from an economic perspective are viewed as “less like a source of income and more like an asset” (Humphreys, Sachs and Stiglitz, 2007).

They go even further, breaking down the concept of “Resource Curse” in its different characteristics outlined as follows.

2.1.1 Unequal Expertise
Considering that natural resource extraction is both capital and over time, technologically intensive, and most of developing economies and their governments see themselves in need of the cooperation of international private sector actors. This generates disadvantageous situation where the international private actors have better knowledge of the “value of the good being sold”, thus resulting in “unfair” contracts signed between poor countries and multinationals, e.g. low taxation, low royalties or retributions, unprecedented long concessions of exploitation rights, etc. (Humphreys, Sachs and Stiglitz, 2007).

2.1.2 Dutch Disease
The so-called “Dutch Disease”, is characterized by increased development in a specific economic sector, whilst the other economic sectors simultaneously experience stagnation or actual decline in development. For instance, a growth in the mining sector whilst the agricultural sector growth is stagnated or declining at the same period is an example of the Dutch disease. The Dutch disease occurs mainly due to revenue increases in the specific sector that is growing due in part to the inflow of foreign direct investments, resulting in the increase in value of the local currency. The increase in value of the local currency becomes
detrimental to the other economic sector, whose exports becomes more expensive and hence less competitive, and in the end would require some sort of protection or subsidy (Ebrahim-Zadeh, 2003).

2.1.3 Volatility
Other problems arise due to the “timing” of the earnings made on the extraction of the natural resources, because according to Humphreys, Sachs and Stiglitz, (2007), if viewed as source of income, the natural resource incomes are very volatile due mainly three reasons. Firstly, the variations in extraction rates in time, secondly, the variability in time of payments of corporations to governments, and thirdly the fluctuation of the value of the natural resource in time.

This is particularly sensitive because many economies tend to commit the mistake of having large expenditures during “good years” and later find themselves having to make big constraints or cuts during the “bad years” – this known as the “boom-bust cycles” (Humphreys, Sachs and Stiglitz, 2007).

2.1.4 Living off your capital
Since the natural resources are non-renewable, the revenues generated should be viewed as consumption of capital instead of consumption of incomes. This means if all the revenues are consumed within a cycle, the total amount of capital of nations is reduced.

In order to avoid capital reduction, it is recommended that when producing natural resource based wealth, revenues be converted to into financial assets and invested in diversified portfolios, whilst treating the surplus generated from the interests as incomes. The most common convention says that countries do not become “wealthier” when exploiting their natural resources; it simple changes the composition of its asset base.

It is recommended to further invest in other sectors, such as housing and building sectors or “other assets above ground”. (Humphreys, Sachs and Stiglitz, 2007)

2.1.5 Insufficient investments in education
Ironically, when economies over stimulate the consumption of their generated wealth, there is a tendency to under invest in education because it is not seen as an investment, even though resource based economies require a diverse, skilled and well-educated workforce.

If contrasted with economies based on manufacturing or other productive activities, evidence has shown that education is essential to the future of the activity and its wealth creation. On
the other hand, economies based natural resources tend to myopic, since education investment has no immediate effect on the economy. (Humphreys, Sachs and Stiglitz, 2007)

2.2 Resource Curse Outcomes

Majority of scholars, independent of their school of thought, have agreed that natural resource based economies are more likely to have nondemocratic ruling systems, limited political and social freedoms, elevated levels of corruption or have suffered or presently are suffering political and social unrest (civil wars, dictatorships, etc.). Below is set of most common mechanisms that may cause the aforementioned outcomes:

2.2.1 Spoliation

With high levels of corruption comes the “short run availability” of financial assets that can be subject to theft by the political actors within the ruling system. This may become endemic since it can be used by political actors in order to perpetuate their position in power either through more peaceful means, e.g. political campaigns, or more violent means.

Examples are numerous, but the most renowned ones are the political corruption cases in oil producing countries like Nigeria and Venezuela.

2.2.2 Weak and unaccountable states

Paradoxically, countries that rely on incomes derived from natural resources have weaker linkages between the government and their citizens and hence, are less reliant on their citizens. On the other hand, when citizens are not taxed, they have fewer interactions with their governments and tend not to hold them responsible and accountable for any wrong actions it may commit. Taxes have been shown to be a powerful tool for citizens in order to be able to put pressure on governments because of the financial support they give the state through the taxes.

2.2.3 Threats to democracy

Corruption and weakened states is an immediate threat to any political system. Examples of countries rich in natural resources that have suffered dictatorial overthrows are countless (particularly African and Latin American nations).

