Non university sources of science in Chile

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Abstract. The following ideas are widely accepted in Chile with respect to scientific activity:
a) is carried out mainly in universities and science is considered a naturally university activity,
b) that was developed in a period of more than 150 years by isolated individual efforts, c) it
was transformed into an institutionalized activity at the universities after the university reform
movement at the end of the 1960 decade, d) the activity is finally institutionalized in the
country with the creation of the “Comisión Nacional de Investigación Científica y Tecnológica,
CONICYT (National Commission for Scientific and Technological Research) in 1967. This
work presents preliminary findings showing that there are other institutional initiatives,
different to the efforts from universities and directly dependent of the Chilean Government, in
order to produce science and technology in Chile. This governmental initiatives start at the
beginning of the Republic of Chile circa of 1810.

1. Introduction

The scientific activity produces more results than can be handled by universities. These results
impact all areas of society: economy, health, education, natural resources, environment, freedom and
welfare of citizens, international relations, defense, popular sovereignty and national sovereignty. This
has been understood many years ago by the developed countries, where scientific activity is carried
out in universities and state institutes, private centers, public and private productive sector and armed
forces. Contrary to what happens in developed countries, in Chile more than 95% of the scientific
research is conducted at universities, virtually without connection with state institutions, the
productive sector and the armed forces, which makes practically impossible that the cycle Research +
Development + Innovation can be completed.

The stories about the history of science in Chile consider mainly the contribution of individuals to
scientific activity. Starting back with the contributions of Claudio Gay, a French scientist, who in 1830
was hired by the Government of Chile for a study the natural history of the area and everything that
contributes to know the industry of the country, its commercial activities and management. In 1838 the
Chilean government hires the Polish scientist Ignacio Domeyko to work as a teacher at the “Liceo de
Coquimbo” (High School of Coquimbo). After that, between 1840 and 1846 Domeyko makes trips
through the territory of Chile and describes its geology.
Henceforth, the various stories of the history of science in Chile refer to the contributions of individuals without relation with a policy or institutional interest in developing scientific activity in Chile (see for example reference [1]). In fact, scientific research is not considered an important activity in Chilean universities until after the university reform from the sixties of the twentieth century.

Thus, nowadays one may find the following ideas in the Chilean intellectual imaginary with respect to the scientific activity in Chile: a) is carried out mainly in universities and science in Chile is considered a naturally university activity, b) that was developed in a period of more than 150 years by isolated individual efforts, c) it was transformed into an institutionalized activity at the universities after the university reform movement at the end of the 1960 decade, d) the activity is finally institutionalized in the country with the creation of the “Comisión Nacional de Investigación Científica y Tecnológica, CONICYT (National Commission for Scientific and Technological Research) in 1967.

However, Chile has about 17 State Research Institutes. State Research Institutes are institutions for scientific and technological research created by the State outside the universities. Their goal was to increase the productivity of various economic and strategic sectors through the introduction of technological innovations and the creation knowledge. To do so, among his tasks it to included the development of basic and applied research, coordinating and dictating policies in this area, and to train specialists [2].

2. Research institutes created by the Chilean State.

Although the Bacteriological Institute was created in 1929, and the Institute of Experimental Medicine in 1937, the golden age of the State Research Institutes is the second half of the twentieth century, between 1957 and 1970. To get an idea, apart from the above, during that period the following institutes were created: Geological Survey (1957); Chilean Antarctic (1963); Fisheries Development (1963); Occupational Health and Air Pollution (1963); Agricultural Research (1964); Natural Resources Research (1964); Chilean Nuclear Energy Commission (1965); Forest (1965); Committee Harnessing Geothermal Energy (1967); National Hydraulic (1967); Center of Studies in Measurement and Quality Certification (1968); Technological Research (1968); Mining; and Metallurgical Research (1970).

From the mid-1970’s and 1980’s most of these institutions suffer a strong reduction in budget and self-financing policies are imposed to them [2]. During the subsequent governments, since 1989 to date, there are no policies oriented to the State Research Institutes. Government policies and instruments include incentives to universities and to the productive sector. None of these policies and instruments consider the particular reality of State Research Institutes. Thus, at present most of these are far from fulfilling one of their original objectives, mainly, to develop basic and applied research. In most of them their main activities are the provision of services and routine production activities. Even though, they have a small number of professional researchers, they have a lot of highly skilled and competent of other type of professionals and technicians. In addition, many of them have infrastructure and equipment that the universities do not have.

