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Chapter

**ENVIRONMENTAL OUTCOMES:
LINKING SOCIAL AND ECONOMIC ISSUES**

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ABSTRACT

Concepts like environmental conservation, sustainability and sustainable development are not currently considered primary concerns in most of Latin-America and the Caribbean. This omission can partly be attributed to the lack of environmental history in this area. By the 1950s, the concept of environmental conservation was introduced to our legal and technical vocabulary due to influences of conservationism associated with academic-intellectual national elites. These elites formed an eco-spiritual movement closer to socialism ideology than to eco-centric ideas, as a natural outcome of the late 60s and early 70s culture. The military governments, which took power during the 70s and 80s, persecuted people associated with socialist ideologies, resulting in a dispersal of members and ideas resulting in the loss of environmental concepts and ideas for over 10 years. The economic reforms of the 1980s and the adoption of the neoliberal paradigm increased the importance of the exploitation of natural resources. These reforms increased economic development yet led to the concern regarding the environmental impacts. As a response a new institutional network was created. New institutions allowed the establishment of various institutes and centers that funded research as a response to the neoliberal economic model. Introducing ecological concepts, their main concern was the indiscriminate exploitation of natural resources. The focus was mainly on profits and environmental issues related to agriculture and mining resources (Vallejos, J.P.; 1994). During the 1990s, new intellectuals associated with Non-Governmental Organisations (NGOs) emerged. The focus was for the promotion of democracy and social justice, rescuing their social influence from the original socialist thinking. This also meant a turning point in the collective conscience about the environment by introducing a social

component, Nevertheless, environmental concern was often used according to their personal agendas.

The "institutionalization" created by new intellectuals disappointed with the socialist approach and instrumentalization, adopted equality issues and development concern thus putting an end to its ideological use. However, it is acknowledged that these trends have set the overall development of the new legal institutions, which, since the return to democracy and the incorporation of highly technical professionals to high public positions and private management, led to the passing of laws such as Law on Environmental Framework Law No. 19,300 in Chile. This law marks a turning point in the development of national public policy as a model to follow in Latin-American and Caribbean, defining environment as an "overall system consisting of natural and artificial nature of physical, chemical or biological ones, socio-cultural elements and their interactions, in permanent modification by human or natural causes, and conditions governing the existence and development of life in its many manifestations"(SEGPRES; 1994); a definition that includes the human being and the socio-cultural environment and its interaction with the physical, chemical and biological systems, recognizing this global system as part of an underlying critical natural capital on issues of sustainability. Nevertheless, these legal framework and institutions have been not enough to solve environmental conflicts between government, industry and civil society.

Nowadays, Chile has achieved various outcomes that are similar to those of developed countries; a high quality schooling system (although highly unequal), high life expectancies (82- year - old women vs. 78- year - old men), high per capita income of US\$15.400 in 2011, as well as a growing economy which is supported mainly by mining and the agro industry. Currently our PM10 levels are 61.5 micrograms per cubic meter, several times higher than the OECD average of 22 and by far the highest level in the (OECD, 2011). Furthermore, there are several unresolved environmental conflicts throughout the country especially on sites where industrial and urban activities coexist. In fact, in the most recent Environmental Performance Index (EPI, 2011), Chile slips down to 58 in the world environmental ranking.

Finally, Framework of Convention on Climate Change has encouraged the region to think about our role and commitment as developing countries to fight climate change as well as making decisions about a successful adaptation to the changing climate and adopting new approaches capable of designing protocols for implementing environmental policies. The technical characteristics of this new approach are determined by the growing relationship between industry and universities focused on implementing improvements in manufacturing processes, minimizing the impacts on the environment as well as environmental investment in promoting energy efficiency and the use of renewable energy. Moreover, additional incentives are necessary to promote and support private initiatives to resolve current environmental conflicts. These initiatives might incorporate approaches that rely on sustainability concepts related to solving problems among industry, government and communities. This tool could be the correct incentive for the promotion of accountability with focus on environmental issues and paving the scientific basis on which this knowledge generation may in turn have an effect on new public (Pohl, C.; 2008) policies based on interdisciplinary environmental science and not on ideology (Kwa, Ch.; 2008). As aforementioned, visions that have prevailed in environmental policy and its historical development have four main streams of thought: Conservationist, Ecological, Environmentalist and finally, the economical vision due to neoliberal vision explaining our current outcomes (Aldunate, C.; 2001). Nevertheless, independently or merged, these visions cannot by themselves propose a model of sustainable development. A holistic approach is thus necessary.

THE DRIVING FORCES OF ECONOMIC GROWTH

As is frequently the case with underdeveloped countries, the Chilean economic history could be narrated (at least for most of its independent existence) in terms of its main exporting commodities. In fact, one could claim that, if the importance of a given industry for a country could be measured by the body of the data collected about it, then what you sell is what you are. Since its independence from Spain in 1818 and well into the first half of the 19th century, Chile was a semi autarky with very little international trade concentrated, mostly in copper, silver and some gold (Penderson, 1966 and Meller, 1996). The Chilean inclusion into the big international trade and the first wave of globalization came in the 1880s when the exploitation of the rich nitrate (saltpeter) fields in the Tarapacá and Antofagasta Region began. Between 1850 and 1880 the annual growth rate of Chilean exports was around 3%, between 1880 and 1920 that rate went up to 5.3 percent due, mostly to nitrate shipments (Bherman, 1977).

The nitrate industry had a deep impact in the Chilean economy, development, and politics. From 1879 to 1883 Chile fought a war against Peru and Bolivia (the nitrate ore fields were located in what was then Bolivian and Peruvian territory) for the control of the industry and the mineral¹. Chile ended up securing the nitrate rich fields in Antofagasta and Tarapaca, however the market share of Chilean owned companies in the worldwide nitrate industry actually fell. Most of the new *Salitreras* that began operations since 1880 were actually owned by British interests and the UK rose up to represent almost 60 percent of the whole market (Soto, A.; 1998). As some authors have stressed before the war is unlikely to have been fought for the best interests of the Chilean economy. It is hard to understand why the Chilean capital actually retracted from the nitrate industry. In fact, the exploitation technology was relatively intensive in unskilled work (something Chile had in abundance and provided to the industry throughout all of its expansion) and required unsophisticated capital and knowledge. The experience of the Antofagasta Railway Co. (a Chilean company) shows that the railway system technology was known and well understood by Chilean entrepreneurs. Why therefore was the industry handed down to British companies? One thesis, presented by Meller (1996) states that the Chilean entrepreneurs lacked the advanced knowledge of international trade arrangements and financial system needed to undertake large-scale operations.

Whatever the reason for this separation of Chilean capitals from the nitrate industry, the nitrate industry has long been considered a textbook case of the hypothesis of enclave economies, meaning the natural resources are mainly exploited by entrepreneurs from a developed country that operate the sector and the host country seldom benefits from the ownership of the resource. Nevertheless, this is hardly the case in the Chilean nitrate experience. In fact, while the nitrate industry was controlled by foreign investment and little of its accounting profits actually stayed in the country (the profits sent by the mining companies to their parent corporations abroad had been estimated around 6 percent of the GDP annually), the use of the tax lever on the external sector by the Chilean government was important economically. Between 1890 and 1915 the revenue collected from the external

¹ At least nominally, what is now known as the War of the Pacific was detonated by the Bolivian government threat of confiscating the property of a Chilean mining company producing nitrate that refused to acknowledge and pay a new piecewise tax created by the Bolivian government in 1878.

sector (i.e. the saltpeter exporting firms) was never lower than 70 percent of all the revenue raised (Meller, 1996 using data from Mamalakis 1971). These revenues, (equivalent to 30 percent of the total gross sales of nitrate) were used by the Chilean governments to invest heavily in social and physical capital investment. This provided important expansion of the railway system and the public schooling system coverage during these periods^{2,3}.

Some of the saltpeter riches also found their way to the Chilean wealth (in the form of either government transferences or the ownership of some salitreras); during this period, the value of imports of luxury goods (wine, jewelry, clothes and perfume) accounted for twice the amount of imports of capital goods (Pinto, 1962). Throughout its history and up to its final demise during the 1920s the nitrate industry acted almost free of government interference other than taxes. There were no regulations in their labor arrangements much less on their environmental practices. Labor conditions in salitreras were particularly harsh; workers lived in the desert, in camps built by the mining company close to the ore deposits. They were paid a fixed piecewise rate according to the quality of the mineral they extracted (if the ore was considered substandard there was no payment even though the firm processed it anyway, benefiting from the saltpeter obtained). Payments to the workers were not made in currency but in tokens that the workers could exchange for merchandise only at the company store (the pulpería) and at company set prices. Furthermore, privately owned scales and weights were forbidden so workers often suspected that the company measures were biased against them. These conditions gave birth to the uprising of what was euphemistically called “the social issue” (Grez, S.; 1995): a social unrest movement coordinated mostly by socialists and communists that traveled the desert from one company to the other organizing workers to stand against their working conditions. The decline of the importance of the nitrate industry began with the creation of synthetic nitrate (the Haber process) discovered in the early 1900s but widely produced during WWI. Although production began to fall during the 1920s, the final blow came with the great depression: by 1929 the value of Chilean nitrate exports was the same as those in 1880.

Although the nitrate era doesn't fit into the enclave model, the public opinion at that time was that it was a lost opportunity for the development of the country and that, ultimately, the lion's share of the saltpeter wealth benefited foreign interests. Of course, the fact that Chileans almost paid no taxes and the important public investment that took place during the period made it hard to hold such a radical position. Some very important lessons weren't learned during the period (1920-1930) and, as we shall see, it took almost a century to come into effect with Chilean policymakers. For example, the total deregulation of the industry, a testament of the laissez-faire approach that has ruled most of the Chilean independent history in economic policy, gave rise to the abuse of other very valuable natural resources in the zone (like fresh water⁴) that were not considered as part of the costs of the industry. From a

² According to Meller (1996), the public railway network expanded from 1,106 kilometers in 1880 to 4,579 kilometers by 1920, while the number of students in primary and secondary public education expanded by a factor of 20 between 1860 and 1920.

³ The fact that revenue from enclave sectors in a natural-resources-rich economy are often used to increase investment in human capital has been confirmed several times in the literature. See, for example, Stijns (2001).

⁴ The Brit John Thomas North, for example, became an important player in the saltpeter mining industry when he secured a contract to become the monopolistic provider of fresh water for the very important city of Iquique and its surrounding salitreras. The production of nitrate from saltpeter ore implied extracting the mineral from the crushed stone by heating it and injecting pressurized water vapor, a process known as Shanks Process due to its inventor, John Shanks. (Soto, 1998).

macroeconomic perspective, the main lesson which was ignored from the nitrates era was endemic to the Latin American region as is often stressed by Economic Commission for Latin America and the Caribbean (ECLAC): tying most of the revenue and fiscal expenditure to the revenue raised from the sale of a single commodity induced a higher volatility in the economic level that would have been expected from the fluctuation of the international prices of the referred commodity only. The fiscal sector actually amplified the trade terms changes inducing domestic booms and recessions as the commodity prices went up or down respectively. Amazingly, it would take the Chilean government almost a century to take measures to solve this problem⁵.

