

# Knowledge Production, Mobilization and Standardization in Chile's HidroAysén Case

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**Abstract** The Aysén Hydroelectric Project in Chilean Patagonia proposed the construction of the country's largest power facility to supply its capital, nearly 2,000 kilometres away. We seek to explain the way science, politics, law, business and the civilian population are joined up. To this end, we analyse the project's evolution, the construction of techno-scientific arguments by the participants and how Chilean regulations are adapting to this process.

**Keywords** Knowledge production · Controversy · Expertise · Environmental impact study · Hydroelectricity

## Introduction

The Aysén Hydroelectric Project (HidroAysén for short) in Chilean Patagonia tabled the construction of five dams to supply energy to Chile's central region. To this end it proposed the flooding of 5,910 hectares and a major electric power transmission line from the sources of production to the centres of consumption. Valued initially at US\$3.2 billion,<sup>1</sup> the largest hydroelectric project in the country's history involved the relocation of indigenous families and the expropriation of large

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<sup>1</sup> This was the initial estimated cost for the dams; later the price would double due to the cost of the power transmission line.

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private lands, in the hands of a few property owners (Holmes 2014). During the environmental assessment process for the dams' construction in the first part of the project, between 2008 and 2011,<sup>2</sup> a technical dialogue was set up between the company's representatives and the environmental services representing the state, as required by law. During the same period, civil groups opposed to the project formed and came together in an organized movement called the 'Council for the Protection of Patagonia', reaching a peak in mass demonstrations nationwide. The political, technical and civil opposition to the project exposed the fragile balance between technical mechanisms, politics and business (Pestre 2003) in the Chilean regulatory framework, provoking a controversy over the environment at the national level for the second time in less than a year.<sup>3</sup> The opposition criticized the politicization of the technical process of HidroAysén's environmental assessment, warned about the project's potential socio-environmental impacts and reported a potential monopolistic configuration of the electricity market should the project be implemented.<sup>4</sup>

Sociologists' interest in the environment emerged in the United States in the 1970s from interest in environmentalism and environmental movements (Hannigan 2006) dealing with the impact of industrial production on the environment (Carson 1962) and intensive fossil fuel use in such production (Meadows et al. 1972). In time this interest came to focus on establishing a sociology of the environment sufficiently distinct to merit its own field of research (Dunlap & Catton 1979). The New Ecological Paradigm (NEP) proposed by these authors sought to turn away from sociology's traditional approach marked by 'the human exception' towards a more 'ecocentric' view of research, in other words a more holistic view of social processes within the biosphere.

Hannigan (2006) criticizes this distinction, however, for failing to disseminate its typology and methodology across other areas of research. This methodology did not take off in the ensuing decades, but gave way to diversity in sociological works on the physical world. Hannigan distinguishes at least two paradigms related to this article: social constructionism and actor-network theory (ANT).

These pioneering works developed a new interest in the social construction of environmental problems. The researchers identified problems based on observations taken from the physical environment, such as genetically modified organisms (Doyle 1985). The studies, which also concerned themselves with different interpretations, impacts and possible solutions, brought wide acceptance in socio-environmental processes viewed as problematic (Dunlap 2015). They also demonstrated that environmental problems do not simply emerge out of physical conditions but are shaped by a set of actors in the public space (Hannigan 2006).

For decades now the social studies of science have been concerned with socio-scientific controversies. In one piece of research into gravitational waves Collins (1985) proved how the evidence of experiments was determined by their social

<sup>2</sup> The company argued that it would later submit a study on the power transmission line.

<sup>3</sup> A few months earlier an organized civil opposition exerted successful political pressure for the annulment of the 'Barrancones' thermoelectric project, located in a nature sanctuary in northern Chile.

<sup>4</sup> Endesa, a private company owning 51% of HidroAysén, held almost all the water rights needed to implement the power stations. The opposition to the project also demanded a review of the legislation on industrial water use.

conditions of production. He established that it is human actors that read nature and accordingly suggest what belongs to the natural order (Pestre 2006). An interest thus arises in the study of the sciences from the circumstantial analysis of scientific debates and the production of discourses (Latour 1984; Shapin & Schaffer 1985). At around the same time Beck (1992) considered that the consequences of scientific and industrial development are a set of risks and hazards, the likes of which we have never previously faced; that's what he called 'risk society'. Scientific and technological activities generate risks, which societies tackle with more science and technology. Much as expertise and regulatory systems play a central role, they tend to be weakened through the methods used by groups from civil society engaged in cases where risk is involved (Boudia & Jas 2007). The confluence of publics, expertise and laymen in *hybrid forums* (Callon, Lascoumes & Barthe 2001) organizes science and technology, on the one hand, and social aspects, on the other. The study of the impact of therapeutic activism in AIDS (Epstein 2001; Dalgalarondo 2004) or of the social use of scientific knowledge in Chagas Disease (Kreimer & Zabala 2007) are two instructive examples. The social demands of expertise and norm-making thus materialized in the context of environmental controversies, setting up a tension between expertise and ideological commitment in the actors (Grisoni & Némoz 2013).

We analyse the socio-technical controversy of the Aysén Hydroelectric Project using some concepts from the sociology of translation (Akrich, Latour & Callon 2006). We use a problematized description to study how a regulatory framework encourages the emergence of an originator of a controversy (Collins 1975) capable of interesting and recruiting actors, mobilizing knowledge and translating these operations into the formation of a sufficiently robust network to make the originator's goal a legitimate action and become an 'obligatory passage point' for the other actors (Callon 1986, 2006b).

However, we wish to distance ourselves from ANT over the principle of generalized symmetry (Callon 1986) and particularly the symmetrical use of 'natural actants' and 'human actors' as a starting point. Our study considers only 'human' actors because in our analysis agency is only manifested in this type of actor and because, like other authors (Collins & Yearley 1992), we establish an essentially 'anthropocentric' analysis.