In reference to oil based undemocratic countries, Humphreys, Sachs and Stiglitz, (2007) explain: “Overall, at least three features of oil dependent states help to explain the relationship between natural resource dependence and the lack of democratization. First, governments do not feel the same pressure to exchange political power for the rights to tax,
since they can raise their revenues from other sources. Second, they can invest in coercive capacity that can be used to quell threats to their political power. Finally, citizens in these states are less likely to undergo the transformative effects of industrializing countries that have been associated with demands for democratization elsewhere.” (Humphreys, Sachs & Stiglitz, 2007)

2.2.4 Military challenges to governments
Studies have shown that countries with resource-based economies tend to spend more on their military resources and not necessarily during civil wars situations. It has been shown that when there are high levels of corruption within the political system, it has motivated “non-state actors” to try to capture and overtake the state in order to seize the wealth arising from the natural resources. A typical case would be the situation that Colombia has had to face for several decades with the guerillas (e.g. FARC) and paramilitary groups fighting each other and amongst each other as well. It has gone as far as foreign governments, international corporations implicated in such practices when their interest in the natural resource has been overwhelming, as the case of the CIA sponsored coup in Iran in 1953. (Gasiorowski, 2000)


3 Methodology

3.1 Research Design
For this research, the design is based on the methodology of case study. Case study research allows the researcher to do a more in-depth investigation of a new or more “unexplored” phenomenon. This is particularly relevant, because case study research allows to focus on answering the “how” and “why” questions, additionally it allows the researcher to cover relevant contextual conditions that may deems important to the phenomena that is being studied (Yin, 2003).

The main idea is to answer why Chile, being so rich on natural resources, has had it so difficult to overcome the barrier of becoming a developed country.

3.2 Research method
The research method of this research will use the qualitative content analysis, since “the research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use.” (Krippendorff, 2004). The information used in this research is information of public domain.

3.3 Research paradigm
According to Collis and Hussey, “a research paradigm is a framework that guides how the research should be conducted, based on people’s philosophies and their assumptions about the world and the nature of knowledge”. And since the qualitative content analysis will be used, the research paradigm will be the interpretative paradigm, since most of the qualitative analysis research comes from this paradigm.

The interpretative paradigm arose in response to the formally established paradigm of positivism, where most of the research was done in the realm of natural sciences, e.g. physics, mathematics, chemistry, etc. where inductive logic was applied in order to extract theories for predictive uses. But with the increasing need of social research and its varied phenomenon, researchers have come to the consensus that a more interpretative approach is more appropriate (Collis & Hussey, 2014).

3.4 Data Collection and Analysis
As primary source of information, the data collection is based on academic literature and peer-reviewed articles from highly credited sources, such as the KTH library and other academic databases.
As a secondary source of information are conversations and “informal” interviews with a local expert in matters related to governmental policies, in-depth knowledge of the evolutionary process of environmental policies in Chile, etc.

As for the analysis of the collected data, a more qualitative approach will be used. Despite that most literature highly recommends to use supporting qualitative data analysis (QDA) software, due to the immense volume of data that can emerge, but for the purpose of this research, in order to keep track of the gathered information, it was decided that the best approach was to have a comprehending approach to the data analysis. This approach is highly recommended when dealing with no prior knowledge in the research topic.

3.5 Delimitations
Considering also that the topic of Resource Curse is extremely broad and is referred to all natural resources, the majority of the scholars have emphasized their analyses to emblematic resources and countries, such as e.g. oil and gas in Nigeria and Venezuela. The researcher has delimited his work to the revision and literature referred to the mining industry, firstly from a worldwide perspective and subsequently narrowing the research to a more local perspective (Chilean mining industry).

As a vital support to the research, the data collection from the interview/conversations with the local expert has been crucial in order to understand and later present the overall Resource Curse situation in this research and try to answer the above posed research question.

3.6 Ethics and Sustainability
Based on the requirement of KTH and the Swedish National Agency for Higher Education (Högskoleverket in Swedish), this research has followed the guidelines outlined in Collis & Hussey.

The entire research process, was done by the researcher, from the gathering of the data, to the conclusions and further proposed research; and there were no ethical concerns. Collection of the primary data, the local expert interviewed was not compelled to take part of the research but agreed out of him own free will to collaborate.

Regarding sustainability issues, this research is framed within the environmental and economic sustainability goals, in order to try to sustain the ability of using natural resources and its related services, which fundamental for worldwide economy.
4 Empirical Findings

4.1 Chile
The Republic of Chile (18,191,884 habitants) is a country located in the American continent, specifically in the southeastern part of the South America, being Santiago de Chile its political capital (the largest city with more than 6 million habitants).

Chile has a long and narrow geomorphology, 4270 km long and 445 km narrow, neighboring to Perú on the North, Bolivia in the Northeast, Argentina to the East all along the Cordillera range and to the Pacific Ocean in the West having a costal line of more than 6000 km. Chile has 756,096 km2 (considering the insular (e.g. Easter and Juan Fernández islands) and continental territories). Due to Chile’s particular geography there are a vast variety of ecosystems, topographies, vegetation to be found, and almost all of the world’s climates can be found Chile (Gitlin & Fuentes, 2012).

According to several sources, Chile is considered to be developing country and is expected to be a fully developed country within the next 10 years. Chile has been one of the fastest and long-time growing economies of Latin America, the average growth for the Chilean economy during the last 10 years has been 5% per year, despite the global financial crisis in 2009 and the stagnation in the mining sector in 2014, which led to the falling of the GDP growth, rise of unemployment from 5.7% in July 2013 to 6.6% in June 2014.

The Chilean economy is characterized mainly as a market-oriented economy; high foreign trade, healthy financial institutions and sound market liberal policies, resulting in exports of goods and services being almost one third of the national GDP, as a matter of fact; copper mining exports constitute almost 20% of the governmental revenues (Worldbank (2016)) (CIA (2016)).