3. Others non-university initiatives previous to the State Research Institutes.

In a recent study entitled “Institutos de Investigación del Estado: Evolución y Perspectivas” (State Research Institutes: Evolution and Perspectives) presented at the “Encuentro Ciencia, Tecnología y...
It is shown that there were other non-university initiatives, inclusive previous to the State Research Institutes, linked to government policies or public companies that allowed the creation of many organisms and institutions whose objectives were to conduct scientific and technological research.

A chronology regarding the creation of Chilean non-university scientific and technological institutions, it can be described as follows:

**Stage I: First attempts, 1812-1939.**

1811: “Fábricas y Maestranzas del Ejército, FAMAE” (Factories and Arsenals of the Chilean Army).
1817: Primer “Arsenal y Maestranza de la Armada”, (First Factory and Arsenals of the Chilean Navy) at Port of Valparaiso.
1842: “Cuerpo de Ingenieros del Ejército” (Army Corps of Engineers).
1843: “Oficina de Estadísticas” (Statistics Office).
1874: “Oficina Hidrográfica de la Armada” (Navy Hydrographic Office).
1888: “Dirección de Obras Públicas” (Public Works Department). Laboratories are created: a) Railways and Telegraphs, b) Bridges, Roads and Hydraulic Constructions, c) Architecture
1891: “Oficina de Meteorología” (Weather Bureau, later Military Geographical Institute).
1892: “Instituto de Higiene” (Institute of Hygiene).
1896: “Arsenal y Maestranza de la Armada” at Port of Talcahuano (Factory and Arsenals of the Chilean Navy).
1898: “Taller Resistencia Materiales” (Resistance Workshop Materials). In association with University of Chile.
1908: “Instituto Sismológico” (Seismological Institute). Created after the Valparaiso earthquake of 1906.
1914: “Instituto Científico e Industrial del Salitre” (Scientific and Industrial Institute of Saltpetre).
1914: “Servicio Provisional de Estudios Geológicos” (Interim Service of Geological Studies).
1919: “Servicio de Mines y Geología” (Service of Mines and Geology) former Interim Service of Geological Studies.
1922: “Instituto Geográfico Militar” (Military Geographical Institute, former Weather Bureau).
1925: “Cuerpo de Ingenieros de Minas” (Mining Engineers Corps).
1925: “Banco Central” (Central Bank).
1927: “Departamento de Navegación e Hidrografía” (Department. Navigation and Hydrography), former Hydrographic Office.
1929: “Instituto Bacteriológico” (Bacteriological Institute) former Institute of Hygiene.
1930: “Ala de Mantenimiento de la Fuerza Aérea de Chile” (Maintenance Wing Air Force of Chile).
1930: “Departamento de Minas y Petróleo” (Department of Mines and Petroleum), former Mining Engineers Corps.
1937: “Instituto de Medicina Experimental” (Institute of Experimental Medicine).
1938: “Instituto de Investigación de Materiales” (Institute for Materials Research), former Resistance Workshop Materials is associated with Roads Laboratory.
**Stage II:** Companies of the “Corporación de Fomento de la Producción, CORFO” (Chilean Economic Development Agency), 1939-1960.

1939: “Corporación de Fomento de la Producción, CORFO” (Chilean Economic Development Agency), 1939.

1943: “Empresa Nacional de Electricidad, ENDESA” (National Electricity Company).

1944: “Instituto Nacional de Investigaciones Tecnológicas y Normalización, INDITECNOR” (National Institute for Technological Research and Standardization).

1946: “Compañía de Aceros del Pacífico, CAP” (Pacific Steel Company).

1950: “Empresa Nacional del Petróleo, ENAP” (National Oil Company).

1952: “Servicio de Cooperación Técnica, SERCOTEC” (Technical Cooperation Service).

1953: “Dirección de Arquitectura” (Department of Architecture)

1957: “Instituto de Investigaciones Geológicas” (Institute of Geological Research”

1960: “Empresa Nacional del Petróleo, ENAP” (National Oil Company).