We also describe how the originator's described action is framed by a set of norms that considers the environment as subsidiary to economic production. This materializes for the originator in an approximation of the impact by sector, leaving aside the interconnection of the variables and establishing the network's formation around the project and not around its evaluation.

### *The Nature of the Conflict*

HidroAysén proposed the construction of five dams between 2009 and 2022 on the Pascua and Baker Rivers in the Aysén region of Chilean Patagonia, the country's richest in water resources. Considering the project as a whole, this involved flooding 5,910 hectares and building a 1,912 kilometre transmission line to Santiago, Chile's main hub of energy consumption. Given such social consequences as the

displacement of families, expropriation of property, disturbances in traffic, flow of workers and so forth, the company launched a series of *corporate social responsibility* (CSR) actions, such as infrastructure construction, human capital formation, study grants and donations. HidroAysén in turn sought to reduce Chile's dependence on fossil fuels, a country that currently has a power grid diversified between thermoelectric (gas and coal) and, above all, hydroelectric generation.<sup>5</sup> The isolation and patrimonial value of those territories have been decisive factors in local and national opposition to the project.

HidroAysén was set up as a company in 2006 by the Spanish company Endesa (51%) and the Chilean company Colbún (49%). The capacity of the five plants in operation amounted to 2,750 mega-watts, which would have been included in the Central Interconnected System, the largest energy supplier in the country. According to HidroAysén's studies,<sup>6</sup> the initiative contributed 20% of demand, considering all plants in operation.<sup>7</sup>

The environmental impact study (EIS) submitted by the company specifically mentioned the construction of the five hydroelectric dams, not the power transmission line. According to the company, the transmission line impact study would be submitted at a later stage on the basis that the state's services did not have the capacity to analyse a single study including dams and transmission lines. The main opposition group to the project, the Council for the Protection of Patagonia, criticized the fact that this division was due to a company strategy, since it was more feasible to obtain approval for the project in two halves and then putting pressure on the authorities to adopt the project in its entirety once the first part – the dams themselves – was approved. In regulatory terms, Law 19,300<sup>8</sup> said nothing on the subject.<sup>9</sup>

In August 2008, the project entered its environmental proceedings phase under the provisions of the act. The company submitted an EIS that underwent review by the state's services. The questions relating to the EIS by the state's services are collected in a compendium called the 'Consolidated Report of Clarifications, Rectifications and/or Expansions' (ICSARA), published by the National Environment Commission (CONAMA). The company's answers via its consultants are compiled in reports called 'addenda'. Between 2008 and 2010 the company submitted three addenda in response to three ICSARAs.<sup>10</sup>

Non-governmental organizations (NGOs) opposed the project through an unprecedented media campaign beginning in 2006. This resulted in growing public opposition in social networks, nationwide mass demonstrations and the submission of writs of protection, which succeeded in delaying the final approval for

<sup>5</sup> 11.08% of the total installed capacity comes from solar, wind and biomass energy. Information available at: <http://energiaabierta.cne.cl/visualizaciones/capacidad-instalada/>.

<sup>6</sup> See: [http://www.hidroaysen.cl/?page\\_id=22](http://www.hidroaysen.cl/?page_id=22).

<sup>7</sup> It was originally suggested that the five dams would be in operation by 2025.

<sup>8</sup> The General Bases of the Environment Act, available at: <http://www.leychile.cl>.

<sup>9</sup> The new environment law (Act 20,417), in force since 2010, does not allow projects to be broken up. Available at <http://www.leychile.cl>.

<sup>10</sup> Law 19,300 did not demand a ceiling to addenda.

construction of the dams until May 2011. This approval was passed by a vote of the Environmental Assessment Commission composed of the various Regional Ministerial Secretaries<sup>11</sup> involved in the project, the Mayor and the Regional Director of the Environmental Assessment Service (the former CONAMA).<sup>12</sup> The groups opposing the project criticized the regulatory framework, which stated that of the 11 Commission members only one had the technical expertise to assess the project, the other ten being politically-appointed posts. So, once the technical discussions described above were complete, the law stipulated that the decision was ultimately political by virtue of the composition of the members of the Environmental Assessment Commission.

In addition to these circumstances, just over a year earlier, in March 2010, Sebastián Piñera entered office, the first centre-right president to win a Chilean election since the return of democracy in 1990. Piñera's presidential campaign backed the Aysén Hydroelectric Project and during his government, particularly through the Interior Ministry, he took steps to approve it. This reveals a convergence of interests between the project's carrier and the government of the day. Thus, both the EIS and the other instruments described in the regulations provided a space for relations between private expertise, public participation and decision-making (Baya-Laffite 2015).

In turn, the Piñera administration and the action of the opposition groups contributed to the public thematization and politicization of the events.

### *Free-Market Reforms Shaped Hydroelectricity and the Environment*

In the 1940s, the Chilean state laid out plans to develop hydroelectric power. This would be consolidated through the creation of the public company Endesa in 1943 (Bauer 2009), responsible not only for the production, transmission and distribution of electrical power in the country but for water studies for future hydroelectric projects. But a different vision was implemented as a result of the military coup in 1973. Pinochet's government introduced a radical restructuring against the so-called 'communist cancer', and a new social order was imposed, based on the precepts of neoliberal policy and ideology. The 'Chicago Boys' (Chilean economists formed in the Chicago School) promoted Chile's policy reforms defending privatization, deregulation and fiscal austerity and mobilizing the neoliberal ideology that restrict the state to a minimum and maximize the scope of individual freedom (Carruthers 2001).

A number of companies administrated by Enersis (then the energy public firm) were set up in the 1980s: Endesa for production, Transelec for transmission and Chilectra for distribution. Subsequently, at the end of the military dictatorship (1973–1989), all these companies were privatized and, attached to this was the bulk of Chilean Patagonia's water rights. The 1981 Water Code states that water rights are granted by the state, which assigns the rights of water use free and in

<sup>11</sup> Transport, Energy, Housing and Urban Development, Agriculture, Planning, Health, the Economy, the Environment and Public Works.