Therefore, the Great Depression affected Chile like no other country in the world (Meller, 1996). Between 1929 and 1932, GDP fell by an astounding 45.8 percent, exports (mostly nitrate and copper both being the main source of government revenue) fell by more than 80 percent and imports similarly decreased by 85%. In per capita terms GDP fell by 48.2% (Sáez, 1989). These striking effects may have been exacerbated by the orthodox laissez-faire approach adopted by the economic authorities in Chile. In fact, the Chilean government was one of the last worldwide to abandon the gold standard thus contracting monetary supply domestically to unprecedented levels. At the same time, the insistence of the finance ministers of the time on keeping a balanced budget (when almost 80 percent of the government revenue had disappeared) let very little space for fiscal policy to help in any way. Up to the best of our knowledge, no serious attempt has been carried out to apportion the responsibility for the severity of the contraction to these policies. In any case, either because of a significant ideological shift or due to an unavoidable recognition of the failure of the orthodox policies in face of the evidence, the early 1930s represent a turning point in the Chilean development strategy. In fact, the Chilean government gradually moved from a laissez-faire approach and development strategy based in the production of a single commodity (nitrate up to 1920, copper from then on) to one based on Imports Substitution Industrialization (ISI).

The ISI strategy's logic was, at the same time, simple to understand and simple to sell to the public: the exposition to the external sector was undesirable for an underdeveloped, enclave-prone economy like Chile because the riches ended up abroad⁶ and the decaying terms of trade tampered with our growth⁷. The solution, so the story goes, was to gain independence from the foreign dependence by industrializing the country. This industrialization was to be carried out in three steps: First, the country was to close its borders (through tariffs and other para-tariff measures) to the imports of final tradeable goods while keeping them pretty open to the intermediate goods and capital goods required for its

⁵ In this respect, ECLAC permanent concern with the long run problem of decaying terms of trade, enclave economies and the so called "Dutch disease" did very little to help with the short run problem of tying public expenditure to commodity revenue and, indirectly, to commodity prices.

⁶ In the UK in the case of the nitrates, the US in the case of Copper. The attitude of the US government towards the copper industry during the period greatly contributed to this argument: during the Great Depression they established an extra tax on copper imports of 4 cents by pound, equivalent, at the time, to an ad valorem rate of 70%. During WWII not only was that rate preserved, the American Government set a price ceiling of 12 cents for a pound, and both were removed in 1946. During the Korean War a new ceiling was set at 24.5 cents for a pound. Then the Chilean government decided to directly purchase the copper from the American producers and sell it in the New York market, an operation that returned on excess of US\$190 millions between 1952 and 1955. The argument that free market operated as long as it benefited the American interests and was suspended as soon as it benefited the Chilean ones was soon hard to contest.

⁷ Once more, the focus was in the long-term event though most of the problems faced by the Chilean economy were related with the business cycle.

production. Then, the final goods were to be produced domestically⁸. Second, as more and more domestic demand for them was created, the protection would be extended to intermediate goods, which will also be produced domestically in a series of backward linkage. The last step called hard ISI implied the same previous process but this time for the domestic production of capital goods. Of course, there are some obvious flaws in this argument. For example, the disconnection between the efficient scales of production of industrial goods and the size of domestic market for them. Even more obvious was that this scheme would fail to induce the foreign currency inflows necessary to finance the imports of intermediate and capital goods required during the early stages of the strategy. The answer to that question was that the required currency was to be provided by the only available source at the time: the so-called Gran Minería del Cobre (The Great Copper Mining, GCM).

Chile had been producing copper since the 19th century; nevertheless, it was the technological development of the US copper industry that made poor mineral law mines (around 1% to 2%) profitable for exploitation. This technological advantage was the main reason why US capitals secured the two biggest copper fields in Chile: El Teniente, the largest underground mine in the world, and Chuquicamata, the largest open pit mine in the world. Both began operating in the early 1900 with large investments, associated with the capital-intensive nature of the technology. Until the nitrate crisis, the GCM benefited from the laissez-faire approach that characterized the Chilean government. But, in 1924 the “social issue” abruptly gained importance after a military coup d’état that ended up with the passing of a comprehensive labor protection law including unionization and strike rights. This increased the GCM costs although the impact was limited due to the reduced fraction of labor force that actually worked in the copper sector.

More importantly, from 1925 on, the main concern of the successive Chilean governments was not how to connect the copper industry to the rest of the economy but how to capture the largest possible share of the GMC profits. For these different kinds of taxation systems were created with tax rates around 38% of their total sales during the 1950s. At the same time, a parallel, overvalued exchange rate was created for mining operations. Nevertheless, the persistent opinion that copper was “the Chilean salary” and that it was being unfairly captured by the American firms, government, and people created an ever-increasing unrest with the issue that ended up in the “Chilenization” process of the 1960s and the “Nacionalization” of the industry in the early 70s.

Copper mining has been called one of the dirtiest industries in the world. To the point that, according to Diamond (2008) it is in the best interest of the rest of the world for exploitation to occur in the Chilean desert where its highly toxic residues and very contaminating leaching process will affect the fewer people. In this respect, although foreign firms were subject to no regulations at all during the 1900-70 periods, the nationalization was a mixed blessing. From the 1980s on, when the first environmental regulations appeared, the now state owned GMC has enjoyed a special status that; in practical terms, it protects it from any harsh revision of its environmental effects and practices (De Gregori, 2003). The ISI process in Chile was carried on with a kind of zealotry, starting in the 1930s with the protectionists policies implemented like exchange rates controls, multiple exchange rates (for

⁸ The sharp fall of imports during the Great Depression and WWII produced some of these automatically through price incentives: tradeable goods were so scarce and expensive that its prices, at least in part, induced local production of substitutes.

different imports), differentiated tariffs and required taking a no-interest-bearing deposit with the Central Bank prior to the import of a consumption good⁹. Of course, just protecting domestic traded goods production was not enough. The newly assumed economic role of the State during this period also showed up in the creation, in 1939, of the Corporación de Fomento de la Producción, CORFO (literally, The Corporation for Fomenting Production), the first public institution ever created in Chile dedicated to direct industrial investment¹⁰.

CORFO set its foot in several industries considered strategically for development. In a frenzy of public investment, the first national public electricity company was created, ENDESA, in 1944; the Pacific Steel Company (CAP), in 1946; the National Oil Company (Empresa Nacional del Petróleo, ENAP, in 1950); and the National Sugar Company, IANSA in 1952. CORFO opened an office in New York in 1940 with the purpose of obtaining credit lines for financing part of these investments.

The impact of CORFO cannot be understated. According to the Chilean Central Bank, between 1939 and 1954, it represented more than 30% of the total investment in capital goods, 25% of all the public investment and more than 15% of the gross national investment. So, if during the 30s the Chilean government promoted industrialization through tariffs and protectionism, between 1940 and well into the 1950s the State became the most important single entrepreneur. Moreover, from 1950 and up to 1973 the State also became the planner of the economy with development plans that covered several industries including, but not limited to textile, forestry, fishing, alimentary, and automotive industries. Not all these endeavors were successful although some of the aforementioned did outlive the ISI experiment and became very dynamic industries in the Chilean economy, meaning that the state planning was successful in some areas.

The Chilean ISI experiment can be considered somewhere between a moderate and a great failure. By 1970, when the “pure ISI” effort ended, Chilean economic growth was low, averaging a 1.6% per year increase between 1951 and 1970 (Heston et.al. 2011), even more, not only Chile wasn’t less dependent on the foreign sector but, on the contrary, one commodity (copper) represented 65% of its exports. Such a dependency meant the country was attempting to support a highly inefficient domestic industry that was never able to generate the backward linkages that were supposed to transform the Chilean into a developed economy (Meller, P.; 1992). “ISI at all cost” seems to have been the guiding principle of Chilean governments during the period, and that was what they promoted. In this grand scheme anything that tampered with industrialization, from foreign competition to environmental regulation seemed either detrimental or accessory. Therefore during this time very little, if any, development was made in this area. The diagnostic of the socialist government that took power in 1970 was that the protectionism of the ISI era had only

⁹ In the case of luxury cars (of which Chile never produced a single unit) the requirement reached an impressive 1000% that had to be taken several months before the actual import and couldn't be recovered until it was completed (Meller 1996).

¹⁰ CORFO was born in the middle of a curious struggle in Chilean society. The Chilean right wing of the Liberal Party, representing its capitalist constituency, opposed its creation arguing that any competition between private and public firms was, by definition, unfair. The State role, they said, was to protect domestic industry using tariffs and other protectionists measures and to incentive the emergence of new industries with subsidies for private investment. To secure approval for the creation of CORFO the leftist government of Pedro Aguirre Cerda retorted to the Conservative Party associated with the agrarian aristocracy. They promoted two law projects: one allowing the unionization of agrarian workers, the other creating CORFO and negotiated retiring the former project conditional on the Conservative Party approving the latter one (Muñoz and Arriagada, 1977). Agrarian unionization wasn't introduced in Chilean regulations until 1965.

generated a rich group of inefficient monopolists that controlled the production and obtained a handsome profit from selling few low quality manufactured goods to a captive demand. At the same time, the endemic shortage of foreign currency was due to the GMC being under (partial, after the Nationalization process) control of American interests. Whether this diagnostic was accurate or not, the solution was typically socialist: total State control of the productive system and this is what the government carried out. By 1972 the State controlled 85% of the copper mining (the so called “Nationalization” process), 40% of the manufacturing sector, 100% of the utilities and public services, 70% of the transport sector, and equal share of the communications sector and more than 80% of the banking sector. State owned firms accounted for an impressive 39% of the GDP. The socialist experiment in Chile came to a sudden halt in 1973 when a coup d'etat under the leadership of General Augusto Pinochet abruptly ended it.

Between 1973 and 1978 Chile experimented with the most important transformation in its economic history. Under the guidance of a group of Chicago educated economists, highly influenced by Friedman and Halberger, the military government undertook a series of actions and deregulations. These actions included controlling an inflation rate close to 300% in 1973, eliminating price controls for hundreds of goods, unifying a multiple-tariff system to a single flat one of 10%, eliminating barriers that impeded the imports of some 3,000 types of goods, selling a large part of the recently nationalized firms including all the formerly private banks now in hands of the State, and reducing a fiscal deficit that amounted to an astonishing 20 percent of the GDP (Büchi, 2006). To these macro and microeconomic measures soon followed a set of profound institutional reforms starting by the 1981 reform to the pension system moving the country from a ‘pay-as-you-go’ system into a private capitalist one. The main effect of this change was to increase savings (and thus investment) in the country in a dramatic way. Later came the reform to the public education system that transferred the control of public schools to municipal governments, allowed free entry in to the market and established that all schools (public or private) would be financed by a publicly provided voucher. The largest school choice experiment in the world was thus born (Gauri, 1998). The educational reform also included the free entry of private entrepreneurs to the tertiary education sector and private universities were allowed to appear and develop under very permissive rules. The response of the Chilean Economy during this first period of the recovery can only be qualified as amazing: if between 1960 and 1974 the economy grew a sluggish 1,2% in per capita terms, between 1975 and 1981 the economic growth was an unprecedented rate of 5.0%.