The Central Bank of Chile in Santiago serves as the central bank for the country. The Chilean currency is the Chilean peso (CLP). Chile is one of South America's most stable and prosperous nations, leading Latin American nations in human development, competitiveness, income per capita, globalization, economic freedom, and low perception of corruption. Chile has the highest degree of economic freedom in South America (ranking 7th worldwide), owing to its independent and efficient judicial system and prudent public finance management. In May 2010 Chile became the first South American country to join the Organisation for Economic Co-operation and Development (OECD). In 2006, Chile became the country with the highest nominal GDP per capita in Latin America.
4.2 Brief history of mining in Chile

While in the 16th century the exploitation of panning explains the formation of the original capital that granted surpluses that made possible the installation of other economic activities, the 17th and 18th centuries have been characterized by historians as agricultural centuries which the “Fundo” (rural estate) formed the identity of the national soul. Historical records reveal that, in those centuries, even when mining appeared as a secondary activity, artisanal mining of different deposits such as gold, silver and copper continued to be a sizable source of incomes, which allowed the maintenance of internal trade and international.

Chile experienced a 16th century where the mining activities allowed the first “conquistadors” accumulate capital enough that made it feasible the establishing of the General Captaincy of Chile, under the command of the Viceroyalty of Perú.

In the 17th century the Kingdom of Chile had a resized and the agricultural activity, through its estates or “fundos” concentrated most of the economy given the priority of harvesting food for survival. Additionally, the exploitation of mine deposits was forced outside of the zones where there was a long-time resistance of the aborigines (mapuches) in the southern Chile against the Spaniards, thereby starting the major operations of the first mines in the north of the country.

In the 18th century there was a profound estrangement from mining activities. Politician Juan Egaña described this phenomenon in 1803, in his report to the Royal Court of Mines in Spain, the surprising low utilization of mineral resources available in the Andean ranges. Chile survived basically of its agricultural exports.

In the country there has always been exploitations of small and medium importance of almost all mineral resources (copper, gold, silver, salt and coal) firstly by the indigenous population and later by the conquistadors, but starting in mid-19th century and thanks to prominent figures like José Rojas (Coal extraction in Coronel); Matias Cousiño (Coal extraction in Lota); José Tomas Urmeneta (Silver extraction in Tamaya-Ovalle); José Ramón Méndez (Silver extraction in Caracoles-Antofagasta); José Santos Ossa (Saltpeter extraction in the Atacama Desert) together with a more libertarian “institutionality”, mining began to prevail in Chilean exports.

Only in the 19th century, then, after the independence from Spain (1810) and at the drumming beat of the Industrial Revolution and the new freedoms of trade, it gave way to a rebirth of mining as a key activity, this time with discoveries that opened the doors to silver
(Chañarcillo) and coal extraction (Lota) and after the War of the Pacific (against Peruvian-Bolivian Confederation, 1879 to 1883), the saltpeter extraction process with which Chile entered the 20th century, marked by the large-scale copper exploitation.

Subsequently, it was counting off with the 19th century when the effects of spectacular mining development spread to all areas and with the increasing institutional order and the curbing of the banditry by Diego Portales, made the revival of trusts in the agro business, destroyed by internal and external conflicts, stimulating new large investments (major infrastructures, construction, etc.) arising from mining activities.

Also, following a cultural Spanish agrarian tradition – where fame and recognition is collected from the property of the lands, enriched from the mining activity, businessmen came to the countryside, introducing new techniques and crops such as rice, alfalfa and strains imported for viticulture, a phenomenon that today we see reflected in the wine brands best known in the country and the world (Cousiño, Urmeneta) (Ministry of Mining 2016).

4.2.1 The case of the Chilean Saltpeter.

Fast-forwarding to the 19th century, Chile became the main producer and exporter of natural saltpeter (Potassium nitrate) in the world during the first decades of the 18th century, after engaging in a military conflict with its neighboring countries (War of the Pacific against the Confederation of Perú and Bolivia) which as a final outcome led to Chile taking over the most saltpeter productive regions (Antofagasta region). The ill-famed War of the Pacific fought between Chile and Peruvian-Bolivian confederation in 1879, has in its origins the dispute for the control over the mineral between Chile, Perú and Bolivia and which in the end would be replaced by the synthetic saltpeter, engineered by Germany in the beginning of the WWII.

The saltpeter was a natural resource that was used dating back to the period of the Incas, but it was with the conception of the young Chilean republic that it got more attention and a major British investment help to shape the booming business of saltpeter in the region.

By the year 1842, 54,000 tons of mineral resources were extracted and shipped by British companies, primarily coal. But by the outbreak of the War of the Pacific in 1879, British companies extracted only 14% of the available natural resources, and by the end of the war, British companies extracted almost 54% of the minerals. From 1901 the Chilean owned investments increased from a 15% to a 51% by 1921 (Centner, 1942).

The chronicles of the time state that Chile had the necessary political and above all the economic conditions to leave behind the underdevelopment. However, due to the lack of long-
term vision and the implementation of all the conservative policies did not manage to eradicate the agro-industrial growth model, based on the keeping of the “semi-feudal” Chilean large estates economy. As previously stated in the introduction section of this research, the aftermath of the saltpeter industry was not so successful, since Chile had a series of events that were clear indicators of being victim of Resource Curse, such as the political and social turmoil followed the Civil War of 1891 where the constitutional order was interrupted and resulted in the death of president Balmaceda and followed by the “Parliamentary Era” where the Chilean congress held the real power. This was unprecedented since the global tendency (especially in Latin America) was to have a “presidentialist” mode of govern.