<sup>12</sup> The CONAMA ceased to exist in 2010 under the new environment law (Act 20,417).

perpetuity.<sup>13</sup> This Code establishes two categories of water use: consumptive uses allow the removal of water from its place of origin (e.g. agricultural activity); non-consumptive uses occur in the environment of the water source (e.g. hydroelectric generation). Bauer (2009) argues that for hydroelectric generation Chilean case law has favoured non-consumptive over consumptive uses, promoting the interests of specific groups to the detriment of multipurpose administration.

Law 19,300 decreed that it was private actors who had to submit their energy production, transmission and distribution projects to the state, which would only participate through assessment and implementation of any EISs submitted by these actors to the Environmental Impact Assessment System.<sup>14</sup> The state only intervenes annually through the National Energy Commission, a body whose decisions are not binding, but which recommends certain lines of development in the sector to the private sector. In this context, Chile's electricity development depends on private initiative, and the state's role is that of a regulator.

The Environmental Impact Assessment System, whose role it is to evaluate the environmental impact of large-scale industrial projects and so prevent environmental deterioration,<sup>15</sup> began to be questioned in the 1990s. An emblematic case was the mass death of black-necked swans (*Cygnus melancoryphus*) due to pollution of the River Cisnes (Spanish for 'swans') by a pulp plant in 2004. As a result of a chequered history over the past 25 years, the system is currently undergoing a crisis of legitimacy (Costa 2012). The case that made the greatest public stir was the construction of the Ralco Plant in Alto Bío-Bío (Central Southern Chile, Eighth Region), which began in 1998. It was a 300MW dam belonging to Endesa, which faced stiff opposition due to the flooded areas encroaching on ancestral territories of Pehuenche communities (Molina & Correa 1996), who managed to mobilize significant support from environmental and indigenist groups (Camus & Hajek 1998; Bauer 1998).

Chile in those days was experiencing considerable economic development. This was stalled by the Asian crisis in 1997 but showed signs of recovery in 1999 with growth rates above 7% per annum (p.a.), even reaching 10% p.a. in the early 2000s. During those growth years the energy problem was precariously balanced due to a significant part of home energy consumption coming from Argentine gas. This threatened the growth cycle, which was highly dependent on energy consumption. The internal supply problems of Chile's neighbour resulted in power outages to Chile, which came to be known as 'the Gas Crisis' (2004).

Before the Gas Crisis, the energy matrix was largely dependent on hydroelectric production, and therefore on rain cycles (Raineri 2006). But the National Energy Commission thereafter took a different stance, opening up to the idea of setting up a joint energy matrix that included the mass influx of thermoelectric plants capable of providing energy both to the household and the industrial sectors. Power outages

<sup>13</sup> Until 2005 the Water Code encouraged unproductive speculation in water rights, which could be traded even when there was no economic activity.

<sup>14</sup> This service groups all the state's sectoral services (e.g. the Agricultural and Livestock Service (SAG)) capable of assessing the impact of certain projects.

<sup>15</sup> The institutional information is available at: <http://www.sea.gob.cl/contenido/que-es-el-sistema-de-evaluacion-de-impacto-ambiental>.

stopped but energy prices rose because the production costs of these sources – which are also more polluting – are far higher than other resources. As a result, the marginal cost of electric power rose by over 400% between January 2007 and March 2008 (Corbo & Hurtado 2014).

It is important to note that the scope of the free-market's reforms was not exclusively limited to the energetic field. Indeed, the 'state's modernization' conceived during the dictatorship and mostly continued on *Concertación's* governments aimed to privatize the main part of public's goods and services.

During the democratic transition and the stabilization process concerning the strengthening of Chilean's democratic institutions and the civil society empowerment (Garretón 1990; Silva 2009), from the 1990s on, many conflicts emerged around environment, technology and techno-productive problems, particularly around boundaries issues between a lightly regulated natural resources extraction and the social reaction to some industrial practices. We can briefly account some of them: The infectious salmon anemia (ISA) disease killed three-quarters of the salmon population in 2010. The dramatic social consequences were apparently due to the lack of public regulation and to the companies' low standards operations (Asche et al. 2010).

The Pascua-Lama gold mining project is a very interesting case: it started with "the defence of some mountain glaciers being endangered by the mine, the opposition has launched a fully-fledged international campaign. The resistance movement has generated many international alliances and has been able to articulate a legitimized discourse in Chilean and international public opinion" (Urkidi 2010).

The Barrancones thermoelectric plant project was aborted by the Chilean President itself, even though it had been authorized by the environmental regulatory system: The President decided to ignore the institutional regulations and prioritized the preservation of a 'nature sanctuary'<sup>16</sup> situated on the surrounding area (Spoerer 2013).

Thus the HidroAysén project might be considered as a part of these movements; however, it presents some particular features, like its extended period of time, the stakeholders' heterogeneity, the scientific and normative regulation involved, and the collective imaginaries mobilized.

## HidroAysén's Baselines

That same year (2004) Endesa<sup>17</sup> granted new research funds to finance a compendium of studies called 'baseline raising'. This was a process that was kept within a scientific ambit and not leaked out to the media.<sup>18</sup> To this end, the company contracted the services of several Chilean universities and a local consultant, the

<sup>16</sup> Punta de Choros is the natural reserve of 80% of Humboldt Penguins worldwide (Cárcamo et al. 2012).

<sup>17</sup> Endesa had begun the preliminary studies for the project before the creation of HidroAysén in 2006.

<sup>18</sup> Media coverage of the dispute materialized in 2006 based mainly on the action of groups opposing the project.