1960: “Astilleros y Maestranzas de la Armada, ASMAR” (Astilleros and Arsenals of the Navy), former Factory and Arsenals of the Chilean Navy.

1960: “Ministerio de Agricultura” (Agriculture Ministry)

**Stage III:** State Research Institutes of Chile, 1960-1973.

1963: “Instituto Chileno Antártico” (Chilean Antarctic Institute)

1963: “Instituto de Fomento Pesquero” (Fisheries Development Institute)

1963: “Instituto de Higiene del Trabajo y Contaminación Atmosférica” (Institute of Occupational Health and Air Pollution

1963: “Servicio Aerofotogramétrico de la Fuerza Aérea de Chile, SAF” (Photogrammetric Service of the Air Force of Chile).

1964: “Instituto Nacional de Investigación de Recursos Naturales, IREN” (National Research Institute of Natural Resources).

1964: “Instituto de Investigaciones Agropecuarias” (Institute of Agricultural Research).

1964: “Empresa Nacional de Telecomunicaciones, ENTEL” (National Telecommunications Company).

1964: “Comisión Chilena de Energía Nuclear”, CCHEN (Chilean Nuclear Energy Commission).

1965: “Instituto Forestal” (Forest Institute).

1966: “Instituto Nacional de Capacitación, INACAP” (National Training Institute).

1967: “Comité de Aprovechamiento de Energía Geotérmica” (Committee of Geothermal Energy Utilization).

1967: “Servicio Agrícola y Ganadero, SAG” (Agriculture and Livestock Service)

1967: “Instituto Nacional de Hidráulica” (National Institute of Hydraulic).

1968: “Centro de Estudios, Medición y Certificación de Calidad Studies Center” (Measurement and Quality Certification).

1968: “Empresa Nacional de Computación,ECOM” (National Computing Company).

1968: “Instituto de Investigaciones Tecnológicas, INTEC” (Technological Research Institute).

1968: “Comisión Nacional de Investigación Científica y Tecnológica, CONICYT” (National Commission for Scientific and Technological Research).

1968: “Instituto Hidrográfico de la Armada, IHA” (Hydrographic Institute of the Navy).

1970: “Centro de Investigación Minera y Metalúrgica, CIMM” (Center for Mining and Metallurgical Research).

1970: “Instituto Nacional de Estadísticas, INE” (National Statistics Institute), former Statistics Office).

1973: “Coorporación Nacional Forestal, CONAF” (National Forest Corporation).

**Stage IV:** Decline and privatization, 1975-present.

1976: “Comisión Chilena del Cobre, COCHILCO” (Chilean Copper Commission).
1976: “Corporación Nacional del Cobre de Chile, CODELCO” (National Copper Corporation).
1984: “Empresa Nacional de Aeronáutica, ENAER” (National Aeronautics Company), former Maintenance Wing Air Force of Chile.
1985: “Centro de Informaciones de Recursos Naturales, CIREN” (Information Center of Natural Resources), former National Research Institute of Natural Resources.
1990: “Servicio Hidrográfico y Oceanográfico de la Armada, SHOA” (Hydrographic and Oceanographic Service of the Navy), former Navy Hydrographic Institute.

During this last period most of State Research Institutes suffer a strong reduction in budget and self-financing policies are imposed. In addition several State Companies are privatized.

4. Final remarks.

As was shown, the development of scientific and technological activity in Chile has older and beginnings more than the university sector and than the isolated individual contributions. In fact the above chronology shows that institutional efforts predate those by universities and the creation of the National Commission for Scientific and Technological Research, CONICYT.

These preliminary findings are part of a research on the history and institutionalization of scientific activity in Chile. This research in progress is motivated for the following questions: What are the origins and further development of scientific activity in Chile beyond the university environment? Why is there in Chile this ‘universitization’ of science? Why the governmental efforts manifested in the creation of institutes and public companies were not intersected and there is not feedbacked with the university efforts? Is this a coincidence or a consequence of an ideological model?

It would be interesting also to compare the experiences of Latin American countries like Argentina, Mexico and Brazil.

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