4.2.2 The case of the Chilean copper
Ironically, 100 years later (1990), Chile re-experiences a historical experience that would allow it to get out of the category of “developing country” to become a “fully developed nation”.

As a result of the “War of the Pacific”, Chile, the winning country of the confrontation, won new territories on its northern frontier. The extensive Provinces of Antofagasta – Atacama, formerly the property of the neighboring country of Bolivia, came to be entirely owned and managed by the Chilean government of the time.

Since these regions are rich in minerals, mainly copper, 100 years later they would make Chile the leading producer of copper in the world.

4.3 Chilean Mining today
The democratic governments that followed after the military dictatorship of General Augusto Pinochet (1990), aware of the unprecedented historic opportunity, or to finally achieve the opportunity to overcome the status of “developing country”.

This posed a great challenge for the Chilean economy, of turning Chile on its bicentennial anniversary in 2010, into a developed country, meaning, a country with a GDP exceeding 20,000 USD per capita (similar to the southern European countries, Spain, and Portugal of that time).

However, coming the year 2010, the country did not achieve the aforementioned goal. The governments of the ruling coalitions (Concertación and later Nueva Mayoría in Spanish) that came after the dictatorship and stayed in power for the next 25 years gradually shifted the target over the following years.
According to various studies, particularly those done by the Economic Commission for Latin America and the Caribbean - ECLAC (CEPAL in Spanish) who has been very thorough on following-up the development of all Latin American and Caribbean countries, the overall situation of the Chilean mining industry is as follows.

In the last 10 years, the mining industry constituted between 13% and 21% of the national GDP. Comparing with other related economic sectors/activities, in terms of added value, the mining industry represents 200 times fold the aquaculture industry, 24 times fold the industry of forestry, 17 times fold the lately rising wine industry, etc. As a matter of fact, within the mining industry, the copper production constitutes more than 90% of all the mining production, and all the metallic (copper, iron, molybdenum, silver and gold) mining production constitutes more than 97% of all production. Contrastingly, the mining industry has a very low employment rate, as of in 2013 the mining industry represented 13% of the GND and that year the industry only employed less than 1% of the total working force.

Regarding the constitution of the different companies involved in the Chilean mining industry, the biggest company is the state-owned CODELCO who has 33% of the market share, and is followed by Australian BHP Biliton with a 16%, and the remaining is spread out between various foreign and Chilean companies (ECLAC, 2016).
4.3.1 Production linkages

Despite of experiencing the miraculous growth of the mining industry in the late 1990s and first decade of the 2000s, national and foreign analysts have come to the census that compared to developed countries’ mining industries; the Chilean has had a sub-sufficient production linkage within the mining industry. The linkage to the upstream sector, related to suppliers, machinery, technology, etc., has been “unsynchronized” in regards to the downstream sector, production of higher value products.
If taking as an example the cases of Australia and Canada, both countries have had strong production linkage policies in the downstream sector, since for instance, the Canadian companies (foremost Barrick Gold) virtually controls all the gold mining production in Chile, and Australian BHP Billiton is second biggest contender in the copper mining sector, after state-owned CODELCO.

In the case of Chile, having poor production linkage capacities, it has manifested through foremost three particular situations:

1. Having poor upstream linkage: the end-products are not useful as supplies in other areas of production
2. Having poor downstream linkage: the end-products have little added value due to little use of local (not imported) supplies
3. Having simultaneously poor downstream linkage due to the fact that one of its supplies is not available in the local sector, hence requiring getting it imported and thus making production costlier and inefficient.

### 4.3.2 Environmental issues

As the worldwide mining industry started to go through its transformations over time, it also became very invasive on its surrounding environment and generated considerable impacts on
the environment. By mid-20th century, authorities worldwide started to take notice of the potential devastating effects that the mining industry could have on the environment. Before that, the premise was firstly prioritizing the economic progress and wealth over the potential consequences.

By the 1990s, Chilean authorities began discussion the possible measures in order to try and curb the already devastating effect that the mining industry started to have on the environment. By 1992, Law decree Nº 185 was passed, that legislate the sulphurous emissions coming from smelting and tailing facilities in order to reduce air-pollution. Additionally, a framework of agreement was negotiated between the government and various productive sectors, to initiate a decontamination plan of five state-owned smelting plants, environmental impact studies in every new mine site. Together with the new environmental legislation coming into force, Chile also signed the Basel Convention, committing to the control of Transboundary Movements of Hazardous Wastes and Their Disposal.

In 1994, the creation of the Law Nº 19.300 – Bases of Environment, where among other thing authorized the first “enforcement” body specifically for environmental issues, CONAMA (explained in more detail in coming chapters) and 2010 the final creation of the Ministry of Environment (SMA, 2016).

4.3.3 The cycle of copper

To better understand why, come the year 2010, Chile did not achieve the proposed goal to achieve the “developed” status, it is necessary to mention the cycle of the copper.

As it is known, the value of exports of copper undergoes constant changes inherent in the law of supply and demand in the international market.