Centre for Applied Ecology (CEA), to conduct an environmental description of its specialty in the region: the University of Chile carried out two studies, one on soil, climate, meteorology, hydrology, hydrogeology, geology and geomorphology, and one on risk areas; the Pontifical Catholic University conducted two studies, one on population, socio-economic aspects, quality of life and tourist activities, and one on land tenure, infrastructure and equipment; the Austral University was responsible for studies on vegetation and terrestrial flora; the University of Concepción studied terrestrial fauna; the University of Valparaíso conducted studies on oceanography, marine flora and fauna, and estuaries; the Central University studied landscape, territorial planning and protected areas; the Bolivarian University performed a study on cultural heritage; and the CEA implemented a study on aquatic flora and fauna, water quality and ecological streamflow. According to HidroAysén, these studies covered nearly 300,000 hectares and were performed in a period of over two years.<sup>19</sup>

On the basis of the scientific material gathered, property of the company, three consultants were hired (Poch, EPS and Sweco) to prepare the EIS for assessment by the competent services. The public study submitted by consultants in August 2008 included the aforesaid baselines,<sup>20</sup> as prescribed by law. This stipulated that each state service<sup>21</sup> had to assess the impact in their respective fields of expertise. For example, the National Forestry Corporation, which is accountable to the Ministry for Agriculture, analysed the project's impact on forests.<sup>22</sup> In this framework, Law 19,300 contributed to assessment by sector and did not stipulate communication between the studies nor a subsequent integrated perspective. Thus, by 'sectorializing' the assessment of the projects, the law did not incorporate ecology as a discipline since it did not view the sectors as interconnected systems. In short, there was no authority in the public assessment to consider the interaction and possible synergies of the assessments of the various different sectors. Put another way, a view contrary to that of a complex system with variables determining each other was imposed through the state. If we analyse this in the framework of co-production of knowledge proposed by Jasanoff (2004), an epistemic dimension relating to technical services and a political dimension relating to the representation of those services intervene in the interaction: the services of the state and its state-making practices collaborate in a partial way.

On establishing that the baselines were a compulsory element of the EIS, the regulation decided that, if there is not enough scientific evidence for the services to assess the impact of the projects, the holder was obliged to finance these studies (the baselines). As a result, the administrative agencies had basic knowledge at their disposal to perform their functions. Against this background it was the job of the

<sup>19</sup> This information is detailed in the project's EIS (2008).

<sup>20</sup> The baselines presented in the EIS were not the original documents but an edited version.

<sup>21</sup> The state services are accountable to various ministries: e.g. the Agricultural and Livestock Service (SAG) is accountable to the Agriculture Ministry.

<sup>22</sup> Alongside the Agriculture Ministry in the evaluation assessment process were the Ministries for Mining and Energy, Transport, Public Works, Health, Planning, General Secretariat of the Presidency (through the CONAMA).



administrative agencies to require of the holder the details of the reports submitted. In exceptional circumstances the administrative agencies could conduct independent studies.<sup>23</sup> This peculiarity is explained because the law did not provide the sectoral services with a specific mechanism for that end.<sup>24</sup>

The Aysén Hydroelectric Project presented an unprecedented case given the scale of the project and the shortage of scientific studies on its area of influence. The Aysén region was at the time in a particularly precarious situation scientifically speaking: the region's first scientific centre, the Research Centre of Patagonian Ecosystems (CIEP), was founded in 2005, yet there has so far been no major scientific activity in the region. This scenario demonstrates the difficulty for administrative agencies to assess the EIS and therefore the importance of relying on the baselines for that function.<sup>25</sup>

With certain exceptions the baselines were not scientific publications but studies commissioned by the company and conducted by scientists.<sup>26</sup> These reports then were heterogeneous: even when the law forced a company to include a baseline in its EIS, it mentioned nothing about the quality of these documents; as a result, the heterogeneous nature of the baselines was determined by their production conditions. Not being subject to peer assessment or to assessment by the company (through the consultants' work), the scientific quality of these studies depended largely on their authors and implementation (field conditions, methodological proposals, etc.). Here it is worth mentioning that in the introduction to the HidroAysén EIS's 'executive summary', the holder presented the baselines as

An environmental description that covered studies in almost 300,000 hectares, an area several times larger than the project's surface area of works and dams. For a prolonged period of time, more than two years if need be, *prestigious*<sup>27</sup> universities and research centres conducted various fieldwork campaigns, generating large amounts of new information about the Aysén Region.

The prestige associated with the knowledge producers the holder describes in the presentation to the report is functional to the development presented later in the same document. The data collected by the 370 researchers<sup>28</sup> on-site are thus integrated with the project's possible impact on the description. These data belonged to the company for a given time (private contracts stipulated various different criteria for service providers) and could subsequently be used for scientific purposes, subject to authorization by the company. The systematized information on

<sup>23</sup> A case in point was a report commissioned by the DGA from the EULA Centre of the University of Concepción, analysing the baseline submitted by HidroAysén for river basins. Available at: <http://www.dga.cl>.

<sup>24</sup> Act 20,417 radically alters this situation by creating a Ministry for the Environment one of whose functions is to conduct all the studies necessary to develop the baselines.

<sup>25</sup> According to CONICYT figures, the Aysén region contributed 0.35% of national scientific production between 2008 and 2012.

<sup>26</sup> The environmental descriptions were mainly censuses, cadastres and databases.

<sup>27</sup> Our emphasis.

<sup>28</sup> The figure claimed by the company.

the baselines was used on specific occasions for scientific publications (Arenas & Osses 2012; Ramírez et al. 2012).

Once the holder had allocated the funds for the corresponding studies, the two parties discussed the future studies' terms of reference, and the agreed plan was subsequently implemented. In this way, for the scientists taking part in the process, the allocation of these funds to research a little-studied region was a legitimate way to finance their scientific activity.