The reformist process halted due to the debt crisis of 1982. But the Chilean recovery included a second wave of reforms that included the privatization of most of the remaining public firms (including all utilities except the water companies) and all of the remaining CORFO firms, a second reduction in tariffs (that went up to 35% during the debt crisis), a lowering of the VAT tax, and the creation of a tax exemption for firms that reinvested their profits (Büchi, 2006). Most of these policies were kept in place by the democratic governments that came after Pinochet's dictatorship, starting with Patricio Aylwin in 1989. The period that ensued has been called “The Chilean Miracle”¹¹: from 1985 to 1998 the

¹¹ The “Chilean Miracle” was a term used by free market Nobel Prize winning economist Milton Friedman to describe liberal and free market reorientation of the economy of Chile in the 1980s, 1990s and the purported benefits of his style of economic liberalism.

Chilean per capita GDP grew an average of 5.5%, investment averaged an unprecedented 20.2% of GDP a year, exports grew by a factor of 3.9 and the relative importance of copper exports fell steadily from a 46.3% of total exports in 1985 to a 35.9% in 1998 (Figure 1). For the first time in its history the Chilean economy managed to isolate itself from the fluctuations of a single exported commodity (Richards, 1997). Regulating industries or their effects was far from being a primary objective of the military dictatorship. In fact, the lack of regulations and the laissez-faire orientation that guided the period much exacerbated the environmental issues during the period. Nevertheless, as we claim, it is not entirely fair to blame the Pinochet regime for the unawareness or plain disdain with which the Chilean society has historically treated its environment. More to the point, the Pinochet legacy in environmental aspects is just the natural consequence of a State that has shown no interest at all on the issue throughout its existence.

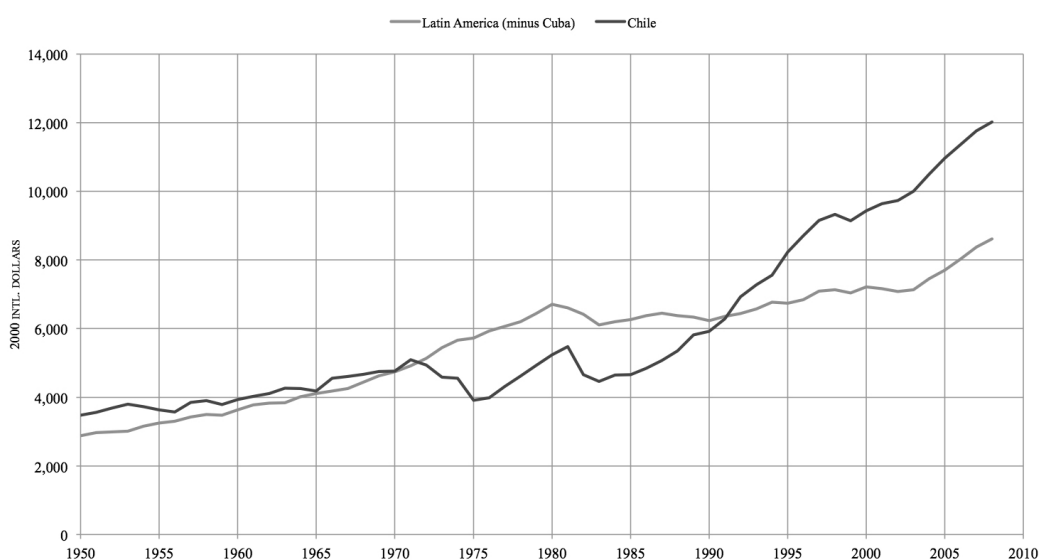


Figure 1. Evolution of Gross Domestic Product per Capita at Constant PPP Prices.

It has been an ongoing thesis stressed by, for example, Silva (1996) and Carruthers (2001) that the commitment of the Pinochet dictatorship with economic growth and free market was the main cause for the null advancement of the environmental regulation during recent Chilean history. In our view this is not a fair description of the situation. On the one hand, it should be noticed that three of the four industries that experienced the higher growth during the Pinochet period (Fishing, Forestry and Mining) are, accordingly to Silva (1996), responsible for the highest environmental damage during this period. These industries had already be chosen for development during the ISI period, which is not considered a neoliberal period. On the other hand, the public and civil commitment with the environmental cause was, during most of the Chilean independent history, almost non-existent or tenuous at best. In fact, the first known organization to raise the issue was the *Comité de Defensa de la Fauna y la Flora* (CODEFF) in 1963. This is a Non-governmental Organization (NGO) that has been active since then and it is still an important player lobbying for environment regulations and protections. As reported by Silva (1996) during the dictatorship that covered most of the 1970s and all of the 1980s there was a proliferation of environmental NGOs probably due to

the fact that they were not regarded as very influential or particularly troublesome by the repressive government. Therefore these organizations became a relatively safe haven for opposition leaders at a time when there was a systematic and violent prosecution of those considered leftist or were too vocal on their critiques to the dictatorship. With the return to a democratic rule in 1989 some of these organizations disappeared, some mutated to a more active and political role, but most kept on lobbying for the adoption of a formal ruling and system of environmental protection. The work of Carruthers (2001) is a very good summary of what the Chilean government did (and did not do) during the period. It must be understood, nevertheless that the attitude of “doing something, but nothing that can seriously affect the results” was widespread during the first two governments after Pinochet¹². Any change to the legislation or model was then to be highly derivative with costs deferred to the future and, consequently, with little impact in the short run. The main purpose was not to tamper with economic success (Carruthers, 2001). Little has changed in the economic model of Chile since 1990. With the shift to democracy the country left the pariah status in the international context. At the same time, the so called “Chilean Miracle” made it an interesting trade model so most of the State actions. During this period, the economical policies were concentrated on “perfecting” the model which, in straight words, meant changing as little as possible, keeping the incentives for investment (both local and foreign) in place and negotiating actively to sign as many free trade agreements as possible with as many countries as possible. Nothing demonstrates this better than the famous statement of former socialist President Ricardo Lagos when in 2002 regarding the success of his government said *“Excúsenme que lo diga, pero qué país negocia con Europa, Estados Unidos y de taquito resuelve Corea”* (Excuse me for saying it but, what country negotiates [a free trade agreement] with Europe, the US, and signs with South Korea on the side?). The same president Lagos has stated time and again that, in his view, economic growth is the most important task any government faces: “To rule is to be able to invest to produce growth and being able to keep redistributing income” (El Mundo; 2011).

The first (slight) departure from this growth-above-all doctrine came with President Michelle Bachelet who, during her tenure stressed the ideas of social protection and endowment rights. During this period there was a revision (a “perfecting” it was called at the time) of the environmental regulations, but one that had little or no effect in making it more effective against projects that can be potentially damaging for the environment¹³. In spite of Bachelet’s more progressive views, her finance Minister (the one who ultimately

¹² Not only was the “preservation of the stability” the main purpose, also there was a rational belief that the military threat was very much alive and that the Chilean democracy was too frail to be put to a stringent test. The best example would be the policy of “Justicia en la Medida de lo Posible” (Literally, Justice to the Possible Extent) stressed by former President Patricio Aylwin in relation to the much pressing issue of human rights violations during the Dictatorship. It has been argued (Navia, 2010) that this view of “the Possible Extent” has permeated much of the Chilean institutions including education, economic rights, and even its Democracy. It remains an open question how it was that this “Aylwin’s Doctrine” found its way even to the environmental ruling that ended up setting a “Protection to the Possible Extent” system. One hypothesis that we may present is that the Government was under a lot of pressure to demonstrate that the economic growth that was perceived as the main achievement of the dictatorship could be achieved under democratic rule by a leftist government something the right wing (that included Pinochet supporters) had kept presenting as dubious during the 1989 presidential campaign. In fact, even the passing of this particular legislation responded (at least partially) to an economic growth purpose: the potential acceptance of Chile for a full membership in NAFTA.

¹³ Several projects that later on produced a considerable spur in people awareness were approved under this new regulations including Hidroaysen (the system of hydropower plants in Patagonia) and Castilla (a very large and very polluting coal fired power plant in the north side of the country)

decided the economic agenda) was as orthodox as his predecessors in focusing on growth, balanced budget, and pro-entrepreneurial measures. Testimony to this is that Bachelet's government had an impressive success in achieving something that no Chilean government has successfully done before: for the first time ever the Chilean government saved the unexpectedly high returns of a positive commodity price cycle¹⁴ and used it later to isolate the economy from the subsequent slowdown induced by the Subprime Crisis. It took the Chilean economists and politicians a whole century to learn this lesson. One can only hope that it takes them less than that to understand the urgency of acting upon regulation for the preservation of the environment.

THE DRIVING FORCES OF ENVIRONMENTAL THINKING

In Chile, the evolution, trends and attitudes about what is or what it environmental thinking means has always been influenced and correlated to genesis, development and evolution of socio-political movements. Therefore, the perception of environment has been defined according to temporary social influences based in respond to political vision. The citizen's perception has changed over last 10 years; mainly due to the strong impact that communications which it has had exposure to possible impacts of global warming and global environmental changes in our region. This information allows to individuals to dominate understand not only the terminology associated with the concept of environment, but change their perception about the associated risks.

Aldunate (2001) makes an accurate description of our environmental history related to specific environmental issues with focus on its origins through historical narrative as well as how this is established in the discussion of public affairs. Throughout our history, the discourse, evolution and conceptualization of relationship's human-environment, has been permanently promoted by influence of various socio-political expressions. Today, the initial conceptions of this relationship between humans and the environment have been originally diffused and defined according knows how man relates to their environment with elements that are not only ideological but also technical. This vision must be captured in a legal framework that defines the concept of environment from a holistic vision to create a framework those another governmental institutions can do decision-making and adopt public policy for a coordinated action between public, private and governmental sectors. Currently, there is a stigma about those that are linked to environmental issues, often these people arelabeled as fundamentalists or "ecogreen" terrorists in reference to the color associated with environmental issues (Little, 1999). Such definitions and associations to derogatory terms have damaged our ability to meet the challenges of sustainable development. It is necessary to change thesemisperceptions that have been geo-politically rooted in our history, and which are a great challenge for Chile today.