During the last few decades, particularly 1990s, China experienced a vertiginous economic growth, having double-digit GDP indexes in their economy for several years consecutive (NBS, 2016), and the demand for material was pressing for the ever expanding Chinese economy. After Chile signed a Free Trade Agreement with China, copper production was shipped off to China, estimating that 2013 the amount of copper exported to China was approximately 15 billion USD, making China one of the most important economies for the Chilean copper industry. Without a doubt, this was one of the pillars that allowed putting the Chilean economy in the forefront of all the countries of the region for the last 15 years.
4.4 The causes
One of the reasons that could partially explain the inability to achieve the “developed” status would be in the implementation of inappropriate policies in the period of democratic transition in Chile (officially between 1990 and 1994), but according to renowned Chilean social experts the transition ended with the arrest of Pinochet in London in 1998, and more drastic scholars claim even further that the transition has not ended, since still until today there are no less important vestiges of Pinochet’s heritage, e.g. the political Carta Magna in force today, imposed by Pinochet in 1980.

Regarding environmental issues, the first government of the democratic coalition, fearing that if creating a fully-fledged Ministry of the Environment, together with the proper environmental agenda with all the environmental policy endowments, it could freeze or obstruct any future foreign investments, which was much needed for the boosting of the post-dictatorship economic development of the country, hence the decision of establishing instead a “National Commission of Environment” (Comisión Nacional del Medio Ambiente (CONAMA) in Spanish).

This was an inter-ministerial entity who was in charge of the national environmental agenda, which only coordinated the policies and environmental initiatives. However, the Commission was not endowed with any ability to control and fiscalize. Only to coordinated the environmental agenda, with which the most relevant aspect of “controlling” (enforcement) was permanently absent from their daily activities.

As a result of this, during the coming years Chile witnessed environmental policies that were both ambiguous and weak, resulting in events such as:

- The proliferation of environmental liabilities ("Hot Spots" such as the Valley of Puchuncavi, where there are large mining and industrial complexes, reaching alarming levels of pollution in surrounding locations).

- The detection of 5 shipments of pork-meat exported from Chile to South Korea, where the levels of Dioxins concentration reached limits above those allowed by the European Union.

- Being that Chile is famed as a power agro-exporter, Chilean grapes are rejected in the North American market.

- The creation of tailings associated with the mining operations becomes a potential threat to many communities located near to the mining sites.
The area of Tocopilla in the north of Chile is declared as one of the most saturated with particulate matters and pollutant gases such as sulfur dioxide, among others, reaching record levels.

The region of Concepcion–Coronel, due to its proximity to cellulose industries (Central Bocamina), it is assumed as one of the milestones of environmental and more important challenges to overcome for the government.

Finally, 25 years after having sworn-in the first democratic government, CONAMA statutes were finally modified, by creating a new environmental “institutionality”.

This initiative partially turns out to be the result of the requirements that the Organisation for Economic Co-operation and Development (OECD) put on as a prerequisite for Chile’s admission to the community of nations.

This new environmental “institutionality” is materialized through the creation of:

- The Ministry of the Environment (Ministerio del Medio Ambiente (MMA), in 2010), from the transformation of the former CONAMA, in charge of among many things:
  - Propose environmental policies and inform periodically of its progress and fulfillment
  - Protecting Protected Areas (reserves and natural sanctuaries)
  - Uphold international conventions

- The Superintendence of Environment (Superintendencia del Medio Ambiente (SMA), in 2012), in charge of:
  - Continuous monitoring of compliance of environmental policies
  - Ensure the compliance of the in-force environmental policies
  - Hiring and supervising the duly certified third party services of inspection, verification and measuring when performing sample collection and analysis.

- The Environmental Tribunals (Tribunales Ambientales (TA) in Spanish, 2014):
  - Judiciary entities in charge of resolving controversies related to environmental issues

- The Service of Environmental Evaluation (Servicio de Evaluación Ambiental (SEA) in Spanish, 2012):
Its main function is to introduce technology and manage environmental management tool called "System of Environmental Impact Assessment" (SEIA), whose management is based on the environmental assessment of projects adjusted to the in-force norms, encouraging and facilitating citizen participation in the evaluation of the projects.

The creation of this new “institutionality” brought with it a new set of tools and endowments that were added to the activities previously developed by CONAMA.

Possibly the most relevant happened with the new environmental “institutionality” in the country, without a doubt, is the new vision on the environmental control.

As a matter of fact, as a result of this new institutional framework, environmental fines radically change direction and amount.

During the existence of CONAMA, the low amounts in the fines associated to environmental infringements, allowed many infringing companies, along with paying their fines with their “petty cashbox”, establishing a sense of “legalization” of their pollution. In the end, it was more convenient and cheaper to pay off their fines than to promote environmental improvements to their processes.

In this sense, the new institutionalism brought about a radical change by “the elevation of the amounts of these penalties”.

As a result of this, the year 2012, the Canadian mining Barrick Gold Mining receives the first and historic environmental fine, an amount of 16 million USD.

In the media at the time, it is possible to note that the breakdown occurred, first in the stock exchange of metals in London and later when the philanthropist and creator of Barrick, Peter Munck, resigned the presidency of the company a year after the historical sentencing.
5 Discussion and Conclusions

5.1 Economic Development
Joseph Schumpeter has been cited as one of the foremost economist to present the most insightful and comprehensive analysis for economic development and social transformation for industrializing capitalism (Elliot, 1983).

Taking into consideration that the prevailing school of thought at the time, Karl Marx and the Marxist economic theories of means of production, the alienation of the working classes leading to a struggle of the classes through historical materialism, etc.