Tironi & Barandiarán (2014) claim that scientists' participation in the assessment process undermined their credibility to the extent that the EIS was 'science for sale' and the information collected in the baselines contained no results. The scientists were thus faced with the dilemma of financing their activities in return for losing control over the results.

The notion of 'science for sale' proposed by the authors is questionable in light of understanding the scientific exercise as a socio-cultural practice (Callon 2006b; Pickering 1990). Conceived as an environmental description, the baselines came to be a service provision carried out by the scientists. In this sense, science is not only a matter of results concentrated in statements but a series of material and social elements linked to scientific activity. The environmental description of the Aysén Hydroelectric Project is thus also part of the science and not necessarily its sale as if it were just another commodity.

The information collected on the baseline was also socialized through two devices implemented by the company in the framework of its 'communication and information' strategy in the region. One of the main arguments of the company's public communication was to claim absolute openness in relation to the information collected. On this subject, the executive summary of the HidroAysén EIS stated:

The different dimensions of the project's study phase has been approached in an innovative fashion. Indeed one of its main features has been to establish early, proactive, open and transparent communication from the commencement of the studies with the objective of providing timely information for communities, opinion leaders and local, regional and national authorities regarding the project's progress and the environmental components studied.

Where the baselines were concerned, this will was manifested, on the one hand, when the holder put the so-called 'Open Houses' at the residents' disposal: these were permanent itinerant outreach centres in the region, where inhabitants could have access to all the information collected, including the unedited baselines (Tironi & Barandiarán 2014).<sup>29</sup> The holder also organized meetings between the various different local actors and the scientists taking part in the baselines. These meetings, called 'scientific exposition panels', were held in January 2008 in Coyhaique and Cochrane, the two largest towns in the project's area of impact. The experts who set the baselines used the panels to present their results to the community, authorities, businessmen, trades union leaders, civil society representatives and so forth. They attended the representative panels of the CEA, the Pontifical Catholic University,

<sup>29</sup> The full environmental description of the project is currently not available, neither on the company's nor the Environment Ministry's websites.

the Austral University and the University of Valparaiso. By participating in these activities voluntarily, this group of scientists vindicated the work done on the baselines.

These scientific panels were carried out in a joint action between HidroAysén and the CIEP. Thus, the newly founded scientific centre publicly validated the methodology applied in the baselines. The CIEP's director explained to a regional newspaper on that occasion why it was linking itself to a company:

The preparation of the baselines for an environmental study corresponds to processes validated with scientific methodology to establish beyond any doubt the current inventory of flora and fauna existing today on the Baker River and its surroundings, as well as determining the state of the waters, shoreline, bed and atmosphere of such a prized river and its surroundings. If implementation of these studies has been contracted from the CIEP and/or the universities associated with the Centre, it is practically the ideal situation because that means that the baselines have been produced by scientists of excellence and integrity.<sup>30</sup>

The CIEP subsequently disassociated itself from the HidroAysén project, when no record of its participation in the EIS came to light.

## **The HidroAysén EIS and its Assessment**

The 1992 United Nations Convention on Biological Diversity (UNCBD), ratified by Chile, defines the ecosystem as 'a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit'. However, the production conditions for raising the baseline did not consider an ecosystemic approach. Consequently, the environmental impact of the project was dealt with by the consultants in the EIS and not at the previous stage. Moreover, the assessment of the report was conducted sectorially by the administrative agencies,<sup>31</sup> as there was no service that considered the impact as an integral situation, i.e. from an ecological point of view.<sup>32</sup> Establishing the rules whereby each sector assesses the project in its area of competence through the regulations facilitates the protection of its interests and not the conservation of biodiversity in all its complexity.

The administrative agencies' observations contained in the ICSARAs about the Aysén Hydroelectric Project's EIS cast some light on this situation. On the subject of water use, for example: this being a hydroelectric generation project, the company is obliged to apply to the General Water Board for a construction permit,

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<sup>30</sup> Arguments available in the press article at <http://www.eldivisadero.cl/noticia-25593>.

<sup>31</sup> There was no communication among the state services in the EIS assessment process. For example, the case of amphibians is particularly problematic, as species are dealt with by various services.

<sup>32</sup> Act 20,417 includes a purpose-built service. A law to approve the creation of a 'Service for Biodiversity and Protected Areas' accountable to the Ministry for the Environment is currently being processed in the Chilean Congress. The latest information on the proceedings is available at: <http://www.proyectedefareasprotegidas.cl/recursos/tramitacion-proyecto-de-ley-sbap/>.

since it does not own all the water rights for such production. But that is just one of the administrative agencies that has to analyse the implications of water in the project: woodland is irrigated by water (National Forest Corporation: CONAF); water is used in the irrigation of agricultural holdings (Agricultural and Livestock Service: SAG); it has an important symbolic and cultural value (National Corporation of Indigenous Development: CONADI); and is the ecosystem that houses the development of aquatic species (National Fisheries Service: SERNAPESCA). The impact of a hydroelectric project can also influence water temperatures, and that can have an impact on the marine environments of river mouths, which in turn has an influence on the larger-scale marine environment, producing increased CO<sub>2</sub> emissions and so forth. Water from each service was analysed accordingly in terms of their competence. However, those replies did not include an ecosystemic approach because that was not in the spirit of the law.

Another example concerns the impact of the population arriving in the region to work on the construction. HidroAysén's EIS proposed the arrival of 2,260 workers, located in camps with 'strict rules of confinement' in the vicinity of the works. As in the previous case, the impact assessment was performed independently by administrative agencies. For example, the regional health service noted that the study did not refer to the possibility of sexually transmitted diseases among the floating population arriving in Cochrane should the project take shape.<sup>33</sup> In the first ICSARA Tortel Municipality<sup>34</sup> also estimated that HidroAysén failed to make adequate projections about the impact on the town's public services.