Sergio Aldunate began public discussion about environmental issues in the early 1960s. In the beginning, the environmental thinking was based on strong conservationist influence born from the intellectual elite rooted in the academy. This vision began as a response to reflection on the effects of the industrial revolution, almost at the level of an ecological spirituality, which reached its greatest influence in the late 60s and early 70s. The association with left-wing movements to these initial groups saw in this new current common views on

¹⁴ During this period and for the first time in its history Chile became a net lender in the international capital market.

the concept of ideology between conservation and equality generating that these currents of thought were influenced and related to those ideologies and therefore linking to the academy with polarized groups.

These movements of thinkers were related to leftist movements, which during the military government were victims of political persecution leading to dispersal of its members and subsequently causing the hibernation of their ideas for over a decade. The military regime and since early 1980's, the economic reforms aforementioned were supported mainly on the exploitation of our natural resources allowing us boost Chile's economic growth encouraging the neoliberal conception market. This ideological economic vision, brought the awakening of those old thinkers, idealistic and deeply rooted in its origin conservationists to the erection of new ideas expressed through the implementation of new institutional framework. However, the institutional framework created embodied several institutes, centers studies and research but focused strongly on human rights principles, relating the social scope to the environmental concept. These thinking emerged in response to the neoliberal model also seemed strengthened by leftist inspiration from the previous decade. The sustenance of this revival came conditioned by the questioning about economic development based on indiscriminate exploitation of resources. In Chile, a maximum public discussion on issues associated with the exploitation of mineral reserves (e.g. copper and fishing) is reached becoming an attractive area of investment in the region.

With the economic outcome of the military regime, Chile became in a South American regional economic leader considered mainly as a mining country due to the continuous investments in mining industry. Currently, Chile has become the main producer of copper in the world, representing 40% of our commercial balance and 30% of our Gross National Product (Ministerio de Relaciones Exteriores, 2011) thanks to CODELCO (Copper Corporation, a governmental industry) and continuous private investments inside the mining industry (e.g. BHP-Billiton; Minera Escondida, 2007). Nonetheless, according to the environmental history since early 1900s, diverse environmental impacts due to continuous excavations, dust production, noise emission by heavy machinery, production of acid mine drainage, and accumulation of hazardous wastes have disturbed land and ecosystems through habitat modifications as a consequence of these activities and its type of exploitation between open pit and underground mines. Therefore, despite the promotion of mining activities, the relationships among the mining industry, society, and environment have been complex due to continuous environmental impacts arising from abandoned mine sites and to confrontations and cultural disturbances (Vallejos, 1994).

Despite the environmental impacts, the general perception of Chilean population has been to accept the mining industry because it is an important development engine (Ministerio de Relaciones Exteriores, 2008) and incomes. Indeed, the impacts of abandoned mines have even been accepted by the population to the extent of, with the attitude of the industry, complying with current legislation and positive externalities in relation to their community beyond the generation of new jobs working. In Northern Chile, mining developed without a framework of sustainability, the impacts have been tacitly accepted due to compensation in wealth creation, which provide with detriment of developing cities such as, Calama and Chuquicamata. Unfortunately, the rise of the cities was never intended in a sustainable way, in which Chuquicamata (Lagos, 2010) has become a ghost town similar to Ventanas Bay (Garcia-Huidobro, 2001).

Therefore, throughout our history, relations between industry, environment and society have not been smooth, revealing the lack of environmental regulations governing the many clashes that have been related to topics ranging from resource exploitation and use of ecosystems to socio-cultural disturbances. With the return of democracy and the political reform that led the late 90s to address the need for a plebiscite, the intellectual thinkers make institutions emerge but associated with NGOs in the promotion of democracy and social justice, rescued from their socialist influences. This marks a turning point in the collective consciousness on the environment, because the social component is tacitly inserted as part of the narrative as a definition of the concept, but yet used instrumentally on account of personal purposes.

Since 2000s, despite the economic benefits that the mining industry offers to Chile, environmental concerns were relevant to government, which had the mission of designing and implementing environmental policies based on the “environmental impact assessment system,” (SEGPRES, 1994) linked to specific regulation on closed and abandoned mine sites, and production of hazardous wastes that already existed. Finally, after 20 years, the Ministry of Environment has already been created with the mission of designing protocols to implement environmental policies based on our “environmental law” linked to specific regulations.

Today, Chilean citizens perceive that our industry has a negative environmental impact but with a capability to revitalize our nation economically, being the coordination of our policies in favor of a right balance between development and consumption a challenge. However a big challenge is inserting itself act citizens and assume their role in public policy proposals with environmental awareness, to extend their own responsibilities to neighborhoods and urban development, because the problem is no longer outside in the physical media if not in my closer environment, the city. The fusion of thoughts of ecological foundations and sociological concepts allowed the concept of environment to be developed over two decades, in which a technical vision enacting to public policies on behalf of finding a balance between development and environment was incorporated gradually. This was far from the conceptualization of the environment from an ideological perspective towards a technical perspective.

THE DRIVING FORCES OF OUR CURRENT INSTITUTIONALISM AND ENVIRONMENTAL LAW

Until 1994, Chile had a significant environmental regulatory dispersion, with hundreds of laws, decrees and regulations. The policies’ aim was the environmental protection and the establishment of permits and authorizations to carry out various types of activities related to natural resource exploitation. In 1994, Law No. 19,300 called the “General Bases Law of the Environment” (“Ley de Bases Generales del Medio Ambiente”), along with the 1980’s Constitution set forth the principles and rights and provides the basis and the main principles of the legal-environmental system in Chile.

It establishes a legal framework and regulates issues such as the Environmental Impact Assessment System (hereinafter the “EIAS”), the environmental liability, the way in which air and water quality and emission standards are set, and the establishment of the prevention and decontamination plans, among other relevant topics.

In 2010, after several years of academic and political discussion about the shortcomings of the Law No. 19,300, the Law No. 20,417 introduced the most important amendment.

Up to 2010, Chilean institutions in charge of the protection of the environment and the permits granting system were effectively the National Corporation of the Environment (Corporación Nacional del Medio Ambiente, CONAMA). The group was in charge of the coordination of the EIAS, and the Regional Corporations of the Environment (Comisiones Regionales del Medio Ambiente, COREMAS) in charge of the granting of the environmental approval resolutions (hereinafter “EAR”).

The amendments introduced by the Law No. 20,417 after several recommendations of the Organization for Economic Co-operation and Development (hereinafter “OECD”) during the process of the incorporation of Chile to the OECD, consisted in the separation of the three most important activities performed by the Government in terms of environmental protection, the creation of public policy, the granting of permits and supervision.

Accordingly, the Law No. 20,417 created the following institutions: (i) the Ministry of the Environment, which coordinates the governmental action and policies; (ii) the Environmental Assessment Service (hereinafter “EAS”), responsible for managing the EIAS; and (iii) the Superintendency of the Environment (hereinafter the “SE”), which oversees compliance with environmental regulations and imposes sanctions if applicable. Notwithstanding EAS’s faculties, there are other public agencies with authority to establish environmental regulations and supervise the compliance thereof on those aspects not covered by the SE such as the Ministerio de Salud (Health Ministry), the Servicio Nacional de Agricultura (National Agricultural Service), the Corporación Nacional Forestal (National Forestry Corporation), the Dirección General de Aguas (Water Bureau), the Servicio Nacional de Geología y Minería (National Service of Geology and Mines), among others.

The best known and relevant instrument for the protection of the environment under the Chilean law is the EIAS, because of its wide scope to regulate almost every activity related to the exploitation of natural resources and because the most important permits to develop this activities is the EAR, which may be obtained after the assessment process contained in the law.

1. Description of the EIAS

The EIAS is an administrative procedure under the supervision of the EAS, which aims to determine –based on Environmental Impact Study (hereinafter “EIS”) or Environmental Impact Declaration (hereinafter “EID”) - whether projects’ environmental impacts conform to the relevant laws. The EIAS laws and regulations provide that projects or activities listed therein may only be executed or modified after an environmental impact assessment.

The project owner must submit the relevant information of the project to the EIAS through either an EIS or an EID, depending on the magnitude of the environmental impacts generated by the project or activity, which parameters are defined by the law 19,300. The amount and characteristics of the information to be submitted to the EIAS will depend on the type of instrument used to apply for the environmental license. In general terms, the required information would be as displayed in table n^o1.

Table N°1. Environmental Impact Assessment System

EIS A description of the project or activity;	EID A description of the project or activity;
Description of the baseline;	The technical background to justify the absence of the effects, characteristics or circumstances of Article 11, which may give rise to the need for an EIS;
A detailed description of those effects, characteristics or circumstances of Article 11 of law N°19,300, which triggers the need for an EIS;	Identification of the applicable environmental regulations, and a plan for compliance and,
A prediction and evaluation of the environmental impact of activity, including any risk;	
The measures taken to eliminate or minimize adverse effects of the project or activity and the remedial actions to be performed, where this is appropriate;	
A plan for monitoring the relevant environmental variables that triggers the EIS and;	
A plan for compliance of applicable environmental legislation.	

Identification of applicable sectorial environmental permits and all the technical information associated with its conditions and requirements. In first place, the EIAS consists in a brief preliminary review by the EAS of the legal formal requirements of every EIS or EID. Later, if it is approved for assessment, the EIS or EID is circulated within the public agencies with jurisdiction over the various environmental components of the relevant project. If such authorities request further clarifications, rectifications or additions, the EAS prepares a unique document that the applicant must respond within a certain amount of days by a document called “Addendum”. All the observations and answers shall be made within the legal term established to assess the projects submitted to the EAS, 60 business days for an EID and 120 business days for an EIS, terms that may be suspended by the applicant twice. In practice, the assessment of an EID may last approximately 4 to 6 months and 8 to 12 months for an EIS due to the suspensions.

In the EIS assessment procedure there is a community participation phase, in which both directly affect people and NGOs may participate formulating observations. In the EID assessment procedure, the EAS may decree community participation phase if the project generates “environmental charges”, this concept is not included in the Law No. 19,300. Although this phase contributes to inform the community of the environmental consequences of projects and to assess the opinion of the communities and NGOs towards them, the results obtained are not binding. Once the project owner complies with all the requirements and observations made by the public agencies, the environmental assessment process culminates with the issuance of an Environmental Approval Resolution (hereinafter “EAR”), provided the authorities consider the specific project complies with all applicable environmental laws. The relevant Evaluation Commission, one per region, issues the EAR. The Commission could

also reject the environmental assessment of the project if it does not meet the environmental and technical requirements stated by the relevant authorities on the procedure.

2. The Environmental Approval Resolution

The EAR operates as a global environmental permit, which certifies that the specific project complies with all applicable environmental requirements and regulations. After obtaining the EAR, the applicant must apply to the other public agencies which the sectorial environmental permits (permits by industrial sector) related to specific environmental components detailed in the EAR and to all other kind of technical permits.