John Maynard Keynes of the Keynesian theories of strong and active governmental intervention in the market place in order to assure growth and stability, was a fertile ground for the ideas that Joseph Schumpeter presented in his most celebrated publication, “The theory of Economic Development”.

In order to begin understanding the concept of economic development, he acknowledges that the economic life is a fundamental part of the human activities within the society, as a social process, and as such an “indivisible whole”. As a social process, it is delimited to a certain “conduct” towards acquisition of goods.

Schumpeter later introduces the concept of classes, referring to the specialization of people within the framework of economic conduct, where everybody is an “economic subject” or dependent upon one, and hence once everybody in society is “occupationally specialized”, different classes of people appear, based on their economic conduct or business (Elliot, 1983).

Now, the interaction of the different classes of people within the society, creates an economic “circular flow”. Within this flow there is a tendency towards an economic “equilibrium”, where the economic activities are continuously repeated in the same way, year after year; however, within this framework, the concept of “development” is understood as a spontaneous and discontinuous “change” from within the economic circular flow and the equilibrium is forever changed (Schumpeter, 1911).

Thus far, Schumpeter sets the scenario that could practically resemble any industrialized society with its interacting actors, distinguished by their “specialization” and interacting with each other. The most distinguishing part of Schumpeter’s publication is the introduction of “entrepreneurship” as a central figure that “destabilizes” the equilibrium of the circular flow and is the engine that could perpetuate the movement of the economy towards further growth or development of society. One must take into consideration that, at the moment when
Schumpeter postulated his economic theories, the world was at its height of industrialization, where the natural resources and the easy access to them were of the essence.

What does really mean to be a “developed” economy? A more generalized interpretation would be a country’s capacity to “maximize” the usage of all its available resources. In this sense, the majority of the developed nations would fall in the category of “underdeveloped”. Many economist and social scientist have identified three main factors contributing to economic development – land, labor and capital, but new-coming economists have started to add two additional dimensions, technology and cultural configuration (Ginsburg, 1957).

Technology is basically the knowledge to transform and generate “surpluses” in society. The Westernized approach to knowledge is the combination of scientific knowledge with practical engineering, denominated as “know-how”, that has the property of mobility (can be applied everywhere), easy access and low cost; allowing to extract natural resources where “indigenous” technologies have failed (Ginsburg, 1957).

Regarding the cultural configuration or cultural endowments, it is defined as the means to a social organization that combines a set of values, goals and objectives that any society possesses and “pre-setting” the level of “want” or drive that a society can have. The higher the “want” or drive a society has the more rapid growth a society can have. (Ruttan, 1988)

In recent years, scholars have started to change the paradigm of economic development, asserting that physical and human capital was not the only conditions necessary for economic development. Traditional economic systems were of the notion that the proper process for producing goods, services and hence generating welfare were exclusively based on the accumulation of physical and human capital. Scholars recognize the additional category which is the natural and environmental resource endowment available to the economic development with necessary care of not depleting the natural resources and maintaining a “sustainable” economic development. The environmental Kuznets curve states that, depending on a certain set of factors, a relationship between environmental quality and economic development can be found. it is depicted in the figure below (Barbier, 2003; Vogel, 1999)
Figure 3: Environmental Kuznets curve

2016 – projection of Sulphur dioxide emissions from poor and rich countries contrasted with its GDP per capita, where the turning point would around $5000.

5.2 Chilean Economic Development

Relating the aforementioned to the Chilean reality from a historic perspective, Chile has had its fair share of political and economic changes, with strong Keynesian economic influences during the first half the 20th century, the failed socialist stint in 1970s – The Chilean Way to Socialism (Spanish: La vía chilena al socialism) – and the present neoliberal economic system. Also being endowed with natural resources, the technological capacity, the working force and the progress of the country has been very much a “roller-coaster” during the last 50 years. It has caught every Chilean scholar’s attention that Chile has had the opportunity take lessons from the past economic periods of growth (e.g. the saltpeter period) and now that the copper industry is in the worldwide spotlight. One can only ask why Chile has not been able to “cash-in” on the mining industry.

Focusing on the last 25 years and based on what was exposed in the empirical findings section and analysis of the Chilean case study, a possible hypothesis is whether the decision of the post-dictatorship governments, in the implementation of an Environmental Agency (CONAMA) instead of a Ministry of the Environment was a wise and accurate decision. It may have been, based on the political-institutional circumstances dictated by that time, but
nevertheless it may have not been an accurate decision from a long-term perspective, and from a sustainable policies framework point of view.

To better understand this situation, it is necessary to clarify that, unlike many countries that experienced dictatorial governments and transitioned later to democratic systems, Chile proved to be exemplary in its process of a peaceful transition from dictatorship to democracy.

In this sense it is necessary to highlight that in Chile, the process of democratic transition occurred with the dictator, General Augusto Pinochet, being alive and in full exercise as the head of the Armed Forces, with the entire organization ready and willing to maintain the vertical of control and obedience to its Commander-in-chief.

The unexpected defeat in the plebiscite surprised the dictator, who was forced to hand over the power to the democratic coalition, which they, in turn had to pass through a weak and incipient institutional path, where they gradually laid the foundations of a democratic system.