However, the arrival of these workers and of the associated floating population was not analysed from an ecological viewpoint. Nothing was said, for example, about roads between the camps and the urbanized areas, or about the intervention of protected woodland for those roads, or about the impact of camps and roads on the local fauna, or on the socio-demographic consequences of the introduction of this population on the associated transport network and the impact this implies, and so on and so forth.

Another aspect to be considered was the citizen consultation stipulated by Law 19,300. This set a sixty-day period for civil organizations and their representatives to make observations on the study, which the company made available to citizens at various points in the region, as prescribed by the abovementioned law. Environmental organizations deployed an important instrument (Mirosevic 2011), which gathered over 11,000 observations, eleven of which were included in the first ICSARA submitted to HidroAysén. This negligible fraction of citizens' observations contained in the report is proof not only of the regional authority's weak will at the time to forge a more inclusive process but also the problem of the 'civic epistemology' in the spirit of the law, understood as the criterion whereby a society validates public knowledge as such: the ICSARA is a public instrument in which the

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<sup>33</sup> The town of Cochrane has 3,000 inhabitants.

<sup>34</sup> Tortel is Chile's least populated commune: at 0.03 inhabitants per square kilometre, it has just 531 inhabitants.

assessment of the administrative agencies dominated the citizen observations to such an extent that they were virtually ignored.<sup>35</sup>

In short, all of the above also reveals how the construction of knowledge around the Aysén Hydroelectric Project's EIS was organized. It involved a vast amount of information gathered using scientific methods, but which was not 'research science' in the sense proposed by Jasanoff (1990). The result was not scientific articles, the fundamental control mechanism was not peer review nor was professional recognition from the scientific community the main incentive. Rather, the application of knowledge is oriented by industry, research products are subject to a variety of control mechanisms and knowledge is legitimised by its use. Jasanoff (1990) calls this body 'regulatory science': assessment standards are more diffuse and are subject to political considerations. 'Regulatory science' has a use in regulating other practices, in this case, for example, the environmental impact of industrial activity. The author suggests developing mechanisms to promote negotiations between 'research science' and 'regulatory science' (Jasanoff 1995).

This situation was seen in the EIS, the ICSARAs and the addenda. The specific case of the baselines is not a matter of 'research science' (traditional scientific activity) or 'regulatory science' (scientific activity implemented by regulators or industry, in this case the EIS), since the scientists' goal in this environmental description was not to study the project's impact (that was the EIS's goal).<sup>36</sup> Nor could the baselines be classified as 'science for the people' (inasmuch as democratic values were paramount in scientific practice). We observe a separate category, which could be classified as 'Commissioned science' committing scientists' activity to a practice different from that mentioned above.

## Chilean Environmental Regulations

The shape of the environmental description, its integration into the environmental impact study and the above assessment by the various administrative agencies are circumstances arising from the regulatory framework of Law 19,300. In this context we believe it is relevant to set out certain historical institutional elements that put the emergence of that law and its evolution in the context of Chile's changing environmental regulations from 2010 onward. This evolution is reflected in the trajectory of the central ideas that have emanated from ecology, motivating the work of scientists and other social actors, and impacting on institutional matters (Hadley 2006; Nakashima & Nilsson 2006; Petitjean 2006).

During the military dictatorship's administration, between 1973 and 1989, there was no specific legislation on environmental matters (Camus & Hajek 1998). Yet the pressure to standardize, assess and sanction any action having an environmental impact during that administration became manifest when the military relinquished

<sup>35</sup> The new environment law, Act 20,417, establishes civil participation mechanisms that are more inclusive and more decisive in decision-making.

<sup>36</sup> Our fieldwork showed how scientists from the EULA Centre decided not to participate in raising the Aysén Hydroelectric Project's baseline because as an organization they felt any such activity could not be dissociated from the subsequent EIS.

power in the framework of the democratization process that materialized in the control of institutions by civil society and its representatives. It should be remembered that this relinquishment was agreed by both the old and new leaders.

The transition did not only involve a change of leadership but the continuity of a legal institutional apparatus imposed during the dictatorship that established a subsidiary state, an economy that entrusted its smooth functioning to market laws and scant public regulation, with a heavy emphasis on natural resource extraction, and consequently a total opening to, amongst other things, raw materials exports (Tecklin, Bauer & Prieto 2011).

The bill for Law 19,300, Chile's first environmental law, was submitted in 1992 and approved in its entirety two years later. The EIS was included as a governance technology, having already been tested in developed economies and legitimized by the World Bank as an instrument adapted to protecting environmental business interests (Baya-Laffite 2015). Tecklin, Bauer & Prieto (2011) argue that this legislation was not enacted through an internal democratic process but was the consequence of relations with foreign economies. For these authors, Chile's legal and institutional apparatus is a special case, being geared to promoting market opening and not market regulation. This hypothesis is particularly sensitive where environmental issues are concerned. As a result, the evolution of laws – particularly in this regard – has more to do with market than social factors.

In parallel, the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992, produced the United Nations Convention on Biological Diversity (UNCBD), signed by Chile, which focuses on three basic principles: conservation of biological diversity, sustainable use of its components, and the fair and equitable sharing of benefits from the use of genetic resources. Its general aim is to promote measures that lead to a sustainable future.

Chile's participation at this Conference and its signing of the UNCBD a year later was included in Law 19,300, passed in 1994, as reflected in its first article: 'The right to live in an environment free of pollution, the environment protection, nature's preservation and the environmental heritage conservation shall be ruled by the law herein, without prejudice of the provisions of other legal norms on this subject'.

The overlap between the process of Law 19,300, adapted to promoting international trade, and Chile's affiliation to a multilateral treaty – the UNCBD – prevented the law fully meeting the UN's environmental requirements. Similarly, its conventional nature points to improvements in current legislation, which did not preclude future amendments to the law, irrespective of whether it achieved the goal of accelerating international trade agreements. There is then in practice a prevailing management approach to exploit natural resources (Mace 2014), and the function of the law materializes in the preservation and conservation of the ecosystems in relation to such management, namely, protection of endangered species and regulation of the impact of human and industrial activity on the environment.