3. Penalties

The agency in charge of the supervision of all the activities approved by an EAR is the SE. Up to this date, the SE supervision and sanctioning faculties are suspended until Congress approves the law on Environmental Courts, which is expected to be enacted no later than June 2012. During this period, public agencies that took part in the EIAS must control the permanent compliance with regulations and conditions set forth by the corresponding EAR. Before the enactment of Law 20,417, the breaches to the EAR were sanctioned with warning, fines up to 500 UTM (US\$40,000 approximately), or even revocation of the EAR (uncommon). This issue was one of the most important modifications introduced by the amendment to the law, and the SE is entitled to impose, in case of breaches to the EAR or to the environmental regulations, written warnings, fines up to 10,000 UTA (US\$9mm approximately), temporal or definitive closure and revocation of the EAR. Clearly, the severity of the penalties under the Law No. 20,417 was the answer to the several critics raised by the community, which for many years argued that the amount of fines was much lower than the benefits the companies obtained by the breach of the standards, so there were no real disincentives for companies to stop breaking the law and permissions.

4. Environmental Liability

In regards to how the Chilean law regulates the environmental liability, there are three types of liability that may be taken into account:

a. Environmental Restoration Action

The environmental restoration action is established to obtain restoration of the environment that has been negligently or intentionally damaged. The companies could be liable for environmental damages, if the incident causing the damages resulted from a negligent or intentional action or omission of the Company, or its dependants or employees. This liability would require proof of fault or negligence. This action must fulfill the following elements: (i) an action or omission; (ii) intention or negligence (fault); (iii) causation and (iv) significant damages. Therefore, Companies will only be held liable for the restoration of those environmental damages caused by its own negligent or intentional actions or omissions. The definition of “intentional” or “negligent action” is analyzed case by case and should be proved by the claimant. However, lack of essential permits and authorizations, in addition

with the non-compliance of environmental regulations, are legal inferences and/or disputable presumptions of culpability. This is the most relevant barrier in order to determine liability under the environmental restoration act.

b. Tort Liability or Ordinary Civil Claim for Damages

The companies could be liable to third parties for property or personal injury or death, arising from an environmental damage, under a general tort theory or negligence action, if the incident causing the damages resulted from a negligent or intentional action or omission by the Company, or its dependants or employees. This liability would be civil in nature and would require proof of fault or negligence, again, a very difficult barrier to overcome. The tort liability is subject to the general principles of tort law established under the Chilean Civil Code and it is basically similar to “negligence” as a cause of action under common law. There are tort liability when the following elements are present: (i) action or omission; (ii) intention or negligence (fault); (iii) causation; and (iv) significant damages. Consequently, according to Chilean law, an entity or individual may only be held liable for those damages caused by its own negligence, being such negligence a result of its actions or omissions.

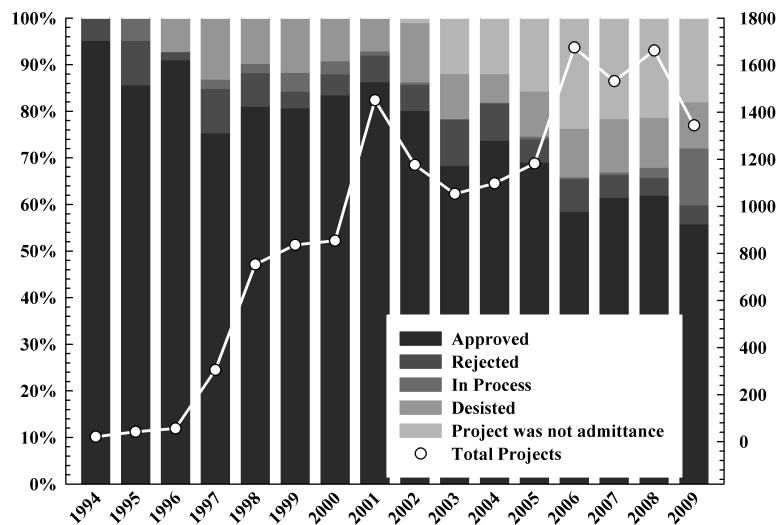


Figure 2. Evolution of number of projects presented to EIAs since 1994.

a. Administrative Liability

This responsibility is produced by the non-compliance with applicable regulation either environmental (fines up to US\$40,000 approximately today) or sectorial (such as air emissions, waste management, noises, land use, construction permits, etc). These infractions may trigger the imposition of fines, permits revocations and in some cases the closure of facilities. Since 1994, the numbers of total project presented to EIAs are increasing. But the numbers of approved projects are decreasing too due to increasing social demands which requires that each ministry carries out deeper analysis of them. Today, these analyses are necessary because Chile has updated its policy and regulations as well, according to

fulfillment of international agreements, e.g. OECD, Organisation for Economic Co-operation and Development. The effects of complying under the Law No. 20,417 remain unknown (Figure 2).

ENVIRONMENTAL OUTCOMES

The successful Chilean economical growth has as an outcome a rise in a national or per capita income and product as well as economic development which implies more, particularly improvements in health, a broad educational system achieving 98% school attendance and likewise, other aspects of human welfare related to life tables. Due to the “Chilean Miracle”, Chile has increased the production of goods and services and along with it, average income increases with consequent alleviation of poverty, but with high-income inequality measured by income inequality metrics including GINI coefficients (0.494), according to the United Nations (UN), the World Bank, the US Central Intelligence Agency (CIA), and the OECD (OECD, 2011).

In spite of the fact that the industrial production is carried out along the country, the capital of Chile, Santiago, concentrates a high proportion of population as well as a huge proportion of richness because the financial center is located in Santiago (Figure 3).

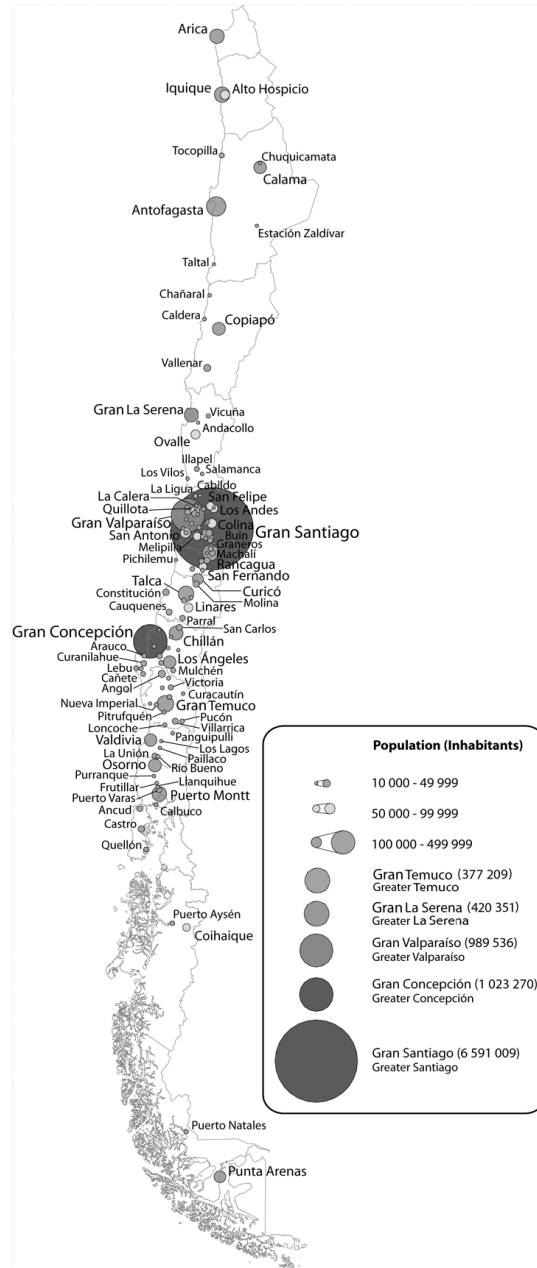


Figure 3. Distribution of population along Chile (inhabitants).

An outcome of this unequal distribution has been the limited economic development of cities outside Santiago. both in the north and south of Chile. Only those cities closer to mining sites related to bigger mining companies receive higher incomes per household but public services such as schools or hospitals remain low quality (Parry, 1997). Therefore, due to attractiveness of Santiago, the trends have been a continuous migration of population from the rural to urban zones (Figure 4A) causing a rapid urban growth, land-use changes and air pollution (Romero et al. 1999). Yet, in addition birth and death rates are decreasing (Figure

4B) with the current (Figure 4C) life expectancy from birth in Chile being 77.8 years. Therefore, the Chilean population is an aging population with a growth in steady state but with challenges related to reducing inequality and improving the quality of life.

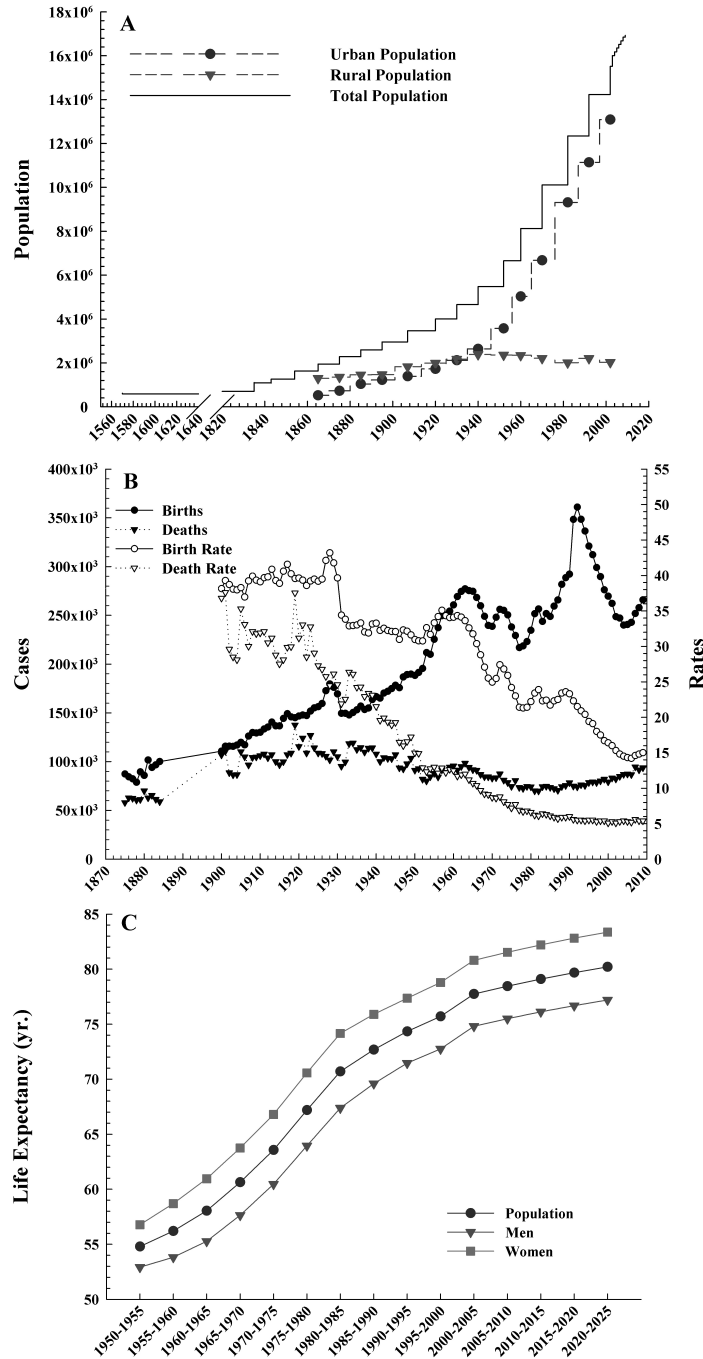


Figure 4. A. Population per zone. B. Births and Deaths with its respective rates per year. C. Life Expectancy.