The reasons described above, to a large extent, forced the first post-dictatorship democratic government, to establish laws and policies that would allow the gradual development toward a full democracy. Among these policies, was the establishment of an institutional Environmental framework, which would not threaten the investment, especially foreign ones, to support the process of democratic recovery of the country.

Spain and other Latin American countries that have experienced the restoration of democratic processes, could do it once the dictator died; or killed as in the case of Nicolae Ceaușescu in Romania or simply dismissed and exiled as in the case of Ferdinand Marcos of the Philippines.

The world recognized the audacity and capacity of the first democratic government (Patricio Alwyn 1990-1994), for being able to carry out successfully the transition.

However, once neutralized, the influence of the dictator and a high rate of economic growth, makes the country suffer the effects of a weak environmental “institutionality” that today prevents it from achieving the levels of development of other countries of the OECD, organization to which Chile joined in 2010.

5.3 The current reality and the "Resource Curse"
Today, after 25 years of democratic regimes, the country faces an environmental situation that demonstrates the urgent need to strengthen the mechanisms of control and environmental
compliance, as an inevitable step to strengthen its position as a country that aspires to full development.

Ever since the implementation of the Ministry of Environment, Superintendence of Environment, Environmental Tribunals, etc. there has been a series of discoveries of huge environmental infringements by the heavy industry (mostly mining), that have caught the public’s attention. The big fines slapped on the mining companies have sent out a warning to other actors in the productive sector, but on the other hand will this have a negative impact in the future? Many speculate that future investments could be put on hold, especially now that the Chinese economy has shown signs of slowing down. (OEC, 2016)

The introductory section of this research began by stating the alarming rate of environmental infringements that were discovered and sanctioned by the new environmental authorities. This unveils underlying evidence that could be the reason why Chile is yet to overcome several obstacles in order to move towards the status of a developed country.

From a more local perspective, today it is clearer than ever, that the “neoliberal” policies implemented during the junta era, has had a huge social impact and cost on the Chilean society. The disarticulation of the public education system, privatization of the health system, the alienation of the majority of the working and active classes from the means of production (practically non-existent unionized labor activities), the astounding income inequality (Chile is ranked within the top 20 according the Gini index) (Woldbank, 2016). This could be an example of one of the possible outcomes or manifestation (weak and unaccountable states) of the Resource Curse, as it was outlined in the Literature Review section of this research.

From an international perspective, Chile, as well as other prominent Latin American countries, has also been in the spotlight recently due to a series of negatively impacting occurrences (e.g. impeachment case of Dilma Rousseff in Brazil or the civil riots in Venezuela). A dramatic decrease of Michelle Bachelet’s approval rate, several scandals that led to a serious decline in public confidence in the political elite, severe cases of corruption or dubious financial contributions from distinguished financial institutions to political parties, just to mention but a few. Even though the Chilean cases could be deemed as not so severe as the Brazilian or the Venezuelan case, these are clear indicators of the resource curse (Spoliation, as outlined in the Literature Review section) still affecting and having its toll on the Chilean economy and society, and this can further damage Chile’s financial reputation on an international level.
Why is the research done for this thesis of any relevance? This opens a new subset of questions, whether if anything can be done to curb the still lingering effects of the Resource Curse? What would be the next steps to take in order to get rid of the resource curse (if possible)?

5.3.1 Where do we go from here?
The wellbeing of this planet in recent times, has taken a front row seat more than ever. The worldwide tendency, in terms of social and economic endeavors, is to push toward sustainability.

The 2015 United Nations Climate Change Conference, COP 21 or CMP 11 Paris, is an indication that the developed countries have taken environmental matters more “seriously” and measures need to be taken in order to combat the ill-famed “global warming”. Important measures and commitments have already been agreed, as an example, the USA’s commitment to reducing the usage of coal in the electricity industry (EIA, 2016) or countries like Sweden committing to 50% of the energy produced coming from renewable sources and a 40% reduction of the greenhouse gases by the year 2020 (Regeringskansliet, 2016).

But still the fact remains that the world will continue to depend on natural resources, especially on mineral resources (iron, molybdenum, copper, etc.), hence it is imperative for Chile to implement and drive its natural resource based activities in a sustainable manner – Environmental Sustainability is a must.

So far, Chile like many other countries have adopted or used as a point of reference the environmental standards developed by the U.S. Environment Protection Agency (EPA) or European Environmental Agencies, but this has not yielded the desired results. The most challenging so far, has been the compliance and accountability of the environmental regulations in-force today in Chile.

Firstly, from a legislative point of view, the already implemented body of statutes and laws in force today need to be revised and modified according to the reality and necessity of the Chilean environmental status.

Secondly, the quality standards in the sample-taking processes, when fiscalizing the mining industries, need to be revised and improved urgently, since the enforcing entity, the Superintendence of Environment only has the power, as previously stated in “Hiring and supervising the duly certified third party services of inspection, verification and measuring when performing sample collection and analysis”. This has shown to be particularly flawed
since neither the Superintendence or the Ministry have standardized protocols which the “third parties” can follow, thus resulting in erroneous and faulty on-field procedures, involuntary sample contamination resulting in misleading final readings, etc.

At present, according to local experts, there is only a handful of third party entities available in Chile that manages quality standards up to with the level of those used in developed countries.