This was confirmed by the OECD Environmental Report (2005), stating that for the period between 1994 and 2004 Chile sought to improve its social performance without ignoring economic growth. In this context, the environmental measures proposed sought to minimize economic costs and prevent the controversies that had

discouraged investment. As Law 19,300 did not regulate all environment-related sectors, intergovernmental committees were set up to draft specific regulations for each sector, representing prospects for both economic development and for quality of life and the environment. The Ministry General Secretariat of the Presidency was responsible for arbitrating the drafting of those norms (Arriagada 1995). It thus established a legal framework with the aim of joining up the different environment-related sectors: environmental management instruments were set up, along with the first environment-focused bureaucratic body – the CONAMA – with its respective satellites in the various regions, the Regional Environment Commissions (COREMAs); environmental impact assessments were included in investment projects through the Environmental Impact Assessment Service (SEIS); and firms could be held liable for environmental damage.

The debate over environmental regulations highlighted the reluctance of certain ministries – e.g. Agriculture or Mining – regarding the loss of sectoral competencies. The regulations also imposed conflicting interests, Ministries being responsible for the conservation and productive development of their sector (Avila Akerberg 2011).

Law 19,300 was the object of much criticism over the 14 years it was in force. That period saw the approval of projects that met with considerable resistance in the form of an organized green opposition (Camus & Hajek 1998), on the one hand, and public discontent, on the other. The SEIS came in for particularly harsh criticism. In the opinion of Tecklin, Bauer & Prieto (2011), this was not designed to reject projects but to improve them. However, having environmental regulations in place that were in line with existing international treaties allowed Chile to consolidate its market exploiting natural resources and to provide security for both foreign investors and Chilean exporters. The new environmental standards passed in 2010 (Act 20,417) and consistent with this development were ultimately a certification of the OECD standards required by that organization as a condition for Chile's accession (Olivares 2010). According to these standards, the country committed itself to apply efficiently environmental policies, to integrate environmental considerations on economic, social and sector-based decisions, and to enhance its environmental international cooperation (OECD-ECLAC 2005).

This explains the establishment of the development model of free international trade that Chile has implemented ever since the period of democracy. Chile has had a free trade agreement in force with the United States since 2004 (deepened in 2015) and another with the European Union since 2003. Both the United States and the European Union validated Law 19,300 as an adequate regulatory body for the establishment of the treaties and legitimized the law on the basis of politico-economic equivalence. In other words, according to these regulations, Chile was complying with the required environmental standards to become a business partner.

Chile has also ratified many international conventions in the field of conservation<sup>37</sup> and has taken an active part in the UN's global sustainable development

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<sup>37</sup> The main international treaties signed by Chile are the Convention on International Trade in Endangered Species on Wild Fauna and Flora (CITES), the United Nations Convention to Combat Desertification (UNCCD), the Bonn Convention on Migratory Species (CMS), and the Ramsar Convention on Wetlands of International Importance. All the treaties are available at: [http://www.mma.gob.cl/librobiodiversidad/1308/articles-45421\\_recurso\\_3.pdf](http://www.mma.gob.cl/librobiodiversidad/1308/articles-45421_recurso_3.pdf).

agenda, which began with the Rio de Janeiro Conference (1992) and continued with the Millennium Declaration (2000) setting out the Millennium Development Goals (MDGs) to be achieved by 2015. International environment treaties have the force of law but are not applied, due to the absence of regulation and legislation for their operation (OECD-ECLAC 2005). Faced with the evidence of a lag between the adoption and implementation of international treaties, Chile has established various mechanisms to promote their implementation. For example, the National Biodiversity Strategy (2003), implemented by the CONAMA and later by the Ministry for the Environment, aims to ‘achieve a significant reduction in the current rate of biodiversity loss’ (CONAMA 2003). In the framework of this strategy’s implementation, juxtaposed with the creation of the new environmental constituency (2010), five reports were drawn up to describe the process. The fifth report (2014) established an Advisory Steering Committee to set the guidelines for the national biodiversity strategy’s assessment process. The Committee consists of 11 ministries represented by 19 services or departments, two NGOs, two scientific institutions and five professional associations (Ministry for the Environment 2014). This new line-up, coordinated by the Ministry for the Environment, seeks to break with the sectoral logic, and to consult and welcome Committee members’ observations. It is legitimate then for Committee members’ interests to differ, having full voting rights in any discussions over environmental impact projects.<sup>38</sup>

## Conclusions

In a seminal article, Collins (1975) describes scientific knowledge transfer as a cultural artefact, paying particular attention to the conditions that make this transfer effective. He thus takes as his starting point the experiment of an ‘originator’, who implements a variety of different resources in order to achieve their goal: namely, a successful experiment. In our analysis the originator would be the company, a set of actors who mobilize knowledge and researchers with a given objective.

The sociology of translation is also of particular relevance when it comes to analysing this controversy. The will to align interests, which we analysed in the company, is repeatedly seen throughout our description. For example, bearing in mind the executive’s public approval of the project, in the vote in favour of the dams’ construction by the Environmental Assessment Commission, the members of the Commission consisted mainly of representatives of the executive (Ministerial Regional Secretaries represented the various ministers and the Mayor represented the Chilean President). This community of interests was decried by groups opposing the project but by then the network was already robust enough to stand on its own.

The members of the Commission thus translated (Callon 1986; Callon 2006a) the issues in terms of their own interests. The ‘technical artefact’ – the environmental assessment process – was shaped by external forces, and the succession of

<sup>38</sup> If the Committee reaches no consensus, the new environmental law establishes an Environmental Superintendency and Environmental Courts that have the competence to rule in contentious cases or cases that contravene regulations.



inscriptions (reports, meetings, minutes, press conferences, etc.) provided a record of the translation process. The same process was joined by a wide variety of actors from the political and economic spheres, who by using various communication tools (opinion columns, letters to the editor, special editions of journals, declarations, etc.) expressed agreement with the project's construction.