Nevertheless, continuous migrations of population from rural zone to urban zone have caused an uncontrolled urban growth. These land-use changes have caused that prosperity of big cities, such as Santiago, yet the prosperity is not equally distributed throughout the population. In the big cities, ghettos and suburbs coexist making these cities socially heterogeneous (Sabatini and Salcedo, 2007). Also, the expansion has left older industrial areas inside the cities overlapping with new residential areas providing a source of social conflicts. The uncontrolled urban growth has also increased the air pollution by mobile sources and residential wood combustion. The level of atmospheric Particulate Matter 10 (PM10) is 61.5 micrograms per cubic meter, and is by far the highest level in the OECD Better Life Index despite the environmental law containing stringent standards, trends, however are decreasing (Figure 5).

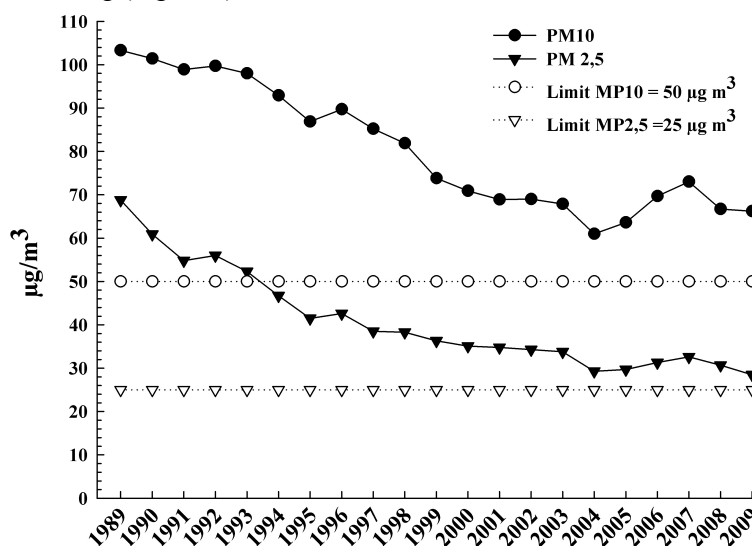


Figure 5. Evolution PM10 and PM2,5.

As aforementioned, the production of goods and services over time has increased providing greater wealth yet has caused additional adverse impacts: loss of environmental quality of ecosystem services (Lara et al. 2009). Due to continuous loss of ecosystems since 1930, the numbers of hectare of national parks, national monuments and management areas have increased. However, during the military government no changes were made. When democracy resumed, the protected areas were recovered with trends similar to those seen previously (Figure 6A). Nevertheless, this increase is still not enough. The forestry industry production has increased 10 times over the last forty years with subsequent environmental impacts of biodiversity loss (Lara et al. 2009) and land-use changes in the south of Chile. The loss of biodiversity is caused by deforestation of native forest as well as monoculture with *Pinus radiata* or *Eucalypto sp* (Figure 6B). But, in the southern cities, this activity is a great engine of economic growth as a main industrial activity.

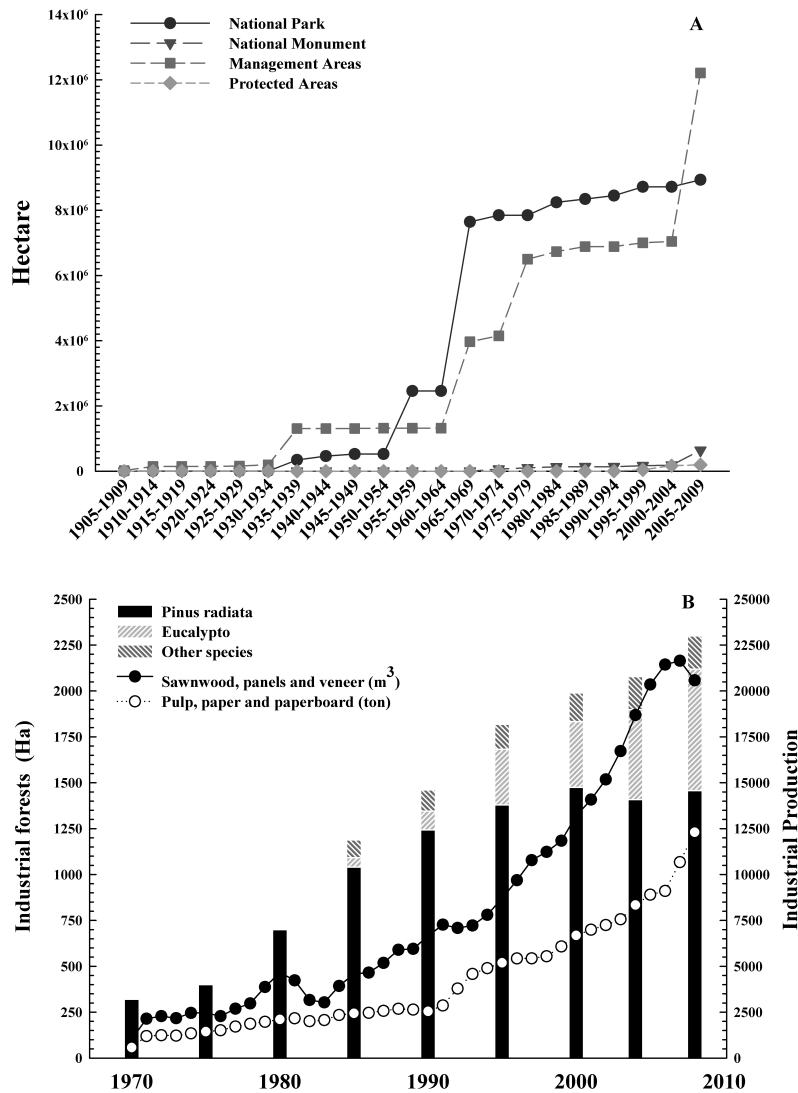


Figure 6. A. Evolution of protected areas and B. Production of Forestry Industry.

Similar outcomes are obtained analyzing the exploitation of marine resources. Since 1974, the total landing of fish, seafood and seaweed increased reaching a maximum in 1994 and then dropped sharply during before 2000 before recovering slightly and then once again reducing (Figure 7A).

These trends could be showing two effects. First, environmental impacts are caused by overexploitation of marine resources correlated to increasing therestriction of captures, fishing quotas and management areas. Since 1995 the total landing of fish, seafood and seaweed from industrial fishermen has dropped whereas the total landing from local fishermen has steadily increased. Therefore, these numbers could indicate a reduction of available resources (Figure 7B).

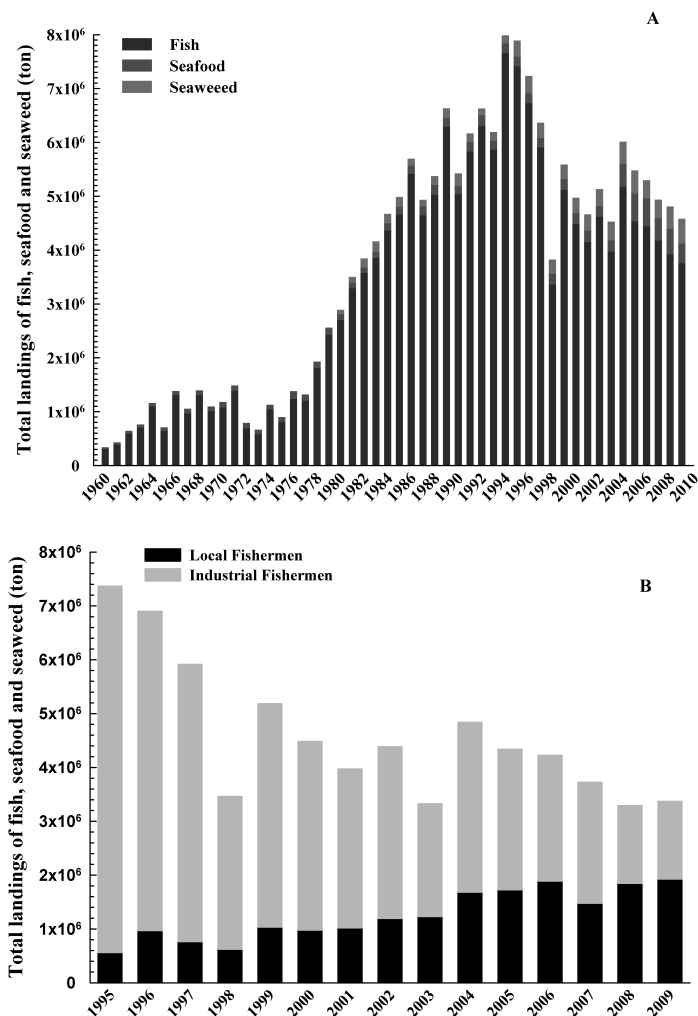


Figure 7. A. Evolution of total landing of fish, seafood and seaweed B. Evolution of total landing of fish, seafood and seaweed by industrial and local fishermen.

Finally, it is important to discuss the outcomes related to carbon and water footprint. Our successful economic growth is supported by our natural capital from ecosystem services. But the industrial intensity of energy consumption is increasing constantly (Figure 8A). The main increasing of energy consumptions in teracalories over the last forty years has been caused due to an increasing of activities related to industrial and transport system following the period of the “Chilean Miracle”.

During last two years, the mining industry has been a great consumer of energy due to an increasing demand from China and India for copper. Regrettably, an increase of mining activities is correlated to an increase in foundry activity (smelting copper), and therefore, leading to greater emissions of pollutants affecting the local population and sensitive economic activities such as local agriculture (Ginnocchio, 2000; Garcia-Huidobro et al. 2001). Indeed, transport and copper mining has been the main consumer of electricity during the last thirty years (Figure 8B). These consumptions are one relevant variable to consider in new

strategies, energy policies to expand our current power grid to support both key economic activities and ensure electricity supply and demand projections.