5.4 Conclusions
The aim of this research was to answer whether Chile was still suffering the “Resource Curse” in its thriving mining industry today. Based on the detailed analysis of the literature review and the empirical finding, one could conclude that Chile fits within the definition of country that suffers the “Resource Curse”, mostly due to its historical “incapability” of overcoming the status of developing country, added to the weak environmental “institutionality” that reigns in present days.

On two occasions, Chile has had the opportunity to make most of the wealth generated of the boom in the Saltpeter industry during the 19th century, considering the tremendous cost of even having waged a war against Perú and Bolivia; as well as the boom of the copper industry starting the 20th century, after suffering a brutal dictatorships and the aftermath of implementing tepid economic and environmental policies in the beginning of 2000s.

It is at the heart of this research to review and analyze all past economic events in the Chilean mining industry, in order to compare with the present-day situation and draw conclusions and perhaps make suggestions.

Even though the two industrial milestones (the 19th century saltpeter industry and the 20th century copper industry) analyzed in this research may have shared the same diagnostics – resource curse, the symptoms and outcomes may have been different between both milestones. Whether the social scientists, industrialists and authorities of the 19th century could have done anything to prevent the resource curse syndrome (even though there was total ignorance of the concept at the time) remains unanswered. Today’s concern, is the utmost urgency to face the potentially harmful effects of the resource curse, threatening the future and sustainable economic growth. For example, the environmental infringements outlined in the introductory chapters are evidence of the threat to the sustainable development of the country.
The researcher has outlined a series of measures that could counter the resource curse, but with a particular interest on the last point (refer to the upcoming chapter “Suggestions to overcome the Resource Curse”, point 4b), the development of an ICT-based tool permitting a more comprehensive fiscalization tool of the various industrial sectors, thus enforcing compliance to the environmental policies by the industrial sectors and imposition of accountability for actions of the different actors of the industrial ecosystem.

5.5 Limitations
The most immediate limitation is the limited time within which the researcher had to analyze the overwhelming literature that is available, considering the need to review all the literature preceding the Resource Curse thesis literature in order to get a chronological perspective.

Due to time constraints and the overwhelming amount of information available, the reliability of the results may be affected, but since the research is framed within an interpretivist paradigm, the most important aspect is the resulting opinions and interpretations of the researcher (Collis & Hussey, 2014).
6 Suggestions to overcome the Resource Curse

Unlike the 19th century, today the copper mining industry provides Chile a new opportunity to jump to the status of a developed country. For this purpose, it is still necessary to consider a number of key aspects, such as:

1. Taking advantage of the super-cycles in the copper price, taking advantage of the copper income surpluses to increase the budget in education, research, innovation and development from a current 0.5 % of GDP to 1.5%, as in the case in most of developed countries,

2. Put an end to the delivery of the 10% of the surplus proceeds coming from copper industry to the armed forces (policy imposed during the dictatorship of Pinochet).

3. To promote an educational reform aimed at enhancing the comparative advantages of the country. The comparative advantages are desired in key areas of the Chilean economy like agro export, winery, fruits, salmon, minerals.

4. In a more specific issue, the need to strengthen the Environmental Control Protocols, through the strengthening of control mechanisms and Analytical Quality Assurance. Careful attention could be given to the chain of custody on the characterizations of chemicophysical of environmental pollutants in the ground:

   a. *The environmental policy enforcement*: it is necessary to note that Chile like a majority of the countries with a similar level of development has a large set of standards, environmental baseline and good practices. The majority of them, copied from more comprehensive standards such as the US EPA or European standards. Historically it has lacked an adequate capacity for the control and enforcement of these rules and the field verification of the implementation of the standards. So that it is not lack of standards but the lack of control, which has led the country to a low environmental performance.

   b. *Strict in-field control protocols in mining sectors*: given the situation described above, the introduction of ICT-based tools, that allow raising the level of control and verification of compliance to the protocols when dealing with field sample collection, proves to be a suitable way. These protocols are aimed exclusively at the activity developed in the field; “prior to the entry of the samples to the laboratory for analysis” so as to strengthen the chain of custody,
Quality Assurance and Quality Control (QA/QC), and deliver to the service “plaintiff” the analytical certainty and reliability, complying with the minimum requirements.

In this way, these ICT-based tools work in conjunction with the LIMS (Laboratory Information Management Systems) system existing today, thus improving the whole chain of analytical service “End-to-End” (E2E) i.e. from the moment of the sampling, characterization, analysis and the issuing of final results until the final elimination of the wastes.
7 Further Research

Most certain, in a globalized world, the importance of the concept “lessons learnt”, broadly used by the International Agencies e.g. United Nations in its collaboration and support programs to developing countries around the world, has taken a particular importance.

Within that context and mainly focused on environmental issues and the future sustainability of the planet, it would most recommendable for the developing countries, as well as the developed countries, be able to develop verification tools and efficient and timely environmental control policies. To be able to establish mechanisms for environmental inspection in order to guarantee not only the sustainability of large investment projects from international consortiums, but also enforce “the same environmental standards” that multinationals have to abide in their countries of origin.

As it was outlined in this research, it is outrageous that Canadian mining companies, such as Barrick Gold, practices different qualities of environmental standards in Canada and in Chile. Under this premise and within the framework of this research, an interesting future research suggestion is to develop an IT tool that improves the quality of environmental control and analytical field sampling in order to achieve similar standards as the analytical tools used by European agencies or the US EPA.
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