The process called baseline raising can also be analysed in this light. By allocating research funds in a context of scarcity, the originator attracted scientists to take part in his project, exempting them from any responsibility for the potential impact of the hydroelectric complex. Through this rationale, which we have termed 'commissioned science', the originator recruits scientists to the company, making his network sturdier through academic prestige.

The originator 'enlisted': the executive and part of the legislature with the argument of reducing the energy deficit; the business world with the promise that the project would reduce energy costs and make Chile more attractive to foreign investment; a section of the academic world with the claim that the project would ensure a stable electrical supply; a section of citizens with the view that HidroAysén would contribute to Chilean development and so reduce poverty; and a section of local populations through extensive 'corporate social responsibility' campaigns. It thus became an obligatory passage point for all the actors associated with his project. Taking into account that the Law of the General Bases of the Environment (Law 19,300) favoured the adoption of projects (Tecklin, Bauer & Prieto 2011), the originator used the network to establish the obligatory passage point in the project, not in its assessment, making any assessment project-dependent. The process described was designed to form 'black boxes' (Whitley 1970),<sup>39</sup> statements validated by a wide variety of actors claiming that completion of the hydroelectric project was necessary for the country. In the same vein, Baya-Laffite (2015) contends that the EIS is a black box used to de-politicize the argument and, imbued with a 'technical aura', is adapted to line up with the interests of industry only to re-politicize projects later on.

Not even the 'betrayal' of administrative agencies' experts (given that the government was in favour of the project) was strong enough to bring down the network established by the originator. Finally, the rift threatening the black box was the public success of the communicative action of the groups opposing the project and the public support that this generated. This was what brought about the final schism that would end the originator's activity. The betrayal came from the electorate. On 9 June 2014, three years after the Environmental Assessment Commission's approval, the Committee of Ministers<sup>40</sup> decided to reverse the Environmental Qualification Resolution, effectively denying permission to carry out the construction work. The formation of the network established by the leader of the opposition to the project (the grouping of non-governmental civil organizations calling itself the Council for the Protection of Patagonia), which contributed to the

<sup>39</sup> Kreimer (1999) notes that the concept was proposed by Mario Bunge in 1963.

<sup>40</sup> The law states that, if convened, the Committee of Ministers (Energy, Mining, Agriculture and Health) had a sixty-day period to rule on the Supreme Court's decisions. Given the project's unpopularity, the Piñera administration suspended this procedure; it was the next administration, Michelle Bachelet's, that would take the decision to reverse it.

public thematization of the controversy and forced the company into a process of communicational argumentation not required by the regulations, has not been analysed in this article in any detail.<sup>41</sup>

The thousands of pages produced (baseline studies, EIS, ICSARA, addenda, minutes, etc.) in the technical process and the communication devices implemented by the company (open houses, door-to-door, seminars, etc.) are summarized in the Environmental Assessment Commission's decision. The process, which lasted three years and mobilized scientists, civil organizations and 33 administrative agencies, created knowledge in various different formats (reports, documents, etc.) circulating among several social actors in various forms. The studies these bodies conducted now form part of a public intellectual heritage. That is, even though a political decision has been imposed on this body of inscriptions, the region was enriched with the process described above.

We have described how the originator's action mobilized the assessment by sectors stipulated by Act 19,300, favouring the approval of projects. The absence of an ecosystemic approach in the baselines was thus a reflection of the production conditions imposed by the regulations. The description of scientific frameworks in international structures has been joined up with the notion of standard-setting (Star & Griesemer 1989), where different types of institutional sectors at a local level translated (Callon 2006a) the expressions of others in order to crystallize a political will. The baselines were translated into the EIS. The censuses, cadastres and databases that we have called 'commissioned science' were translated into 'regulatory science' by consultants in a report submitted for environmental assessment by administrative agencies. The great compendium of 'regulatory science' that took shape over the dialogue between administrative agencies and consultants (EIS, addenda and ICSARAs) was translated by the Environmental Assessment Commission – consisting mainly of government representatives – into a political vote.

At the same time, commercial trade bodies in Chile pushed for an alignment of legislation regarding international agencies. Since commercial trade dominates the will to conserve biological diversity or sustainable development, Chile was forced to accept the terms and priorities of the central economies to access partner status in a logic that Kreimer & Zabala (2007) has dubbed 'subordinate integration'.

As a suggested access key, this integration does not involve the local mechanisms for its implementation; its effectiveness is thus subordinated to subsequent pieces of legislation and materializes treaties that are in force but non-effective. While the Chilean state has demonstrated a will to amend this situation by setting up committees and strategies for the sectors lacking mechanisms, this whole state of affairs creates 'institutional lethargy' in the implementation of international treaties.

Moreover, the intensive extraction of natural resources, combined with low intensity S&T, leads to the 'neo-extractivist paradigm': this development model relies on the intensive extraction of natural resources as a key factor (Burchardt & Dietz 2014). The extractivist paradigm is severely put in question, since the exploitation of natural resources becomes increasingly a public matter. However, its

<sup>41</sup> For a more comprehensive analysis on communication strategies, see Broitman (2017).

environmental effects are still sizable. For instance, the assessment and the regulation of the industrial activity via environmental policies can be considered as a social reinvestment.

Simultaneously, both the extractivism and the industrial activity are increasingly energy-intensive. The energy needed for this development model must be provided, in turn, by other industrial projects that imply an extended use of natural resources, particularly water. The neo-extractivist paradigm chains more energy than the NCREs energies or the existing systems are able to provide. All this leads to new environmental problems on a legal framework that does not seem to be entirely robust yet.

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