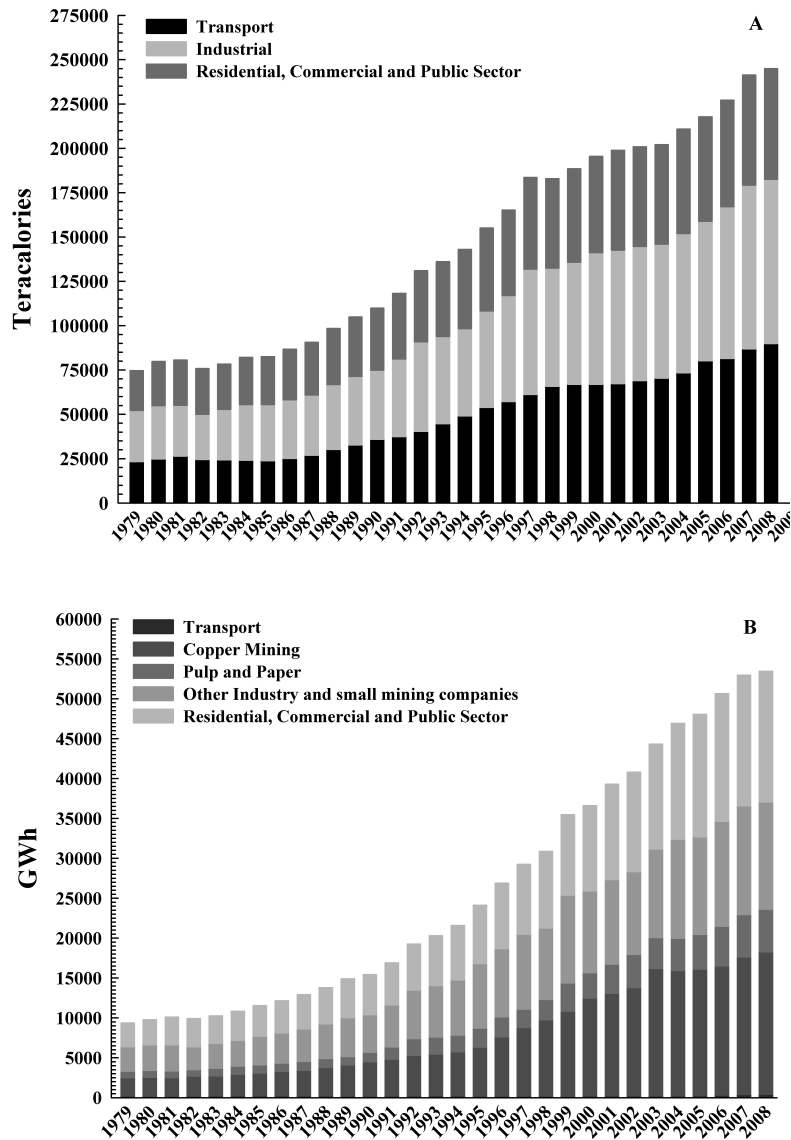


Figure 8. A. Energy consumptions by economic sector. B. Electricity consumptions by economic sector.

Today, the increasing electricity demand sets a new challenge. Which should be our optimal electricity power grid? In Chile, there are four independent electric grids: the Interconnected System of Norte Grande (SING), which is an alternating current power grid serving the Norte Grande zone of Chile – where the main mining companies are placed-, it produces 19% of the national power generation; the Interconnected Central System (SIC), which is the main alternating current power grid in Chile spanning all of Chile transmitting 68.5% of the national generation and serves 93% of Chile's population; and in the south there

is the Aysén System, and the Magallanes System. Only, SIC and SING are the main national systems that support all national activities and therefore their sources of energy will determine our ecological footprint the most.

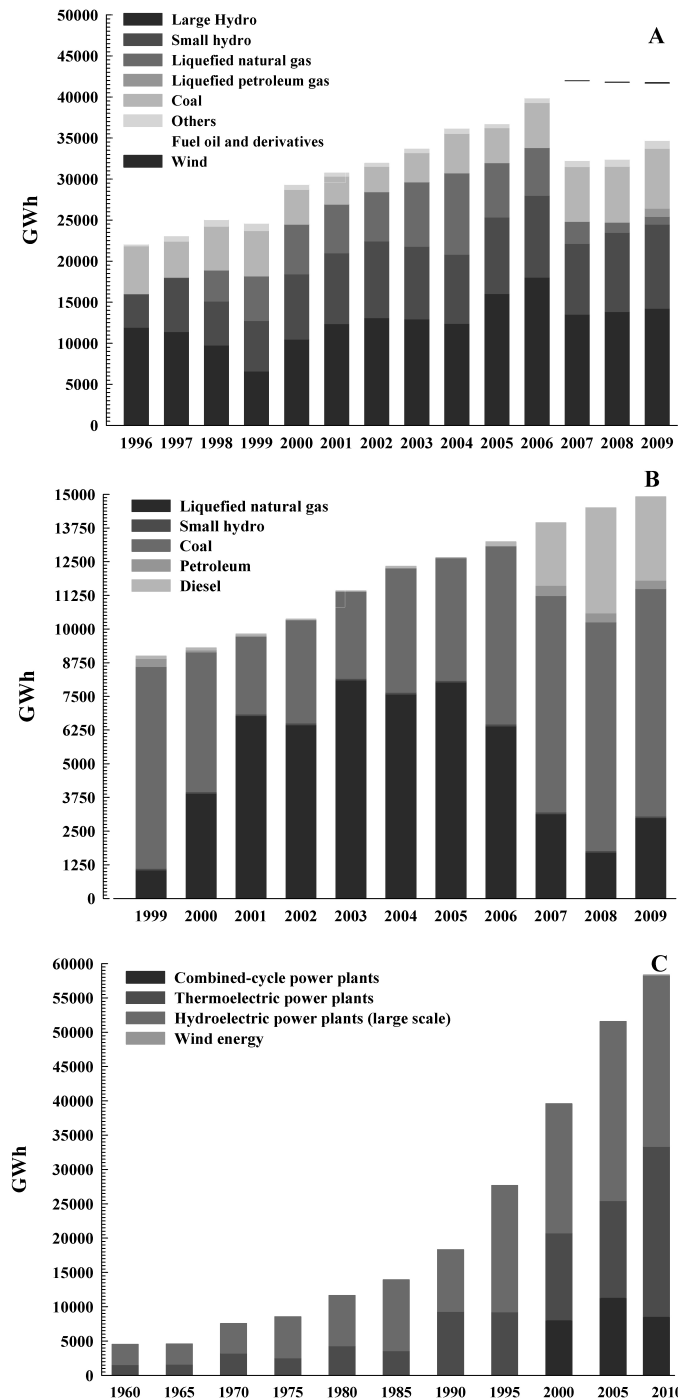


Figure 9. A. Interconnected Central System (SIC) B. Interconnected System of Norte Grande (SING) C. Main energy plants inside electricity power grid.

In the case of SIC (Figure 9A) the main source of generation is hydroelectricity and can be greatly affected by droughts resulting from global warming and climate change. A risk that may arise is the potential conflict with agro-forestry industry as well as communities living close to the dams; especially if these communities are native people by Convention No.169 (the international instrument, which deals specifically with the rights of indigenous and tribal peoples). In contrast, the SING electricity grid is mainly powered by coal burning and combined cycle power plants (Figure 9B&C). These generation methods are highly polluting as many people live in close proximity to coal burning thermoelectric plants, these plants are also result in an enormous carbon footprint, affecting the competitiveness of the export industry.

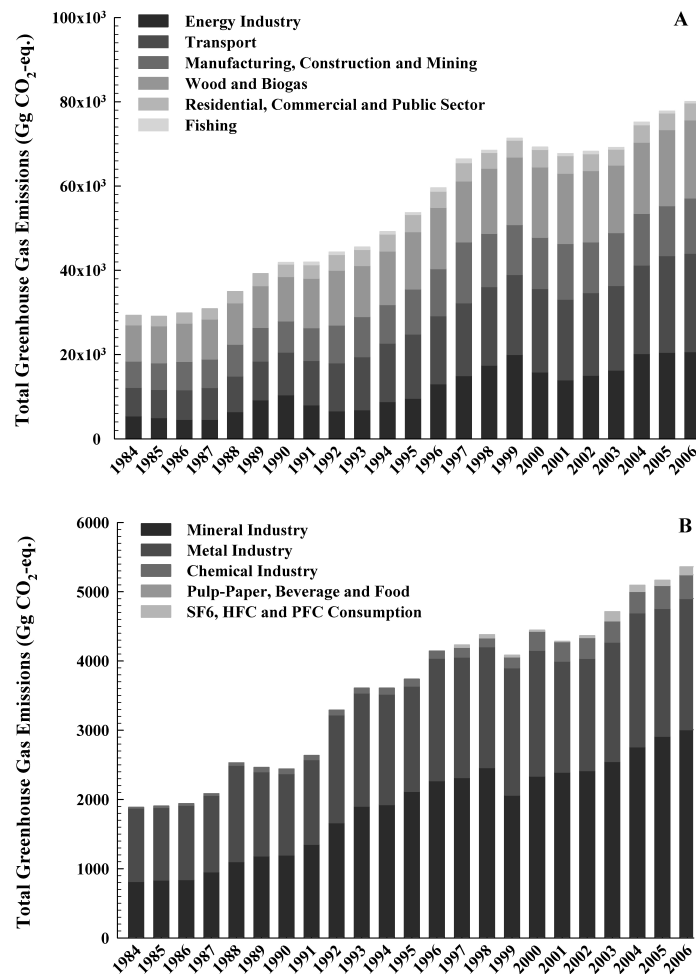


Figure 10. A. Greenhouse emissions by economic sector B. Greenhouse emissions by industry.

Today, the electric power grid is designed mainly around hydroelectricity and coal. A recent report investigated the impact that Climate Change will have on Chile (Samaniego, 2009), The reports suggests that the operation of an increased number of coal-burning thermoelectric plants, beyond direct environmental impacts related to environmental emissions, the CO₂ emitted by combustion, will increase our carbon footprint caused by

electric generation affecting the consumers inside supply chain, mainly those in small and medium-sized enterprises (SMEs). Here, the cost of abatement of one ton of CO₂ will be different between companies relating to their energy efficiency. As a result, our main carbon footprint is produced via the electric and transport sector (Figure 10A) whereas inside industry, the metal and mineral industry are the main sources of our carbon emissions (Figure 10B). Therefore, despite the fact that the mining industry and transport are engines of development, their externalities to environmental impacts are not considered inside national accounts. Consequently, trying to estimate the social and environmental costs could be a goal to understand the actual (and non-economic) cost of production and see behind the “Chilean Miracle”.

Finally, the water footprint is a new political concern because of the effects of global warming resulting in changes of frequency of climatic phenomena such as La Niña or El Niño (Collins, 2005; Paeth 2008). Already, the increasing frequency of drought in Central Chile is a concern due to the fact that this region requires water for hydroelectricity and agricultural use. As agriculture is the main user of water, we face two big problems. One, adapting to climate change requiring a more sustainable form of agriculture and secondly to share a scarce resource with the energy industry. The conflict intensifies when energy, mining industry and agro-forestry industries need to share the same source of water with urban areas (Figure 11).

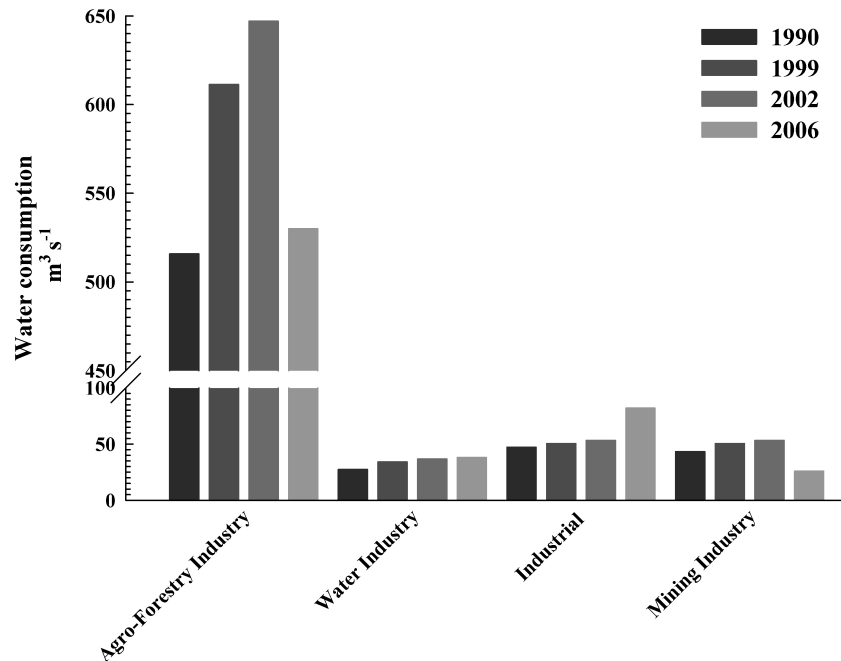


Figure 11. Water consumption by economic sector.

A good indicator to understand the environmental problems that face Chile is the budget for internal programs of the Ministry of Environment. Since 1990, two main programs have increased this budget: the “pollution control program” and the “Biodiversity and Protected area”, both these programs have duties to avoid emissions of pollutants as well as protect our natural resources and ecosystem services (Figure 12).

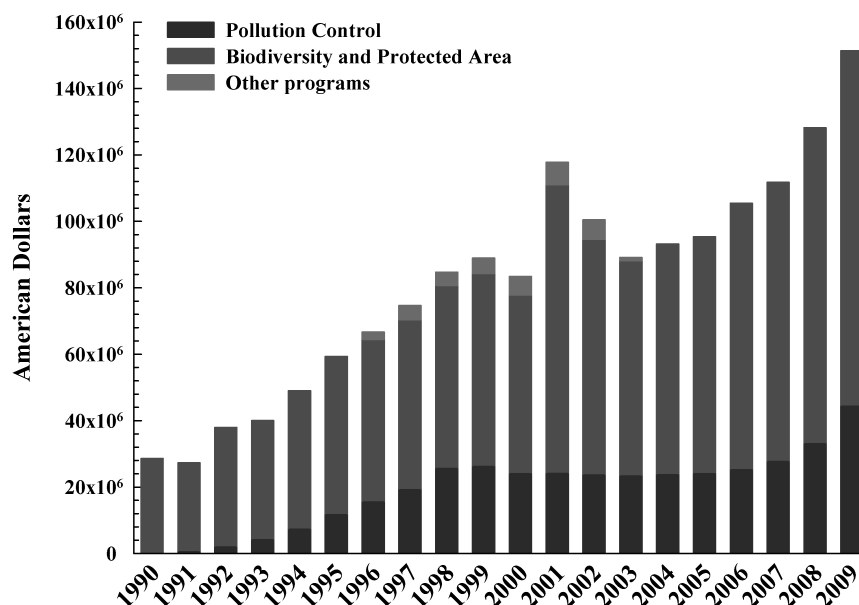


Figure 12. Evolution of Budget of Ministry of Environment.

In conclusion, the presence of different economic activities sharing the same ecosystem resources will undoubtedly affect to quality life of for the local population. The reduction in of quality of life is due to the presence of pollutants in soils and water, hazardous emissions and disposal of wastes measured as environmental charge. As our cities are highly heterogeneous and poorly planned, there will continue to be people exposed to different environmental pollutants creating environmental inequality and environmental injustice. For this reason, continual environmental monitoring and improvement is as necessary as it ever has been.

FINAL REMARKS

In general terms, Chile has a strong economy, growing and prospected to achieve improved development soon but with yet greater inequality. Even though the country achieves a high life expectancy and good standards of healthcare and schooling; a more equal distribution of wealth is necessary. Our economy continues to be based on exploitation of natural resources as natural capital but this is not included inside national accounts. Therefore, the environmental costs of our development remain unknown. In spite of being considered as a global leader in mining activities related to copper extraction and other salts and minerals such as Lithium, Chile has a strong industrial activity related to agriculture, forestry and fishing but continues to be in a first export phase sending commodities to foreign markets. Our challenge is to transit to a second export phase, to manufacture goods with higher value added using our own natural capital supported with Research and Development and Innovation. But, to achieve this development, an equal distribution would be necessary. The inequality income begin with industrial activities, because the production of goods and services is produced in places and cities outside Santiago but where the richness produced does not remain in them, this one is received in the capital city because it is our main

financial center. Finally, the status quo creates environmental injustices because the people living in these cities coexist with a strong industrial activity receiving the environmental impacts but not the economic benefits, which increases the inequality between the capital and outside cities. In terms of regulations, Chile a country with an acceptable amount of legislation aimed to protect the environment in comparison to other countries in Latin America. The introduction of the country into the OECD triggered the necessity of several amendments to our environmental law. These modifications may not provide all round satisfaction but were greatly needed to allow for improved environmental protection and less damaging exploitation of natural resources. Nevertheless we are facing an inflection point in our understanding as regulated individuals due to the introduction of new institutions and the changes that the compliance and sanctions regulation are facing under the law 20,417.

The new challenges for the environmental legislation are related to the inclusion of a more active and relevant public participation in order to approve not only legal projects but “legitimate” ones. The Chilean environmental community is experiencing a new era of how to do things, which may trigger a new way of undertaking environmental compliance not only inside the companies but also inside NGO’s and the community. The expectation of leaving behind the idea of “it is better to ask for pardon than to ask for permission”, that has guided the industry for several years, will pave the way for more sustainable development within Chile. The law has to guide the industry in that sense; the rest is in the hands of the population. Our educational challenge is to include environmental concepts in each area of schooling. Understanding of sustainability and the importance of environmental conservation are poor in all areas but particularly those with a higher income and education. This sentence is so important because a low proportion of population achieves higher education.

Today, concepts such as accountability and sustainability are not considered as a competence acquired in their higher education training programs. The academic accountability, defined as incorporation of social and academic concepts that allow the promotion of a sustainable science through environmental education, must include values such as respect and care from the community, environment and ecological integrity as well as social justice and economy. Briefly, the approaches toward understanding the environment have been implemented throughout a higher education, governmental institutions and our environmental history mainly influenced by ideological tendencies over technical approaches in public affairs (Fields, S.; 1999). The evolution and understanding of environment has been done by a constant exchanging of ideas through the influence of various expressions of social policies embodied today in a legal framework that defines the concept of environment.

The discussion in Latin American and Caribbean has been focused on how to improve the interaction between government, industry and civil society, through new public-private partnerships. However, international, environmental and social scenarios related to the framework convention on climate change, global warming, democracy and social equity, present us a new challenge to reach stringent goals regarding abatement of greenhouse gases without compromising our development, in addition to achieving sustainable development and contributing to the alleviation of poverty. In this case, the concept of poverty is referred to people exposed to low environmental quality or environmental poverty. Although increased wealth is possible, the population continues living in poverty if their environment is not improved as this greatly impacts public health. The implemented public policies encourage the leveling of inequality as well as the recovery of public spaces as central elements of the construction of cities and neighborhoods. There is a necessity to think in terms of a smart grid

system based on renewable technologies in addition to a more sustainable use of ecological resources. This set of public policies, independent of a political system, must translate the will to build new habitats with a strategic vision that reflects our spirit in the twenty-first century, relying on social equity policies and economic growth based primarily on the identification of our “natural capital”(Ekins, P.; 2003). Chile, a region with a variety of environments and landscapes, needs to identify primarily its "natural capital" and “ecological resources”, seen as an environmental function for a sustainable development, while not compromising its development for the next years (Jaffe, A.; 2005). Such capital and ecosystem resources are not restricted to natural resource exploitation, but rather define itself as a function of value creation on the basis of goods and services that are based on their understanding of natural resources, social and cultural factors that make to Latin-American and Caribbean a region with an identity distinct to developed countries.

As a result through our history, relations between industry, environment and civil society have not been smooth, leaving an apparent lack of environmental regulations and socio-cultural disruption. The consideration of new models of coexistence, placing human beings in environment, will come only from the historical analysis of our relations towards the future in line with our idiosyncrasies incorporating these new challenges towards new public policies.

Finally, the vision of maintaining an Environment-Society balance based only on governmental regulations or rules of market will lead to transfer market imperfections of public policies (Bretschger, L. 2005). Due to the fact that environment is not considered as valuable as public good, open and lacking a market price, exploitation of resources, growth, public health, adaptation to change and abatement of green house gases, will produce new internal social conflicts. These conflicts may be resolved through government intervention; where trend towards the resolution of these conflicts has been influenced increasingly based on technological and scientific evidence on the economic compensation of negative externalities.

At this level, sustainability models supported by tools to promote technological innovation will bring responses to the rational use of natural resources to sustain viable economic growth; avoiding their indiscriminate exploitation (Rehfelda et al. 2007). Therefore, advancing scientific and technological innovations related to environmental matters could support the development of new environmental policies for the resolution of these conflicts (Ekins, et al. 2003). Therefore, new methods of environmental management and environmental policies based on sustainability concepts are needed. This approach would allow meeting the most stringent environmental and regulatory pressures in a framework towards reaching the goal of a sustainable development and low carbon economy.

In conclusion, Chile needs to understand the main barriers in technology policy and management, including technological innovation and R&D policy. New policies must allow the introduction of green solutions, as sustainable-engineering technologies create the capacity to resolve current and future environmental problems.

Our challenge is to develop frameworks of analysis to understand the causes and effects of current events contributing to sustainable development and a low carbon economy. This must be achieved through better understanding and integration of local systems, characterized by its natural resources, climate, infrastructure and engineering needs, , social and political situation. These characteristics can be used for decision-making techniques at public policy level, linking science, technology, society, and education. These frameworks of analysis must be flexible to face future global climate changes.

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